Africa
Skills for Progress

FESTO



Africa

Skills for Progress

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“While it is important to distinguish conceptually the notion of poverty as capability inadequacy from that of poverty as lowness of income, the two perspectives cannot but be related, since income is such an important means to capabilities. And since enhanced capabilities in leading a life would tend, typically, to expand a person’s ability to be more productive and earn a higher income, we would also expect a connection going from capability improvement to greater earning power and not only the other way round.”

Amartya Sen Development as freedom (OUP, Oxford, 1999), p. 90

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WorldSkills Competition South Africa 2015, opening ceremony, Cape Town, South Africa.


WELDING

Africa – Skills for progress

Pointing out the relevance of a book's topic in its preface might not seem a particularly original thing to do. In this case however, my pursuit of sincerity trumps my ambitions for innovation. I firmly believe that a good future for humankind depends in no small part on the future of Africa, and the future of Africa depends in no small part on whether this continent will succeed in offering jobs and perspectives to its fast-growing youth population. The issues that are taken up in the following chapters should thus be of interest to anyone who has a stake in the upcoming decades. Still, I would like to highlight two audiences whose attention to the subject is especially imperative for meeting the challenges ahead.

First and foremost, the issue of African youth unemployment of course lies primarily in the hands of the people in Africa themselves. Leaders in politics, business and society on the ground have to find solutions for integrating millions of young people into local labour markets. This often seems like a daunting task and it has become popular to associate the African youth bulge with a ticking time bomb. However, there is no natural law which dictates that high levels of population growth inevitably lead to large numbers of idle and disaffected youths.

On the contrary, unemployment rates have developed very differently across rapidly growing countries in Africa, and some states have implemented promising programmes to leverage this potential. For African leaders this means that they need to stop thinking of their young workforce as a threat that needs to be defused and start focusing on the benefits that can be reaped. This is not to say that the dividends from the youth bulge can be harnessed easily. For one, Africa needs smart and genuine investments in the healthcare and education of its youth. Too many young people still lack even the most basic forms of schooling, and those who have had access to education all too often experience that what they have learnt falls short of what local businesses actually need. Money alone will not solve this issue.

Instead, what is needed are bold and creative ideas from African policymakers and the business community to bridge the educational mismatch that still impedes the ambitions of African youth. And of course, even the best education is of little help if there are no jobs where young people can apply what they have learnt. To benefit from its growing population, Africa will need stable and sustainable growth. The rule of law, functioning institutions, macroeconomic stability and tax systems that are fair and efficient are all ingredients without which long-term

and inclusive growth will remain elusive. Reaching the conditions to turn population growth from a menace into an opportunity is an arduous task. Still, it is anything but impossible and I find it encouraging that an increasing number of leaders in Africa are pointing out that it is their own responsibility to create an environment which ensures that the currently much-used slogan of “Africa rising” will not remain wishful thinking.

Saying that Africa’s success lies in the hands of Africans does not mean that we should not take a look at the bigger picture. So secondly, I would like to point out that there is a responsibility of the global community as well to get it right in terms of creating a global environment that enables Africa to integrate its young population in an economic success story. The international trading system is still far from being development-friendly and the job of shaping a truly inclusive trade system is not yet completed. Industrialised nations have to broaden what is currently a narrow focus on short-term vested interests and find ways to truly reflect African priorities in their trade relations.

For Europe this means, for example, finally and comprehensively removing its agricultural subsidies or making sure that the currently negotiated Transatlantic Trade and Investment Partnership with the US is not detrimental to trade and investment in Africa. Creating an enabling environment also means that Western energy policies have to take a global perspective and lead by example in fighting global warming. It is African youth that will suffer the most if the global community fails to find ways of altering production and consumption patterns which are based on the externalisation of their true costs to Africa. And when it comes to the responsibility of global leaders, there is certainly also the issue of illicit capital flows, which are robbing Africa of around US$50 billion every year. This needs to be stopped and the building blocks for this are fighting against corruption, creating clear national tax codes as well as cooperating globally in order to tackle tax havens.

Finally, as I stress the responsibility of the global community I do not only refer to the usual suspects who attend global summits and frequent ministry conference rooms. There is a crucial role to be played by the international businessmen and women as well. For me as an economist, Africa today provides a textbook example of a situation in which the private interests of profit-seeking companies clearly coincide with the public needs of the people on the continent. There are very few places left where the potential for real growth is as vast as in this region.

Foreign companies that smartly seize the opportunities at hand can profit immensely from the African thirst for investment in roads, telecommunication and energy infrastructure. At the same time, sustained investments will help to integrate local economies into global markets, create work and income for the growing African population and provide room to share know-how and put into practice the positive experience that many European companies have with technical and vocational education. I am glad that more and more companies are discovering the enormous opportunities that Africa has to offer. But the potential of the continent has far from been fully reaped.

Developing strategies to provide Africa's youth with genuine prospects is one of the defining tasks of the 21st century. Moreover, it is a task that can only be accomplished jointly; a task that requires as much individual courage as collective vigilance. I hope that this book, by discussing the issues at stake, contributes to granting the subject of African youth unemployment the awareness it deserves.

Prof. Horst Köhler
Former President of the Federal Republic of Germany

Education and knowledge – For the future of Africa

Seldom in the rich and changing history of Africa have the prospects and perspectives for a positive development of its various nations been so much at the focus of attention among international institutions and governments, both within and outside the continent. Numerous relations of a political, economic and to an increasing extent also of a social nature characterise the growing significance of this continent in the global context. Along with the European Union and China, UNESCO is also showing active commitment in the 54 countries of Africa. It thus comes as no surprise that the World Economic Forum (WEF) in Davos, Switzerland, has repeatedly dealt with the perspectives of this continent – or that it describes Africa as the world's last investment frontier, while boosting intra-African trade and investment by developing new and strategic alliances in both the public and private sectors.

Raw materials and their export must not remain the only objects of trade in a globalised value-added chain; the changing nature of bilateral trade relations in the goods and services sector is arousing increased interest in the African continent. Nevertheless, the share of domestic trade is very low, at a mere 10 to 12 percent.

This all opens up an enormous field of activity for Africa's policymakers, in which they can promote more intensive trade within the continent. The current growth rates of many African states, albeit from a low level, already promise enormous potential for economic activity.

For all this optimism, however, there are also huge challenges that could prove a threat or even a stumbling block to further development. These include unhindered access to clean water, which is an urgent need for all African peoples, a solution to the general food crisis in large parts of the continent, elimination of the overwhelming energy shortages, and finally overcoming the infrastructural deficits resulting from the strong population growth, as well as the many issues relating to employment of the mostly young population. At the current rate of development, an estimated 50 percent of the world's youth will be living in Africa by the year 2040. Sustainable, secure working conditions must be created for this job-seeking human reservoir – the unimaginable figure of 18 million jobs annually. There is no doubt about it: Africa still has a high scarcity of skilled jobs.

The shortcomings of many African states in financial matters call for public, but above all private investment. At US$57 billion in 2014, private investments were

around 20 percent higher than five years previously. The local enterprises in particular should seize the opportunities available and participate in the financing of educational initiatives. In its Europe 2020 strategy, the EU estimates that 7 to 8 percent of a country's gross national product should be invested in education and vocational training in order to maintain competitiveness on a global scale. And the African states are only just starting to develop into modern national economies and must first cover their backlog demand.

To provide lasting perspectives for the growing population of the African continent – which currently numbers over 1.1 billion people – and to prevent it from falling back again, as has so often been the case in Africa's history after an initial phase of growth, enormous efforts are required in this area: the ongoing development and reinforcement of technical education and training. In hardly any other field is there so much potential for the sustainable ongoing improvement of education for large portions of the population. An average of US$400 is invested in education for a child in one of the Sub-Saharan states, while almost US$100,000 are spent on educating a child in the USA or Europe. Education and knowledge constitute the foundation of sustainable social development and contribute to peace and prosperity by securing locations, companies and entire national economies, while at the same time serving the development of human competence and ensuring equal opportunity.

But education has an important counterpart: experience. With the specific application of knowledge in practice and constant on-the-job learning, education is becoming the foremost resource of the 21st century, since innovative power and competitiveness are directly linked to learning and knowledge.

Fundamentally and on a global scale, knowledge transfer provides the indispensable, sustainable basis for a secure future that is worth striving for; education and knowledge thus represent the key success factor for social advancement and economic growth. Only with education is personal participation in social development possible, so that cultural, political, social and economic factors can be recognised and implemented in a fruitful manner. Technical and vocational education and training (TVET) occupies a key position in this process of social transformation and learning, since it provides the fuel for technological progress and success – for both today's and future generations.

The African policymakers agree that TVET is the key to sustainable economic development. 1: it creates a large number of jobs; 2: it enables a maintenance culture that is otherwise lacking (specifically in the field of mechatronics); and 3: it reaches out effectively to population groups who otherwise risk dropping out of formal education at a young age. The following requirements and conditions are important parameters for TVET in reaching this goal:

– The growing emphasis on academic careers is not sufficient. Efforts to demonstrate how TVET (at a secondary-school, college or polytechnic level) provides young people with secure jobs must be intensified.

– There is an urgent need for the coordinated promotion of artisanal skills in the form of outreach programmes.

– One crucial issue in TVET is the language to be used: the students must understand the teachers and the teaching materials. The language must be simple but not simplistic.

– There is a shortfall in training for teachers in TVET.

– The donor agencies/donor countries do not coordinate their TVET projects sufficiently; as a result one country may propose one TVET system, while a second proposes another. The systems therefore continue to be less efficient.

– The German ‘dual training’ system can be very successful where a broad base of SMEs (small and medium-sized enterprises) is in place.

– There is great opportunity for establishing coordinated information/databases within Africa, so that countries can learn from one another. In many cases, reliable statistics would assist in augmenting planning.

– TVET must ensure it includes both genders.

Against the background of ongoing economic and technological change, global markets are presenting enterprises and educational institutions with new challenges. Speed, flexibility and quality of the educational programmes are the defining parameters in shaping processes of change.

The approaches offered and realised throughout the world by Festo Didactic open up favourable opportunities for further successful development of the states on the African continent. We stand for applied knowing. We concentrate on orientation towards solutions as a process – learning by doing. With customers from 45,000 educational institutions throughout the world, Festo Didactic generates tremendous potential in the field of TVET. We are convinced that the competition of the future will take place in the arena of education and knowledge – on an individual level, on a corporate level and in the context of entire national economies.

Educational investment is the best basis for economic growth, and rapid technological changes call for changing capabilities and skills in technical education. The trainees, skilled workers and technicians of today will then become the specialists of tomorrow. Festo Didactic is also a partner to institutes of technology, universities, vocational academies and schools, along with technological educational institutions and companies that have established vocational training programmes.

To ensure that the knowledge imparted is kept up to date, the curricula must be subject to constant ongoing development. Learning centres, classrooms and laboratories must likewise be constantly modernised to keep pace with technological progress. After all, maximum productivity in the manufacture of investment and consumer goods calls for astute selection of the methods and tools applied. The specific characteristics of individual countries, sectors of industry and cultures must be taken into account here in addition to methodical and technological criteria. Festo applies this success model together with its customers.

With this book we are providing a further contribution – an offer of solutions not only for the established national economies of Europe, America, Asia and Australia, but in particular for the burgeoning regions of Africa, where national programmes are needed for skills, training and technical education. Tremendous prospects for a promising future are opening up in the threshold nations. With education and knowledge as a strategic resource, these countries hold in their own hands the key to realising such opportunities. In addition to a well-founded description of prevailing conditions, this book also includes up-to-date interviews with partners on location, such as educationalists and policymakers. This is all enriched with a selection of case studies that present approaches which

have proven successful. In visual terms too, this ambitious publication provides a stimulating, attractive overview of the countries visited and treated, along with the relevant topics.

Education and knowledge have always been a matter of great importance to the family enterprise Festo. For more than fifty years, Festo has played a pioneering role in realising our vision of a better world by promoting education and knowledge. From the very first lectures in technology and the application of pneumatics in the 1950s, up to today's state-of-the-art learning systems that find application in the professional and academic worlds at educational institutions and universities, we understand our ongoing commitment to education as a corporate educational responsibility (CER). In this endeavour, we support young technological talent on an international, national and regional scale. After all, the roots of a national economy's competitive strength are still to be found in a sound technological education and training for its youth.

In summary, many factors could be mentioned that point to an optimistic future for Africa. Four of these can be briefly outlined here. 1: constant growth, which since 2001 has amounted to around five percent per annum; 2: a vast improvement in the overall conditions and business climate in most of the Sub-Saharan countries in favour of solutions that can be easily implemented; 3: improved access to financial services and mobile banking; and finally 4: Africa's more recent achievements in matters of equal rights – as is shown by the example of Rwanda, which in 2014 secured a position among the top ten countries in the WEF Global Gender Gap Index.

We are greatly indebted to the authors of this book, the many interview partners and the photographers: they have created a stimulating publication which invites us to turn our attention to Africa, and which competently and profoundly helps bring to fruition our concept of the opportunities for widespread education and knowledge that this fascinating continent provides.

Dr. Wilfried Stoll
Managing Partner Festo Holding Company, Festo Holding GmbH, Esslingen

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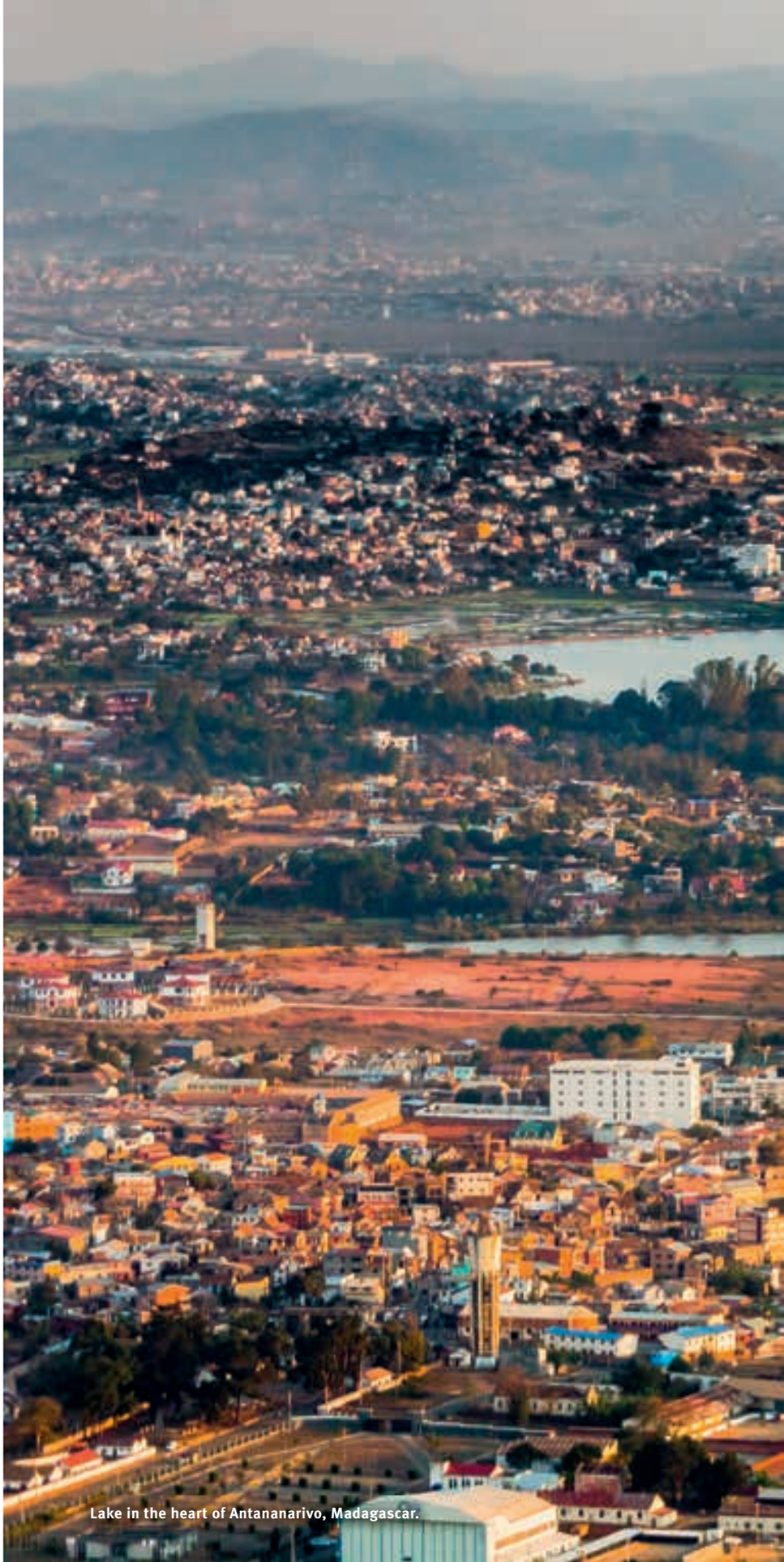
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Lake in the heart of Antananarivo, Madagascar.





Student in a flight simulator at the Ethiopian Airlines Aviation Academy, Addis Ababa, Ethiopia.



From the highlands to the airport

Training in electrical engineering at various levels is helping the country master the challenges of educating its young population and keeping planes in the skies

Debre Markos is a small, albeit up-and-coming, market town on the high plateau some 300 kilometres or seven hours' drive northwest of Addis Ababa. During the semester break, the population is about 10,000 and the town is quiet, with a few of the younger citizens meeting in the park to watch the sun go down. During term time, the figure is well over double that, as Debre Markos is one of the 13 new universities established in Ethiopia since the turn of the millennium. The Ethiopian government realised soon into the new century that a major effort was needed to boost skills levels in the country if the mass of young people were to find jobs and with them social security. To this end, they founded a brace of new universities, with the respective locations destined to lower the distances students had to travel from their home towns and not simply reinforcing existing centres of excellence.

Debre Markos University opened its doors to students for the first time in February 2007, and student numbers had reached as many as 19,400 by the 2013 academic year. The staff of just under 800 are supported by about 700 permanent administrative employees. However, the staff/student ratio is evidently not ideal, and the university has embarked on an ambitious staff development programme to meet the shortfall in qualified personnel.

The Department of Electrical Engineering is a case in point, particularly given the subject's popularity and the role electrical engineers can play in advancing the country's economy. The department is fairly hamstrung, with only seven lecturers at present. It falls to the post-grads from the first graduation wave to run the practical lab courses – at the same time gaining valuable experience. This practical focus is firmly in line with the department's mission to turn out graduates who



Students doing an exercise at the Ethiopian Airlines Aviation Academy, Addis Ababa, Ethiopia.

can work together in terms of addressing the sort of technical problems that are frequently encountered in industry in real life. After all, in today's Ethiopia, electrical engineers must be able to find solutions to new complex and challenging technical problems. They must have strong scientific, technical and managerial skills and be able to integrate technical concepts with practical applications.

Back in August 2008 the National Technical & Vocational Education & Training (TVET) Strategy stated that "Ethiopia's population is growing by around two million people annually, putting tremendous strains on the country's resource base, the ability to deliver services and the labour market. Around 35 million people of the Ethiopian work force are characterised by low skill levels and very low average educational attainment. Only 10 percent of the urban population has post-secondary school education."

Of that tenth, only recently has a larger number held university degrees, such as those from Debre Markos. Indeed, for all the emphasis on practical applications there is a potential disconnect, as the distance between industry and the university can be measured in hours travelled. Without a local industry at hand to advise the Department of Electrical Engineering, it cannot really hope to fulfil its mission adequately.

With welcome frankness, the national TVET strategy National Programme document comments that "the industrial attachment period has been introduced to formal TVET. However, its implementation has faced a number of problems, mainly due to the lack of cooperation of employers as they were not consulted during the planning process." However, it can hardly be judged the fault of the lecturers that they cannot readily contact the industry. At least the university functions as a focus of students; it is not competing with private institutions and certainly has little gender bias, the problems otherwise encountered in the TVET system.

The difficulty of engaging with local industry is a problem that once dogged the slightly lower levels of TVET offered by Addis Ababa's Tegbare-id Polytechnic. Or so recollects Albert Rorarius, posted by GIZ as part of its CIM programme to act as Labour Market-Oriented Education and Training Programme Quality Manager there. The Tegbare-id Polytechnic College is today home to some 3,000 students, many of whom attend evening school, and is busily in the process



Albert Rorarius, Programme Advisor, Tegbare-id Polytechnic, Addis Ababa, Ethiopia.



Tutor explaining to students how to use equipment, Debre Markos University, Debre Markos, Ethiopia.

of refitting its Electricity, Electronics and Automotive labs – these involved highly expensive equipment and the job relies on assistance from international donor agencies. Rorarius has struck up relationships with numerous businesses in the area in an effort to ensure industry interaction in his catchment area in curriculum development. And to make certain the product delivered is the right one, he is having the metal workshops renovated after about 30 years. He relies on a mix of international donors and some private sponsors, e.g. Ethiopian Airlines for electrical engineers. There are numerous small industrial estates "on the edge of town" where the Tegbare-id was built – now firmly part of downtown, but at the top end of the main road running out of town; "basically in the Polytechnic's backyard, there are now numerous industrial parks, SMEs, mechanical companies, electromechanical businesses, foundries and the automotive sector, car vendors and repair shops. The curriculum therefore allows students to attend for two hours after work, and then four hours on Saturdays. This way we get stronger industry buy-in."

As regards interaction between a training programme and a business, a cherished goal for many a young man in Debre Markos is the Ethiopian Airlines Aviation Academy attached to Addis Ababa's Bole International Airport. Ethiopian Airlines has made a strong name for itself with a vast expansion drive into Africa, buying stakes in other African airlines, achieving fivefold growth in passengers and in cargo volumes in the last decade and in 2015 winning the coveted Best Regional Airline of the Year award. At the same time, but largely beneath the radar, one of its business units, the Aviation Academy, has likewise really taken off.

Founded mainly as a pilot training school back in the 1950s, today it has seven business units. Pride of place goes to the pilot training scheme, with its simulators. While down through the years the majority of those who have completed an Academy programme have of course been from Ethiopia itself, with over 100 candidates on the pilot training each year, the African reach is immense. Countries such as Libya, Nigeria, Sudan, Tanzania and Zimbabwe have sent many a student to the Academy, just as many an African airline has sent its aircraft to Addis for servicing there in the American Federal Aviation Administration accredited facility – in the state-of-the-art maintenance hangar with a span of 7,200 m^2 and a height of 25 metres.



Entrance of Debre Markos University, Debre Markos, Ethiopia.



Academy Sales & Business Development Manager Tewodros Balcha explains that the cost of sending pilots abroad for training, like the cost of employing expatriate pilots, is simply prohibitive in the long term, and over the last eight years the use of the simulators has really soared. Likewise, revenue generated by the Academy through its global standard aviation maintenance training, ground operations and recurrent technical skills has surged. Students from all over Africa are learning these specialist skills that are so necessary to ensure that the pace of air traffic expansion in Africa is upheld and that the links between the countries in the continent thus become ever closer. To date, more than 3,000 students have graduated from the academy, with Sudan and Nigeria leading the non-Ethiopian countries.

Aviation Academy MD Samuel Assefe reports that “we’re in the process of making a US$50 million investment, ramping up the Academy, and not just on behalf of Ethiopia, but preparing to cater for all of Africa in this regard.” He explains that “what we are doing is part of the country’s growth and transformation programme. The Government as represented by the Board of Directors has given management a full mandate to enable us to achieve our mission as a commercial enterprise.”

“The majority of our investments go into capital expenditure, but some of course are also dedicated to enhancing the skills of our 150-plus staff members. After all, it’s they who are responsible for training 400 to 500 maintenance engineers from all over the country each year – typically, young graduates with a Science or Engineering degree under their belts, but some of them high-school leavers.” Many of them are eager to study in the accredited Ethiopian Aircraft Maintenance Technician School, which in the nearly 45 years of its existence has provided many a young person with basic and recurrent training programmes with a combination of classroom theory and hands-on practical training. Indeed, the Academy’s able instructors dedicate their time to taking each new wave of young graduates from places such as Debre Markos and preparing them as trainees for the ECAA, FAA and EASA certifications essential for entry-level employment as Aircraft technicians. Small wonder that this is the dream of many young men and women from one of the outlying universities, or of those who have worked their way up to graduation at a polytechnic school, in the provinces. After all, working for the airline is both a great career and a marvellous way to contribute to the country’s progress.

The socio-economic growth story

This chapter offers a brief account of the factors driving the rapid growth seen in many African economies and relates it back to the need for education in general and vocational education in particular

Africa is often used as a label to describe what sounds like a homogeneous continent. But that Africa certainly is not. With 54 countries and over 1,000 different languages, there can be no notion of homogeneity, especially as the continent is almost bisected North/South by the Sahara Desert and East/West by the Great Rift Valley. Quite meaningfully, beneath the umbrella of the African Union (AU) various regional economic communities (RECs) have been established to facilitate trade and mutual development support. While there are shared interests and in part the shared burden of a colonial past, there are also pronounced differences. Africa – a continent characterised by ethnic and political diversity!

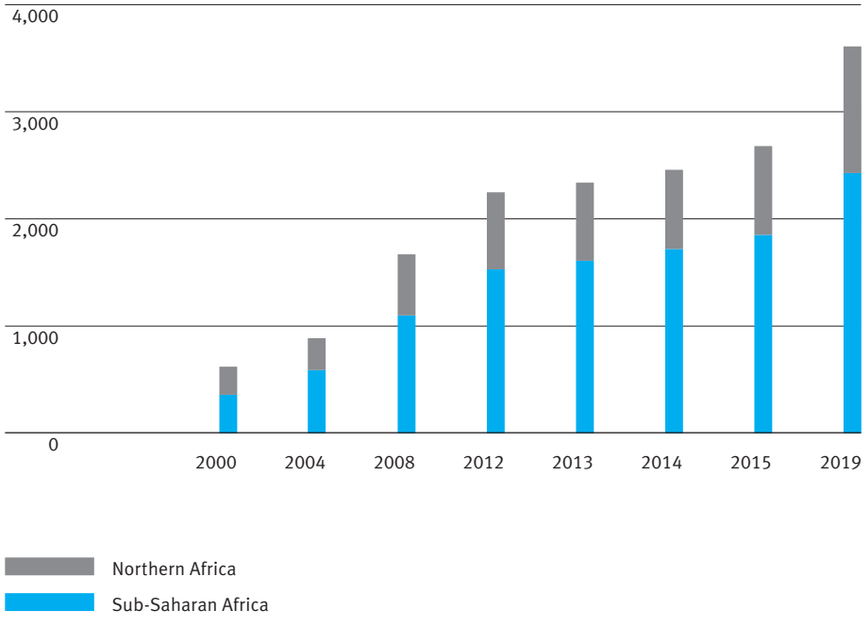
Another aspect of the heterogeneity is that many of Africa's 54 countries are small, with populations of fewer than 20 million and economies of less than US$10 billion. Their infrastructure systems, like their borders, are reflections of the continent's colonial past, with roads, ports and railways built for resource extraction and political control, rather than to bind territories together in an economically or socially meaningful manner. Precisely because Africa's economic geography is particularly challenging, regional integration is the best, perhaps the only, way for Africa to realise its growth potential, for those 54 countries to participate effectively in the global economy, and for them to lock into the benefits of globalisation.

For all the diversity, one thing is certain, and this applies to many of the raft of countries: they form the national chapters of the recently oft-cited African growth story. It is a story of Africa as the new "Lion", as opposed to the Asian Tigers. In March 2011 an oft-quoted World Bank report speculated: "Africa could be on the brink of an economic take-off, much like China was 30 years ago and India 20 years ago."[1] The World Bank's outlook for the continent was in line with other narratives of the African Renaissance, such as the McKinsey report on the continent entitled "Lions on the move" or the frequently cited "Africa rising" stories that ran in "The Economist" and in "TIME Magazine".

Africa is a continent full of opportunities and deserves this attention. The African economies, albeit not all of them of course, have posted impressive growth figures in the first decade of the 21st century, and are continuing to expand. Today, they are growing faster than they have in 40 years. In figures, from 2000 to 2013 the size of the total African economy grew by a factor of 3.9, the size of the Sub-Saharan economy even by a factor of 4.6. And most pundits expect this

growth story to continue. The IMF in its “World Economic Outlook” (October 2014) projects growth rates for African economies between 5 and 7 percent annually through 2019, whereas elsewhere in the world hitherto vibrant emerging markets are expected to falter.

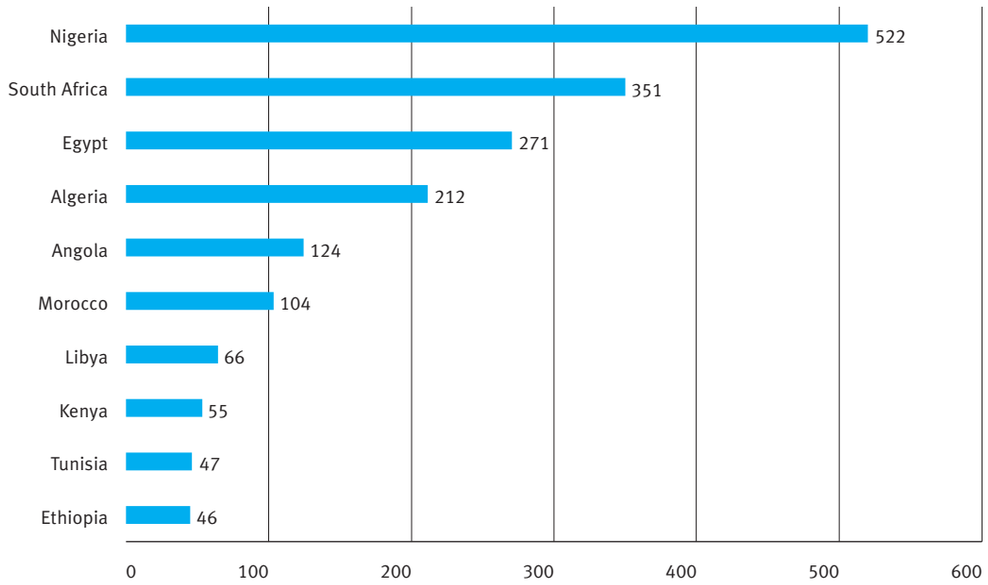
Africa’s GDP in US$ bn [2]



Six of the world’s ten fastest-growing countries in the first decade of the new millennium are to be found in Sub-Saharan Africa: Angola at 11.1 percent a year, Nigeria 8.9 percent, Ethiopia 8.4 percent, Chad 7.9 percent, Mozambique 7.9 percent and Rwanda 7.6 percent, with several others reporting growth of above or close to 7 percent [3] – the figure needed to double their economies in the course of the next ten years. With the rebasing of their gross domestic product (GDP), countries like Nigeria and Ghana have moved up to take their place among the ranks of the middle-income countries. In April 2014, the Nigerian Bureau of Statistics confirmed what many people already knew – by rebasing the Nigerian economy, its GDP totalled US$509.9 billion, which put it well above that of the

hitherto largest economy in Africa, South Africa, whose nominal GDP came to US$322 billion, and elevated Nigeria to the position of the largest economy in Africa. This growth trajectory seems set to continue. Indeed, if we assume that the European Union (EU 28) grows at an average rate of 1.5 percent annually in the coming decades and Africa goes on growing at 5 percent annually, then in 50 years' time the GDP of Africa will outstrip that of the European Union.

The largest African economies by GDP in current prices in US$ bn, 2010

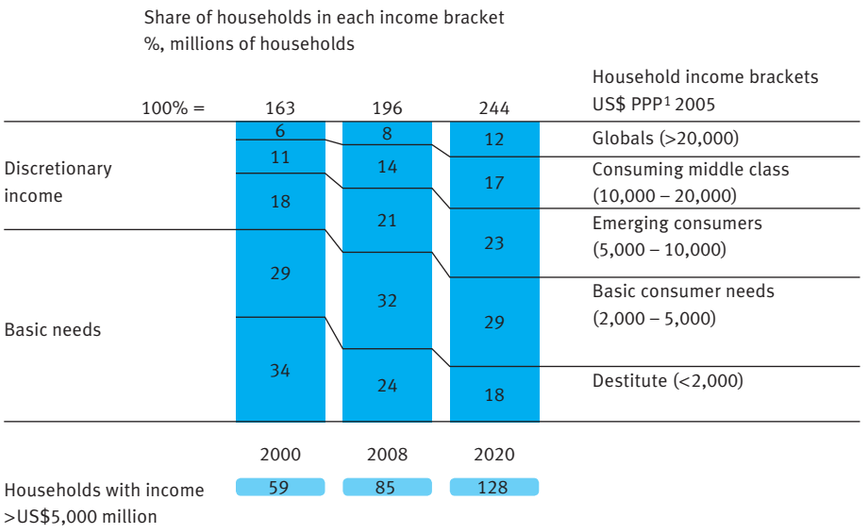


This socio-economic growth is also reflected in the emergence of an African middle class, something highlighted by the consultants at Deloitte, who in 2012 published a report aptly called "The Rise and Rise of the African Middle Class". According to it, Africa's middle classes have trebled over the last 30 years. Furthermore, one in three people are now considered to be living above the poverty line, although this should not be understood to mean that they are wealthy. The current trend suggests that the African middle class will run at around 1.1 billion (or 42 percent of the total population) in 2060.[4] By 2020, more than

half of African households, that is 122 million, will have discretionary spending power, and 29 million households are projected to earn household income of more than US$20,000 p.a.[5]

The fast-growing African middle class[6]

By 2020, more than half of African households will have discretionary spending power



[1] Purchasing power parity adjusts for price differences in identical goods across countries to reflect differences in purchasing power in each country.

What can be safely said is that the “African” economic growth story is very real, and that new chapters are bound to follow.

Growth drivers

Key growth drivers have been the enhanced quality of government policies, diversification, commodity prices, a stronger value chain – and education

This growth has been driven by better overall policies, better economic policies and better governance, not to mention the timely end of the decades-long debt crisis. The latter was put to rest with the UN's Highly Indebted Poor Countries Initiative (HIPC) and the Multilateral Debt Relief Initiative (MDRI); these made sure that no poor country now faces a debt burden it cannot shoulder. Indeed, the current level of external debt in such countries in Africa as a percentage of GDP is now not much greater than it was in 1980.

Other factors that have driven the growth surge include high primary commodity prices in the last decade, the discovery and extraction of new oil, gas and mineral reserves in Africa, investments in infrastructure and the beneficial impacts of mobile information and communication technologies.

However, what also seems certain is that without a strong education drive to make certain that human development keeps pace with the consistently growing population, growth will stutter. The African Centre for Economic Transformation, based in Accra, Ghana, comments in this regard that "a transforming economy would have an increasing share of the labour force in formal employment as the shares of modern agriculture, manufacturing, and high-value services in GDP expand and as entrants to the labour force become more educated. The share of formal employment in the labour force is therefore a good indicator for tracking the human impact of economic transformation (in addition to GDP per capita)."[7] Put differently, growth can also be measured in terms of upskilling.

Diversification of sources of growth

There is a fairly common view that Africa's growth over the past decade has been driven solely by exploiting natural resources. These have indeed contributed strongly to growth, but actually only accounted for less than a third of it. The real push has, in other words, come from numerous other sectors, including agriculture, manufacturing, construction and in particular the services sector. The latter added more than 62 percent to Sub-Saharan GDP, even though it often employs underqualified and mostly poor people and productivity is low.

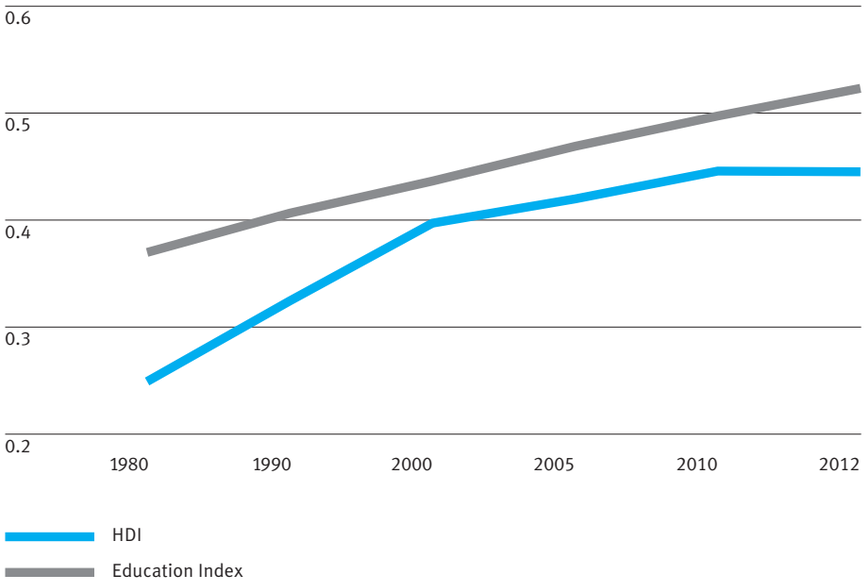
A major barrier to more inclusive growth is without doubt the lack of industrialisation in Africa. In the absence of industrialisation, export diversification has been nigh impossible for Sub-Saharan Africa during the two decades of rapid growth, and exports remain concentrated in a narrow set of products. This has sparked a debate on whether sustainable growth requires a shift toward manufacturing in order to add more value locally, or rather a leap into high value-added activities in the service sector, fired by innovation. After all, manufacturing value added tends to account for less than 10 percent of GDP, a ratio that has remained stable for four decades, not surprisingly as macroeconomic structures have not changed much either.

Opportunities may exist to move up the value chain and away from just exporting primary agricultural products – especially given that the majority of Africans live in rural areas. There is, after all, a need by many countries to be able to feed themselves, and to be able to process and package foodstuffs. Examples of how this can be achieved with staple and non-staple crops already exist, such as cassava flour in Nigeria or flowers in Kenya. A diversification of exports toward better-quality products or new products often supports structural transformation in low-income countries. This hinges on using agriculture as a means for inclusive growth, on boosting productivity, and on enabling the emergence of SMAs – three of the four points recommended by the UN High Level Panel in its development agenda for the period after 2015.

The ACET comments that "increasing agricultural productivity would be a powerful way to raise incomes. […] With cereal yields now running at about 1,500 kilograms per hectare, or a third of the yields of the comparators, raising agriculture's productivity has to be a key part of the economic transformation agenda."[8] Such a process will depend not just on capital investment, e.g. in infrastructure and technology, but on investments in human resources: on education. Hardly surpris-

ingly, the figures show there is a direct correlation between the Human Development Index (HDI) and education levels in Africa. It seems fair to conclude that for Africa the next chapter in the growth story will be a chapter on the growth of education. This is a conclusion various policymakers have already taken on board, a prime example being Ghana.

The human development index and education[9]



Note: Human development in Africa is improving steadily (0 = worst, 1 = best). The Education Index is one of the three pillars on which the overall HDI is based. The Education Index comprises two indices, 1. Expected years of schooling (children) and 2. Mean years of schooling (adults).



Three generations outside the TVET office, Cairo, Egypt.



Mostafa Hamdi

Chairman and CEO of Grands Moulins Fassis and Hida Invest, Casablanca, Morocco

What role does agriculture play in Morocco today?

As in many countries in Africa, agriculture is by far the most important sector in the Moroccan economy. There has been a campaign and plan, “Green Morocco”, destined to enable a smooth transition from traditional farming to modern agro-production. The idea is to stop migration away from rural areas and the attendant problems of urbanisation, to improve general living conditions and to foster high-grade agricultural produce. The overall intention is to boost productivity and profitability. Why? Well, 60 to 70 percent of the farmers, or so I believe, have tended to work at a subsistence level, if not below it. As a result, the next generation has been forced to sell the land of their parents and has moved to the cities, to work in cafés or whatever, in the hope of improving their incomes.

That said, this is also a training problem. Agricultural training is special because of the specific mix of practical and theoretical inputs. We’ve seen an imbalance between the laudable efforts of the Ministry of Agriculture and the programme of OFPPT, the Office for Vocational Training and the Promotion of Labour. For a country as large as ours, ten agricultural schools and two engineering schools are not enough. More interministerial coordination is evidently needed.

What would the alternative be?

One path that seems to offer a solution is to ensure greater involvement of the private sector, as businesses perhaps know better what is needed. One success story is that of the cereal industry. In the absence of appropriate training facilities, the “Association des Meuniers Marocain” in cooperation with USWHEAT founded its own training school. It cost about US$5 million but is now undoubtedly one of the best schools in the world. It turns out 40 to 50 chief millers each year, and they get ‘exported’, to Egypt and other Arab countries, for example. That fills us Moroccans with pride. Here you can see how there are shared interests in African countries as they develop – interests that cut across language barriers and cultures.

Apart from agriculture, which sectors will be key to the development of Morocco's gross domestic product?

I think we should differentiate here between two different areas. First there are tourism and the service sector, which have great potential and can create very many jobs. Then there is the country's pivotal location between Africa and Europe. This forms an ideal basis for it to function as a production hub for foreign corporations seeking entry into the African market. Take the example of Renault, with its cutting-edge almost CO_2-neutral factory in Tangier and the 6,000 jobs that have evolved there – a success for the entire group. The factory focuses on production of the low-cost sections, or 60 to 70 percent of the overall car. The high-tech production, such as the manufacture of the engines, remains in France. A cable industry has arisen alongside this and now supplies multinational firms such as Boeing. In fact, the international aerospace industry, another example being Bombardier, benefits not just from tax relief and the ready availability of land etc., but also from the low wage costs for skilled labour. Here, Morocco seems to have got it right. Public/private partnerships have meant that training is provided where it is needed. In fact, Renault has its own vocational training centre in Tangier.

Have there been challenges?

This offsets the inefficiencies of the state vocational training system, with its centralised structure. It accounts for a large slice of our GDP, but the results are modest. Competition between public and private training offerings is to be encouraged. Morocco has faced unique difficulties, however. The public education curricula were switched over from French to Arabic at the end of the 1970s and in the early 1980s. However, the teachers had been trained in French, most of the materials were in French, and it was hard to impart knowledge in the new language. This was especially true in the natural sciences and technical disciplines. Not that everyone spoke Arabic, either. It is not as if Morocco has been alone in trying to 'indigenise' in this way, just as we are not unique in wrestling with issues such as ensuring local content in large projects. What I do believe is that the challenge must be to interface with business and decentralise. In other words, we need to make certain that when foreign companies locate to Morocco we get training centres on the Renault model set up as PPPs to help us along the path to industrialisation. Otherwise it would be like the chicken and the egg. No industry without trained staff, no trained staff without industry. If we get more training centres then instead of an either/or we get the best of both worlds. And the very many young people in the country will find employment commensurate with their skills. This in turn will incentivise young people to stay in Morocco and work for the long-term progress of the country.

"No industry without trained staff, no trained staff without industry. If we get more training centres then we get the best of both worlds."

What role do you see Morocco playing in Africa going forward?

For some time now, among other things our Ministry of Trade, Industry and Investment has been encouraging us to strengthen our ties to West Africa and I do believe there are numerous opportunities awaiting us. There is a degree of natural overlap over and above the obvious cultural and religious linkages, for various ECOWAS member states are encountering challenges with which we ourselves are still familiar from the past. There are definitely synergies to be tapped. Their development trajectory is one that requires foreign direct investment, specifically in agriculture, for example. And as stated, we in Morocco have a strong agricultural tradition and have a history of investing in business opportunities. Not to forget that we are on West Africa's doorstep or they are on ours. And I am speaking here not in general terms, but from personal experience and out of personal conviction. When I was in North Nigeria I very much felt at home. Now I am not a politician, but I think it is safe to say that with the changes taking place North of the Sahara there are also good reasons for us to strengthen our links and shared interests. I am also convinced that energy, and specifically renewable energy such as solar PV technology, will emerge as one of the most important pillars for development in African countries. I have been involved in this area, mostly in Nigeria, for over three years and I am convinced of the benefits this energy source has for speeding up the development not just of North Nigeria but likewise of Burkina Faso, Mali and Côte d'Ivoire. I am also convinced that alongside education and health the integration of agriculture and renewable energy sources will become the third principal component for dynamic development of our African countries.



Supermarket in downtown Casablanca, Morocco.



Keeping couscous on the table

OFFPT, the Moroccan Vocational Training Programme, and the Institute of Vocational Training for Millers are doing a lot to keep the country in work and food

If you walk into a bakery in one of Casablanca's countless suburbs at the right time of day you will be greeted by the scent of baguettes fresh from the oven. In Morocco, the Northern African country reporting by far the strongest ongoing growth and the sixth-largest economy in Africa, the baguette is a veritable staple. The loaf will cost between 2.50 and 6.00 dirhams, or between 25 and 60 US cents. And at the lower end of the spectrum, a certain volume of loaves come with the price controlled, i.e. guaranteed by the state to ensure that everyone in the population enjoys their bread.

That said, the economy's future growth prospects look rosy. Morocco has done a lot to diversify, although industry is fast being overtaken by a new services sector. At the same time, the country is a busy exporter; among the main products outward are textiles, phosphorous and other minerals, fibreglass and cables. The country is already working hard to assemble cars and also supplying the European aerospace industry. Moreover, the government is busy prioritising trade links southwards primarily to West Africa.

All of the above fields require skilled labour, and Morocco's large pool of young people is eagerly looking to gain such skills. However, the backbone of life remains agriculture, with tobacco and vegetables, oils and fish all heading overseas, or 25 percent of all exports, although grains often come from abroad. In fact, agriculture accounts for some 19 percent of GDP – and directly or indirectly provides as much as 45 percent of the employment, or some four million jobs. Moreover, 14 million Moroccans are directly dependent on agriculture, whereby it attracts ever fewer young Moroccans.

The country's development plan (US$1.1 billion up until 2015) addresses the problem, as 34 percent of it is set aside for training and education. Another



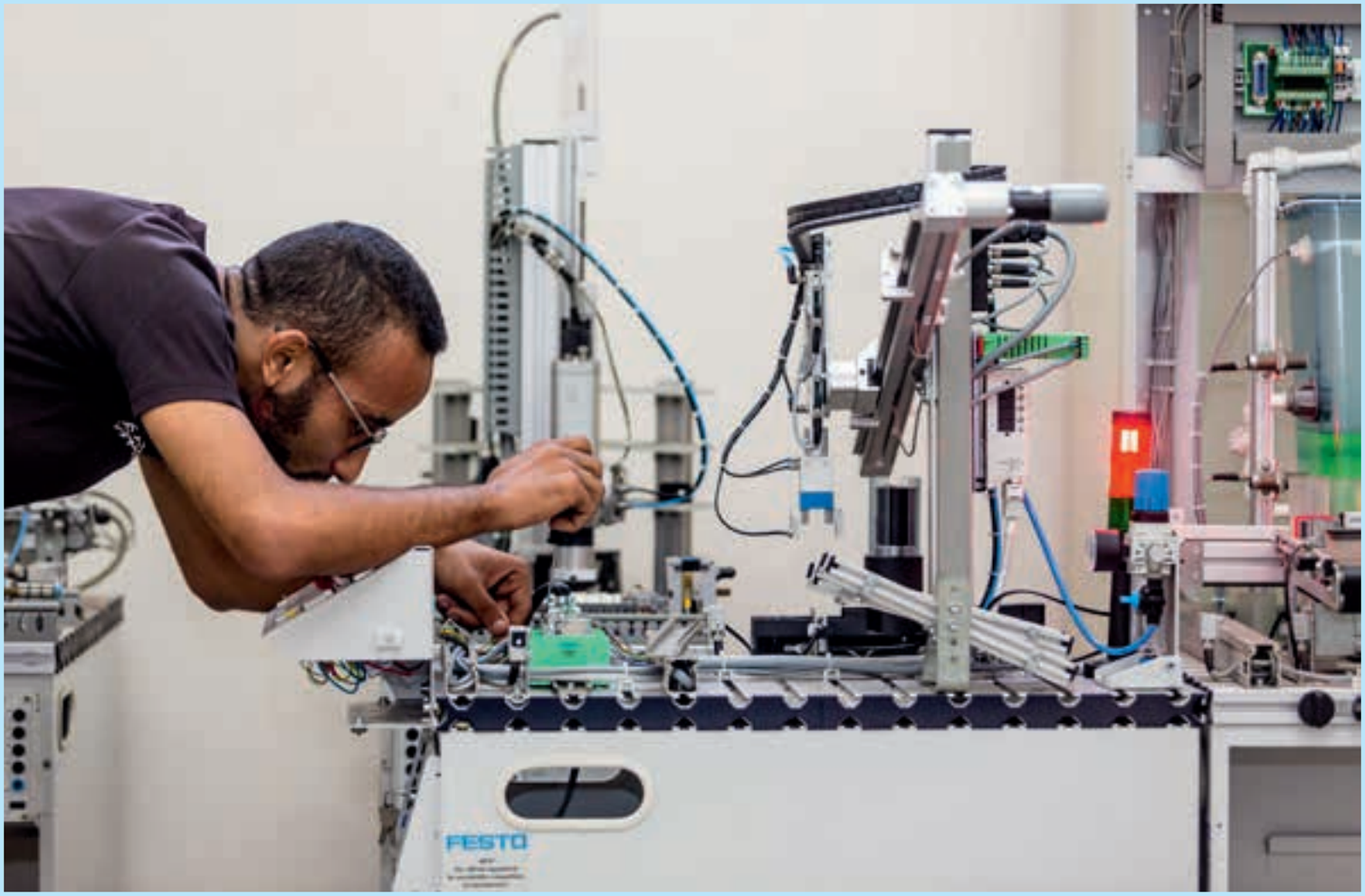
Inside the Grand Moulins Fassis flour mill, Casablanca, Morocco.

24 percent is available as incentives to investors willing to commit to the fields of automotive, aerospace, electronics, textiles and the food industry. The agency that delivers the training for all this is OFPPT – l'Office de la Formation Professionnelle et de la Promotion du Travail, based in Casablanca. A massive total of 12 percent of students enrolled in upper secondary education are taking part in TVET programmes, many of these organised by OFPPT. By 2017, the institution's aim is to have trained one million young people – not a small number by any means. This objective will be achieved through local support, and an emphasis on social development and work promotion and on vocational training, says OFPPT CEO Larbi Bencheikh, who is convinced that providing high-quality training to young people will later help them enter the world of business. "The idea is to meet the needs of human resources while giving young people, and particularly girls from rural areas, job skills," he comments. "In this way, unemployed youth will be more competitive in the job market."

And OFFPT is not just active on behalf of Morocco's youth, and in furthering equal opportunities for boys and girls, as a glance behind the scenes at its large complex in Casablanca shows. The facility is acting as a well-equipped hub for West Africa. This is testimony to Morocco's push to forge stronger trade links with the region, as exemplified by the increased intensity of airline links. The centre is busy training trainers from Côte d'Ivoire in mechatronics, with instruction covering both theory and practice. In the course of the practice the six aspiring trainers hook up the mobile lab to a solar panel and see whether the early afternoon solar irradiation suffices to power it up.

Elsewhere in Casablanca there is also another institution driving African development: not only is OFFPT based in Casablanca, so is the IFIM, l'Institut de Formation de l'Industrie Meunière, or Institute of Vocational Training for Millers. It is one of only five or six such institutions worldwide and was set up by the Moroccan Millers' Association, Fédération Nationale de la Minoterie, (FNM) jointly with the Moroccan government in 1993. In terms of this public/private structure it is a landmark in TVET in the country. The government, through OFFPT, covers the salaries of the instructors.

The IFIM shows that industry-driven projects are often crucial to creating successful TVET programmes. Director Sahaba, who has been at the helm of IFIM since 2003 following a career in public finance and then the oil industry, comments



Preparing instruction equipment at OFPPT, Casablanca, Morocco.

that "about 20 years ago, the millers noticed that there was a real problem owing to a lack of skilled staff. And remember there are over 160 mills in the country. So they decided to create their own institution. Moreover, in the past the function of Head Miller tended to be dominated by French personnel, which was a very expensive policy. Together with the government, the millers' association therefore decided to create their own training centre. Since then, we've trained over 350 students – 90 percent for local industry, with the remaining 10 percent split more or less equally between Africa and the Middle East."

Meanwhile, under Director Mahjoub Sahaba, the IFIM has started to participate significantly in assisting the rest of Africa, by providing training for students from abroad. There are at present 6 or 7 international classes a year, each lasting 14 days, focusing on the entire milling process, labs/standards/technology and theory. Instruction is in French, English (specifically Nigeria and West Africa are targeted, where there are large-scale mills) and Arabic, for students from, for example, the Gulf states. It is after all unique in Africa and the Middle East.

Local students are selected after passing their baccalaureate, preferably with an emphasis on science or technology. The intake is 25 students a year – from among over 200 applications. Baccalaureate grades are not all that counts, as the candidates' own motivation for milling is also critical – after all, the course with a mix of theory and practical work takes two years and the idea is to only have students who have staying power. In fact, the instruction starts quite literally from the ground upwards, as the first step is to learn how to clean the floors of the mill before work can start.

The IFIM, which nestles in large green grounds near the port in Casablanca, right next door to a large mill, has built facilities totalling 1,910 m^2 that include classrooms, an administration wing, and three dedicated labs and simulation equipment, with pride of place going to the pilot mill, which includes industry-acknowledged Swiss Boehler equipment and can produce one tonne an hour of milled product, or 15 tonnes a day, bought with support from the United States. There is also a trial mill where students learn the different yields. The one lab is for chemical and rheological analyses of cereals (it is ISO 17025 accredited), the second for physical analytical work, and the third an experimental bakery so that students can see what their milled product can be turned into. The labs can of course perform quality assurance for outside customers, too.



Lecturer and students examining milled grains to identify differences in the milling process,
IFIM millers' institute, casablanca, Morocco.



However, the IFIM has not been content to rest on its laurels, and thanks to a grant from Canada for US$6 million, it has been able to upgrade equipment to ensure the young millers learn on equipment that meets international best practices. The IFIM has likewise also received support from the US Millers' Association. Mr. Sahaba emphasises that his "mission was to boost investment in the institute, as our strategy has been to move beyond just basic training and make us 'the' centre of excellence. On the other hand, we have always had a national 'milling focus' in one particular sense: given eating habits in the country, we have to concentrate on couscous, which remains the main staple in Morocco, although we have sought to diversify couscous types, sizes and aromas. This contrasts with the training centre being developed in Kenya to work the East African market, as eating habits there are completely different."

To summarise, the IFIM has a crucial role to play not only in shoring up the backbone of the food chain, but also in helping guarantee food security of the requisite quality. One by no means insignificant reason why the millers' association is strong is that alongside couscous, bread is so important for the lower strata of the population and thus strategic for the government. Director Sahaba comments that "the subsidy system is complicated. One category of bread is designated that relies on national flour, whereby 600,000 tonnes are supported annually. The bakers then guarantee that the bread is sold at 2.50 dirhams a loaf. Moreover, the millers guarantee that they use local wheat. There can be quality issues in this regard, because very often the wheat is grown by smallholders, but that is the sort of challenge our labs help overcome."

The political success story – The African Union, democracy and the rule of law

This chapter outlines how political stability has helped the continent draw more closely together – and how this trend has been decisively supported by the rapid growth in air traffic and mobile telephony. It also discusses how both the provision of electricity and the widespread adoption of renewable energy sources can foster that process

In terms of political stability, the last two decades have seen a progressive turn for the better, with the post-Cold War and post-Apartheid era characterised in most countries in Africa by significant political and social reforms. The process of democratisation that has taken root across much of the continent has no doubt also helped create the enabling environment for economic growth and, perhaps more importantly, for substantial improvements in the quality of human life.

The international media tended to focus on the story of post-Apartheid South Africa, which held its first democratic elections on 27 April 1994, with black South Africans forming long queues eager to cast their ballots for the first time. Less attention was paid to the fact that from the early days of independence in the 1960s right through to the 1980s, many an African country was ruled by some form of autocratic regime, with only five African countries holding regular elections in the Cold War era. All of that has since changed, a trend that culminated in February 2015: for the first time in Sub-Saharan Africa, an incumbent was voted out of office in a presidential election – in Nigeria. In other words, the political landscape has changed fundamentally. Regular democratic elections and peaceful regime changes are increasingly the norm across most parts of Africa.

Some if not all of the credit for this sea change must be attributed to the African Union, the successor organisation to the Organisation of African Unity. Unlike its predecessor, the AU champions intervention in member states to ensure stability in times of crisis, placing economic development above political liberation. It was established in May 2001 and formally constituted a year later.

In the interim, the African Heads of State and Government adopted the programme termed New Partnership for Africa's Development (NEPAD) – the founding member countries driving the process being South Africa, Nigeria, Algeria, Egypt and Senegal. NEPAD essentially amounts to the development master blueprint for Africa. It was ratified by the African Union (AU) in 2002 to address Africa's development problems in terms of the objectives of reducing poverty, achieving a sustainable development path, halting the marginalisation of Africa, and empowering women and accelerating the integration of the continent into the global economy. To enable monitoring of progress in the form of self-assessment of good governance, in 2002 under the aegis of NEPAD the African Peer Review Mechanism (APRM) was put in place, and by 2011, 14 countries were in the review process, including heavyweights Ghana, Nigeria and South Africa.

The African Union – Improving continental integration and trade

Forecasts indicate that with economic development the volume of regional trade will climb significantly between 2010 and 2040

Ever since the 1980s, the OAU and then the AU sought to promote economic development along with stability and cooperation, publishing a series of action plans and treaties along the way to this effect. Institutionally this has seen the foundation of two key agencies, the Economic Commission for Africa (ECA) and the African Development Bank (AfDB). At the January 2012 AU General Assembly in Addis Ababa two themes were at the top of the agenda, the first being the establishment of a Pan African University, the second the decision to establish a Pan African Continental Free Trade Area (CFTA) by the indicative date of 2017. While the Pan African University, which conducts post-graduate research, is sub-divided into five regional centres, the CFTA can build on the existing foundations of the Regional Economic Communities (RECs) mentioned at the outset. These were foreseen in both the 1980 Lagos Plan of Action for the Development of Africa and the 1991 treaty to establish the African Economic Community (also referred to as the Abuja Treaty) as prerequisites for continental integration. Currently, there are eight RECs recognised by the AU, each established under a separate regional treaty:

- the Arab Maghreb Union (UMA)
- the Common Market for Eastern and Southern Africa (COMESA)
- the Community of Sahel-Saharan States (CEN-SAD)
- the East African Community (EAC)
- the Economic Community of Central African States (ECCAS)
- the Economic Community of West African States (ECOWAS)
- the Intergovernmental Authority on Development (IGAD)
- the Southern Africa Development Community (SADC).

There is some overlap between membership of the blocs, just as their composition has changed over time. What they foster is the intra-regional flow of goods and people and the strengthening of inter-regional ties that enable the smaller countries to benefit from the economies of their large neighbours.

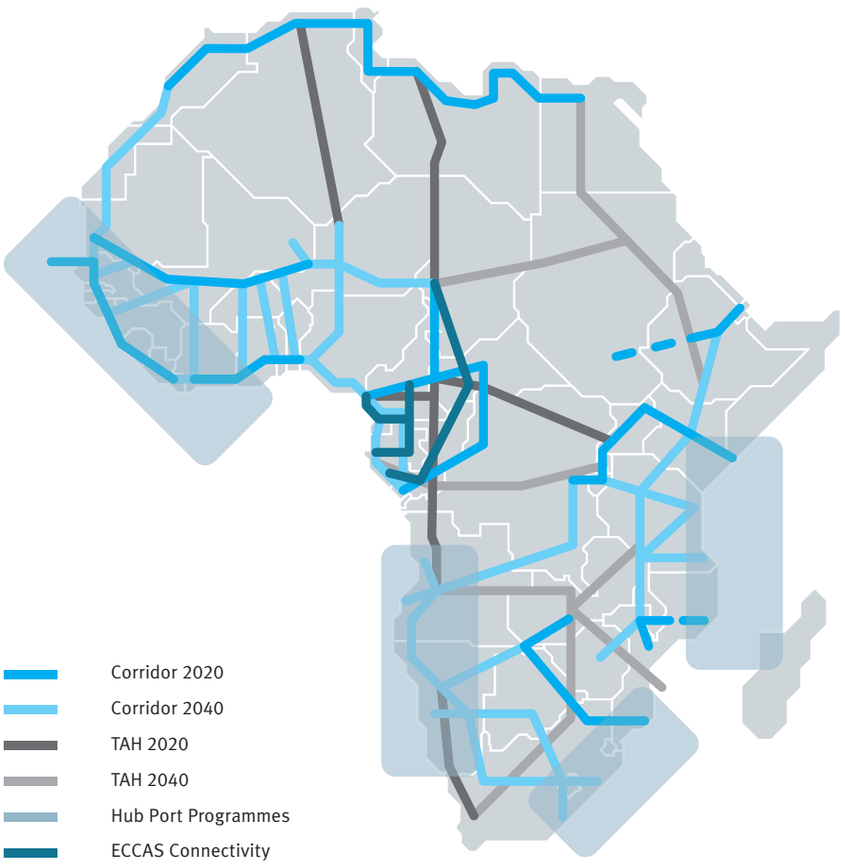
The policy is evidently bearing fruit, as since the turn of the millennium there has been considerable growth in both intra-African imports and intra-African exports. Between 2000 and 2010, intra-African imports amounted to US$29 billion with annual growth of 14.4 percent, while over the same period intra-African exports were on average US$30 billion with an annual growth rate of 14.6 percent. Intra-African imports represent an average of 14.2 percent of total African imports while intra-African exports represent 10.4 percent of total African exports. However, this should be seen in context, as if placed against the background of global trade, the ratio is very low. Indeed, the share of intra-African imports is only 0.25 percent of world imports, while intra-African exports represent 0.26 percent of world exports. These figures may not be that good yet, but the rate at which they are climbing certainly marks the beginning of a new inner-African era. Forecasts indicate that the volume of regional trade between 2010 and 2040 will climb significantly, from some 950 million tonnes by a factor of more than three to approx. 2,800 million tonnes, with the greatest increase to be seen in Central and East Africa. With a view to fostering such trade, the African Union has likewise laid plans for stronger transport integration, defining in particular future railway and interstate corridors and shipping routes in a manner not dissimilar to the approach India has taken with its “Golden Quadrilateral” road plans.

Africa: Growing ever closer together

Inter-regional transportation and interconnectivity is surging – air travel and mobile telephony have been game-changers

Thanks to the African Union's policies and efforts by the private sector, Africa is growing ever smaller – as it is growing ever closer together. There have been two prime symbols of this integration in recent years: the airline industry and the telecoms sector. And one example of where such integration could considerably help the continent in future years is power generation.

Creating an inter-regional transport network [10]





H. E. Erastus J. O. Mwencha

Deputy Chairperson, African Union Commission, Addis Ababa, Ethiopia

How do you view youth empowerment and education?

I firmly believe as Africans we must empower our youth more. And the African Union as a union can play a role here showing the way. After all, as regards skills right now a glance around at what is happening in most of our member states, whether it is policies at the national level or at the continental level, or even at the global level for that matter, shows one and the same picture: the emphasis tends to be solely and exclusively on academic criteria, by which I don't mean primary education of course, but secondary or post-secondary education and universities. It is as if the policymakers had forgotten artisanal skills and how they should contribute to the backbone of any society. Those are the skills we need to go for in the next decade of education. That will create more opportunities.

Is this a field for inter-regional coordination?

I firmly believe we need to ask ourselves of course what is the most judicious strategy: to first identify the relevant skills per country, or to first pinpoint the lack of policies, coordination or information. There are already centres of excellence in Africa and there are opportunities in Africa for skills acquisition, but if you go out on the street and ask someone whether they know where the people train, those who answer in the affirmative will be few and far between. African nations can and must learn from one another, despite the big differences between one country and another.

If I remember correctly, when I joined the civil service many years ago I saw something done in Japan that greatly impressed me. They had a very systematic approach to going out and identifying the kind of jobs the economy needed. Now when I think of the Japanese economy back then it was all about SMEs and small producers. I believe that is the model Africa should go for. Why? Because if you train skills for small companies it will create the most jobs, jobs where they are needed, and this in turn will spur greater socio-economic development. That will invariably help start the oft-cited process of transformation.

“If you train skills for small companies it will create the most jobs, jobs where they are needed, and this in turn will spur greater socio-economic development.”

High-tech or low-tech?

One should differentiate here as to whether the skills are at the level of catering for basic needs, such as food, or whether we are looking at issues of technology, information technology and science. What is more, if the skills are for a small business, then it is potentially easier to cover the investments, as the initial sums you have to perform are smaller. This means that there is a greater likelihood of getting microfinance and sustainability. The African Union is busy trying to encourage greater involvement and is having discussions with international development agencies, the World Bank etc. in this regard, reaching out to them to try and establish how best to proceed and looking for the support that some of the African Union’s member states urgently require. Because the task at hand is definitely not small. But we shall master the challenges collectively, of that I am sure.

Africa’s airline industry

Whereas centuries ago the presence of caravan routes attested to inter-regional trade, today it is the burgeoning number of airline connections. There are various reasons why aviation is an obvious solution to many of the continent’s logistics problems. Not only are 16 out of the 54 AU member states landlocked, but also transportation infrastructure per se is underdeveloped in many regions, making it easier to connect cities by air than by road or rail. Moreover, the sheer size of the African population and by extension of an emerging middle class with greater disposable per capita income works in the airline industry’s favour, as do the immense distances that often need to be travelled. Added to which, the sheer rate of urbanisation means that inter-city travel is burgeoning.

Whereas in the past, days might be spent getting from A to B, that gap can now be bridged by air. Moreover, the pent-up demand is staggering as economic growth really kicks in, and there is an acknowledged strong correlation between GDP growth and an increase in air travel. In 2010 Africa accounted for a minute share of only 2 percent of global air traffic, but the trend is definitely skywards – a tendency that has seen local airlines and national carriers become far stronger than they have been in the past. A classic case in point is Nigeria. Inside the country air travel has truly taken off since the turn of the millennium. While the one or other airline has not survived the scramble for passengers, on the domestic front the sheer number of destinations has soared, with Arik Air serving no less than 17 destinations within the country, and Aero Contractors 12 destinations, to name but the two largest carriers. Likewise, Kenya Airlines now covers ten domestic destinations in addition to its international operations. And beneath the radar of the larger countries, there has been a swift rise in the number of daily flights between the various countries in each REC. Within East Africa, for example, there are now regular connections between Rwanda, Uganda, Dar es Salaam and Nairobi, just as within ECOWAS there are numerous flights between Abuja and Lagos in the East and destinations through to Dakar in the West.

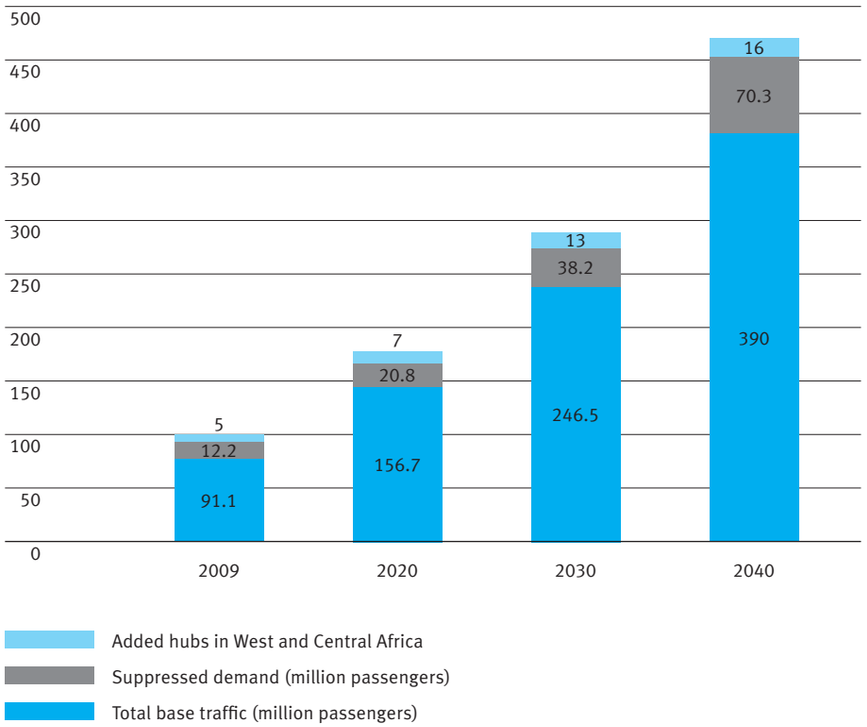
In some countries this successful expansion has gone hand in hand with an insistence on a national carrier, and this has helped ensure financial security during the expansion phase. As a consequence, there are now various African big players on inter-regional and by extension international routes alongside the long-standing national carrier South African Airways, namely EgyptAir, Ethiopian Airlines, Kenya Airways and Royal Air Maroc. And these African Lions are really working the continental routes. While at the start of the decade intercontinental

passenger traffic (45 percent) constituted more than intra-African traffic (22 percent) (AFRAA, 2010), things are fast changing as a glance at the destination maps soon shows. SAA now flies to over 30 continental destinations, with Ethiopian Airlines already rivalling it. Kenya Airways has flights to over 20 countries, with both Royal Air Maroc (18 destinations) and EgyptAir (16 destinations) not far behind. All of these companies are working on the hub principle, making Addis Ababa, Cairo, Casablanca, Johannesburg and Nairobi highly frequented international turnaround points.

It is a trend that has not gone unnoticed outside the continent. International players such as Lufthansa have responded, with the German carrier buying out Brussels Airlines, among other things to be able to use the latter's highly profitable African routes. Emirates and Qatar are busy plying their trade on some of the lucrative West, East and Southern African routes, while Turkish Airlines, which currently serves 20 African destinations, is even running as its 2015 ad claim: "Fly Africa!" This international expansion has also spilled over into cargo services, with companies such as Emirates opening new routes (e.g. SkyCargo: Dubai to Kano, Nigeria) and Lufthansa Cargo now operating haulage flights to Cairo, Dakar, Johannesburg, Lagos and Nairobi, with Rwanda and Burundi handled through Brussels Airlines (BruCargo).

In a sense, in the absence of a mass of long-haul bulk cargo that would require railways, and the dearth of international roads, Africa has leapfrogged such systems and opted for air travel. Indeed, the sector faces rosy prospects. According to Boeing's estimates, annual international passenger growth can be expected to run at 6.6 percent through to 2031 in Africa (Boeing, 2012). According to the African Development Bank in 2010 the aviation industry in Africa supported about 7 million jobs (including 257,000 direct jobs) which were worth US$67.8 billion to the continent.[11] Scheduled revenue passenger tonne-kilometres (RPKs) handled by airlines in Africa as reported by AFRAA, the Africa Airlines Association, increased by 5.9 percent to 292.97 billion in 2012, while capacity measured by available passenger tonne-kilometres (ASKs) likewise grew, by 4.6 percent to 414.2 billion.[12] Moreover, overall continental air passenger traffic is estimated to surpass 450 million by 2040. Seemingly, the sky is the limit.

Africa: Air passenger traffic trends through 2040



Mobile telecommunications

No market has shown Africa's ability to leapfrog past systems and engage with new technologies better than that of mobile telecoms. The latter's spread has been a real game-changer

The sky was most certainly not a limiting factor, as landlines had been, when it came to the take-off of mobile telephony in Africa, another story of the success of leapfrogging solutions accepted in the Global North in favour of the latest technologies.

A major success factor of mobile telephony in Africa is the scarce diffusion of PSTNs (fixed line networks). In 2000, Sub-Saharan Africa as a whole had fewer telephone lines than Manhattan alone. Fixed line networks hardly reach the remote rural areas where a relevant percentage of the African population lives. Of about 400,000 rural settlements that are estimated to exist in Africa, less than 3 percent have PSTN access.[13]

Mobile telephony providers recognised the potential this offered and, in part with support from international development financing institutions, pursued a very upbeat strategy that has led to the extremely rapid spread of mobile networks. While some ten years ago less than 45 percent of rural settlements in Africa had GSM coverage, today the figure is far closer to 90 percent. The ITU summed up the situation fittingly when it declared: Africa is a mobile-only continent! Africa accounts for less than 0.5 percent of the world's fixed-broadband subscriptions, but up to 20 percent of the population will be online by the end of 2014, up from 10 percent in 2010.[14]

According to the ITU World Telecommunication/ICT Indicators database, in 2005 Africa had 87 million mobile phone subscribers, as compared to 550 million in Europe. In 2015, the figures were 685 million and 757 million respectively. It does not take much maths to guess when Africa will overtake Europe and start to compete with the market in the Americas, the second-largest after Asia: it is anticipated that by the close of the decade there will be 930 million mobile phone subscriptions in Africa. In corporate terms, this immense growth has been structured around three companies: Airtel (Q1 2015: Africa: 76.3 million GSM customers), MTN (Q1 2014: 146.7 million subscribers) and Vodafone/Vodacom (Q3 2014: 61 million customers).

As a consequence of the wider availability of mobile telephony, many Africans rely on the cellular network for Internet access, which now links village inhabitants with doctors or clinics in local townships and means people can keep in touch with one another, be it as relatives, friends, colleagues or business partners. Education has benefited in many regards from this spread of the Internet, be it through e-teaching, the opportunity to read online in the absence of budgets for books, or even in the interaction between academics up and down the continent. It is fair to say in this regard that the Pan African University may be the product of an African Union resolution, but the reality of it is the product of the Internet age that has brought with it such fast communications and the ability to reach out and advertise to students in many African countries.

Nigeria, Africa's most populous country, is ranked tenth in the list of the world's top Internet users, according to eMarketer. The country had 57.7 million users at the end of 2014, and the figure is forecast to rise to 84.3 million by 2018. The second African country on the list is Egypt, at 17th, whose year is predicted to end with 36 million Internet users. South Africa had 20.1 million Internet users at the end of 2013; this figure is estimated to have grown to 22.7 million as at the end of 2014 and is predicted to reach 30.9 million by 2018.[15] Moreover, not only has this impressive growth been driven by increasing mobile penetration, it has also heralded a new era of government transparency. As people go online, they can more readily question government or interact with one another. Civil unrest in Nigeria when the federal government tried to completely remove the petrol-at-the-pump subsidy was largely organised by mobile phone, and the same medium played a strong role in the demonstrations at Tahrir Square in Cairo that helped bring down successive Egyptian administrations.

Powering the continent – The need for electricity

A substantial increase in power generation capacity is required to consolidate economic growth

With the possible exception of South Africa, all the countries in Sub-Saharan Africa face one and the same problem: a lack of power.[16] In fact, Sub-Saharan Africa is the only world region where per capita consumption of electricity is falling. And without electricity there can be no increase in manufacturing, no value added through food processing, no agro-industrialisation to create sustainable jobs. While education could lay the foundations for socio-economic development, without a massive increase in electricity generation the African continent's economies could stutter and their growth trajectory plummet. By way of example, Nigeria currently generates approximately four gigawatts, only a seventh of the figure for Argentina – yet Nigeria has over four times the population of the Latin American country. By way of comparison, annual per capita consumption of electricity averages just 124 kWh in Sub-Saharan Africa excluding South Africa. By contrast, the annual average per capita consumption in the developing world is 1,155 kWh and 10,198 kWh in high-income countries. The World Bank has stated that amongst the key factors are low access and insufficient capacity. Only about 24 percent of the population of Sub-Saharan Africa has access to electricity, versus 40 percent in other low-income countries.[17] Secondly, power supplies are often erratic, with African manufacturers having to survive power outages on average 56 days per year. The losses of sales are harsh and the back-up facilities, usually diesel generators, costly and fraught with supply difficulties of their own. Thirdly, power tariffs in Sub-Saharan Africa are on average the highest in the Global South – even discounting the diesel-based systems.

The problem is not new, and is largely the result of a lack of investment over very many years for a variety of reasons, not least a lack of post-colonial infrastructure and resources. The solution has to be found at the national level, among other things by reforms to outdated public structures, privatisation etc., but also at the REC level. Given the location of major rivers, if hydropower is to be exploited to the full, this will only be possible on the back of inter-regional cooperation. The World Bank calls for "greatly expanded cross-border trade in power. Development finance institutions and bilateral donors have key roles to play in both areas."[18] However, such restructuring for competition will only be possible in the larger countries, where the markets are both large and mature enough to support more than one generating company. Those markets will be the ones that are then successful in attracting the large swathes of foreign direct investment (FDI) necessary to finance large new power plants.

Leapfrog fossil fuels and go renewable?

Many countries have identified renewable energy generation as a key resource

At present, hydropower accounts for close to 70 percent of Sub-Saharan electricity production (excluding South Africa). The rest is sourced by fossil-fuel-fired power plants (oil or gas, with South Africa relying heavily on coal, whereby some of the power is generated in Botswana). Africa still has immense economically feasible hydropower resources to tap. The World Bank estimates that at present 93 percent of the continent's hydropower potential (or some 937 TWh/year) remains unexploited. However, so the World Bank continues, "much of the region's hydroelectric potential lies in the Democratic Republic of Congo and Ethiopia, both of which are far from the main economic centres in southern, western, and northern Africa, and their economies are small relative to the multibillion dollar investments that would be needed to develop their hydropower potential."[19] Moreover, even if those countries were to unleash the potential, it would require substantial transnational investments to create the transmission grid.

The alternative route that countries in Africa are increasingly exploring is solar power. While this may not be a silver bullet in all cases, for many East and West African nations it offers a means of generating power with island solutions and avoiding the heavy investments in new transmission capacity. At present the upfront investment is still high relative to that in oil or gas-fired generating capacity, but the long-term cost is not significantly greater and, if one discounts the cost of large distribution grids, can in fact be lower. Moreover, solar power is a means of stabilising existing grids that rely on power injection from only a few points owing to the geographical location of gas, oil or coal. While in the absence of cost-effective storage capacity it only provides daytime electricity, it is this that manufacturing and the agricultural industry needs first. The trend is being spearheaded by Morocco, where the government's Masen agency is driving the extensive introduction of utility-scale solar power plants. Wind and geothermal systems also offer great potential in some African countries, such as Kenya, where geothermal sources are already being harnessed. The advantages of leapfrogging the construction of very large thermal power plants and investing instead in smaller renewable systems include lower maintenance requirements and shorter learning curves. Hardly surprisingly, technology institutes throughout the continent are already busy training young people, be it in a small country such as Botswana or a very large one such as Nigeria. Possibly, we will see the examples of the African airline and mobile telecom industries simply leaving out development steps typical of the traditional industries of the Global North – in power generation.



The SAB World of Learning, located between Johannesburg and Pretoria, South Africa, boasts a fully operational microbrewery used for training purposes.



From Coke to honey beer

South Africa's beverages industry is enjoying fantastic growth prospects, and manufacturers are preparing for the boom by training specialist staff

"A thirst for education." The expression pops into my head as I listen to Luvuyo Vena. We are sitting in one of the training rooms at the Coca-Cola bottling plant in Port Elizabeth, and Luvuyo, a man in his mid-thirties, clad in neat blue overalls and with an open gaze, tells me his story. It begins with his father. A factory worker at a European automotive supplier based in South Africa, which at times operated in as many as three shifts, Mr. Vena senior knew all about the importance of a good education – and completed his university degree at the age of 46! "My father is my inspiration: he taught me that nothing comes easy in life, and that you have to work hard if you want to succeed," says Luvuyo, and goes on to explain that "education has always been in my heart."

When he was 25, Luvuyo took part in a programme for unemployed young people in his hometown of Uitenhage near Port Elizabeth. The aim of the programme: to introduce the youngsters to the world of work by providing simple artisanal training and assistance in finding a job. Having completed his training, to his surprise Luvuyo was offered not just one, but several temporary positions! But then, in 2006, Coca-Cola gave him a three-year apprenticeship as a technician, which was financed by a grant. "This is a match made in heaven between myself and Coca-Cola," Luvuyo says with glee. Training as an apprentice had always been his dream, he explains, as it meant he would never be stuck with just any old job as an unskilled worker. He has long since completed his three-year stint and is now working as a maintenance technician in the Coca-Cola bottling plant. "I'm the doctor for all these machines here," comments Luvuyo with a chuckle, but hastens to add: "This is not the final step in my career." He wants to go on and qualify as an electrician, plus he has asked his boss for permission to train as a Programmable Logic Controller (PLC).



“We are keen to train staff here at the company,” says **Marvin Pearce**, Capability Development Facilitator at Coca-Cola Fortune in Port Elizabeth, South Africa.



“A thirst for education” – **Luvuyo Vena**, mechatronics technician at the Coca-Cola bottling plant in Port Elizabeth, South Africa.

In recent years, some of South Africa's food and beverage producers have reported double-digit sales growth, and if these forecasts are anything to go by, the positive trend is here to stay. The growth in the population and the new black middle class are the main factors driving this happy splurge in consumer spending, which in turn boosts local production output. According to a 2013 World Bank survey, by 2030 the food and beverage market is expected to treble to one trillion US dollars for the entire African continent. In South Africa, along with the tobacco industry, food and beverage production constitutes the biggest single manufacturing sector: with its roughly 25-percent share in economic performance it has easily outstripped such heavyweights as the chemicals and metalworking industries. Within the food sector, alcoholic and non-alcoholic beverages are the single largest segment, likewise accounting for around a quarter of the share. Wine plays a paramount role here – South Africa is among the world's top ten wine-producing nations, and a whopping 57 percent of its output is exported. Turning to domestic sales, it is the non-alcoholic beverages that are the backbone of South Africa's economy. Nothing reflects more aptly the dynamism of the country's beverage industry than the planned merger of two giants announced at the end of 2014: Britain's SABMiller, the world's no. 2 brewery with roots in South Africa (SAB is short for South African Breweries), and US multinational Coca-Cola joined forces with a third South African partner to become Coca-Cola Beverages Africa. The new company is Africa's largest bottler of soft drinks, with branches in a dozen states in Africa's East and South and a payroll of more than 14,000 across the group's 30 or so plants; just over half of the workers are in South Africa. One of them is Luvuyo Vena, who works at Coca-Cola Fortune in Port Elizabeth, right beside the Nelson Mandela Bay Stadium.

In 2010, for its automated bottling systems the factory employed just five maintenance experts like Luvuyo; today, only five years on, the company has 14. "System technology is becoming increasingly more complex," explains Marvin Pearce, Capability Development Facilitator at Coca-Cola Fortune. "We have four high-performance PET bottling lines, and some of them operate 24/7, so we need to make sure there is as little downtime as possible." The company has put in place an elaborate training system to enable staff to keep abreast with technological innovation: semi-skilled operators, and there are 80 of them, regularly complete the modular MCDP, or manufacturing capability development programme. There are theoretical and practical units that workers can take to brush up on their knowledge of mathematics, physics and computer technology, and



Each year some 8,000 people attend courses and seminars at SAB Miller's World of Learning centre, where **Tony Reddy** serves as the Engineering Skills Development Manager.

there are instruction modules for operating the machines and for learning about processes and quality standards in the factory. At the end of each unit, the workers sit exams and good performance wins out as the best are given special allowances. In addition, workers can complete learning modules of the virtual Coca-Cola University during paid working hours.

Moreover, Coca-Cola Fortune provides financial support to ambitious colleagues with an unquenchable thirst for education and the wish to enrol at Nelson Mandela Metropolitan University or a similar college. “Nowadays, thanks to a wide variety of training opportunities it’s possible to get very far for an operator who started out on a bottling system,” says Marvin Pearce, who began his career as a semi-skilled worker at General Motors and worked his way up to be a fitter and turner before he was eventually appointed Capability Development Facilitator at Coca-Cola Fortune. The company also trains apprentices, who complete their theoretical modules at the VW Learning Academy in Uitenhage. In addition, college students regularly gain hands-on experience completing internships in the bottling plant or on the fleet. “After all, if we have vacancies they are always in with a good chance,” Marvin Pearce reveals. By 2016 the company also plans to have its own technical training centre to give operators and artisans the chance to refresh their skills and knowledge. “We are keen to train staff here at the company, and the reason is simple: even though there is great overlap between our machines and those in other plants, they are not fully identical,” explains Marvin Pearce. There are designated training rooms and a whole host of teaching materials (a large portion of which is Festo Didactic), and the technical trainer has also been appointed: his name is Marvin Pearce. And there is no doubt that he will complete further training to master his new task.

While Coco-Cola Fortune places the focus on inhouse training, the South African Brewery (SAB) group pools its training in an outside, albeit company-owned educational centre, the SAB Training Institute. An ensemble composed of red-brick pavilions complete with training workshops, conference and teaching rooms, World of Learning is situated between Johannesburg and Pretoria; the complex embedded in ample park grounds also houses a hotel and a pub, outdoor sports facilities and a swimming pool.

Meanwhile the training institute has grown from serving a small group of apprentices into an all-round capability building facility, training the whole spectrum of



The Coca-Cola bottling plant in Port Elizabeth, South Africa.



employees from apprentices to managers and everyone in between. Today some 8,000 people attend courses and seminars here each year; the majority of them come from SAB or SABMiller and wish to gain extra qualifications in marketing or packaging technology, in management or sales. The training workshops still exist, offering dozens of operators the opportunity to hone their skills in the fields of fitting and turning, industrial instrumentation and process control, industrial electrical and controls, and millwrighting, getting them ready for work in the breweries and soft drink bottling stations, in the distribution centres and malt factories. “We focus here purely on pipeline, to fill vacancies and staff turnover, and it is our aim to take them all on,” says Engineering Skills Development Manager Tony Reddy. “But we do tend to concentrate more on the skills that we need in our factories. Be that as it may, our target is a 100 percent placement rate for our apprentices.”

True to its roots, the SAB World of Learning also boasts a fully operational micro-brewery, which is not only used for training, but plays a role in new product development and research & development work. The budding beer brewers are members of an avant-garde that is busy stirring up South Africa’s beer market with exciting new artisan creations. Consequently, microbreweries in South Africa have evolved from a hobby pursuit into a countrywide trend that shows no signs of slowing. At present, there are more than 60 microbrewers nationwide turning hops, malt, yeast and water into a mind-boggling array of beers. There are pale ales, alt biers, stouts, Pilsners, double bocks, barrel-aged beers, seasonal beers, smoked malt beers and beers made using fruit, herbs, spices, honey, wild yeast and more… “Virtually anywhere you travel in South Africa, rest assured that you’re never far away from the perfect handcrafted pint,” South Africa’s Tourism Board says with pride.

The change story

Change specifically based on agricultural biotechnology, health and health innovation systems, and new energy technologies – all three require technical education

What will the key changes be? What technologies will shape life in Africa in 2063, the year the AU named its AGENDA 2063 after: "A global strategy to optimise use of Africa's resources for the benefits of all Africans."[20] The agenda calls not only for the regional integration we have seen to be crucial above. It also insists on a strong drive to develop human capital through education and training, especially in science and technology. This, so the contention, will lay the foundations for the future of innovation that will enable Africa to find solutions to the numerous challenges it faces. To do so, the AU encourages meaningful partnerships being created with the private sector.

How Africa develops in the decades until 2063 will depend on various "drivers of change", and the policy changes adopted by African countries in response to changing world conditions. As the African Development Bank writes, "these drivers of change will be global, physical and human. Cumulatively, they will create dramatic changes for the African continent and the global environment with which it interacts. Its prospects for development will in turn depend on the policies it implements to take advantage of its vibrant young population."[21]

The AfDB identifies three key areas of technology in this regard:[22] agricultural biotechnology; health and health innovation systems; and new energy technologies, specifically renewable energy technologies. It insists that agricultural biotech will spark a genetic revolution from which the continent will benefit in the form of "yield increases in the staple food crops produced in tropical and semi-tropical environments, the creation of drought- and pest-resistant varieties, and shorter harvesting cycles, enabling the planting of several crops per season."[23] Invaluable work is already being done in this regard, for example at the International Institute of Tropical Agriculture in Ibadan, Nigeria. In the field of innovative healthcare, technological innovations are already abounding – one only has to think of the new potential GSK malaria vaccine. The AfDB comments: "The main technologies that will shape health outcomes in Africa are likely to include: pharmaceutical innovation in drugs and vaccines, including R&D-intensive new chemical entities (NCEs) and the production of 'me too' drugs, including generics; biotechnology as a core component of biopharmaceutical and biomedical research…"[24] Renewable energy is, as we have seen, already a nascent sector on the continent, with projects ongoing from Cape Town to Casablanca, from Katsina, Nigeria to Olakaria, Kenya. In all three sectors, high-tech and by extension technological education will play an ever more important role.

These three sectors will all play a strong role in Africa's future and in doing so start to support existing key sectors of tomorrow, such as the extractive industries (oil and gas, mining). At the same time, the continent will need to concentrate on water management and wastewater treatment if it is to buttress efforts pursued in the field of healthcare. Moreover, as power becomes more readily available, the agricultural industry will take stronger root, and downstream from it food processing and packaging will become core industries, with intra-REC trade in foodstuffs increasing. And last but not least, as the middle class continues to grow and consolidate, the importation of automobiles will no doubt give way to car assembly – a trend already emerging in the larger economies. At the same time, as inter-city road infrastructures improve, so too will the need for greater road haulage capacity come to the fore, and with it the demand for locally assembled trucks. Africa may only just be starting out on this road, but the pace of change looks set to continue.



Prof. Ashraf Mansour

Prime Founder and Chairman of Board of Trustees, German University in Cairo, Cairo, Egypt

When you founded GUC was it your intention to create a flagship university for technical education for Africa or did you just want to make a university?

It is not only about Africa. I wanted to establish a university cooperating with Germany as I had studied there through to post-doctoral level and was convinced by their system of technical education. My intention was to establish an international university which has an equal standard and level of education to Germany, and at the same time to capture the German approach to technological subjects. For sure we can't emulate Germany with its 100,000 engineers but we can contribute maybe something like 100 a year. We already have experience working with German industry, for example in Baden-Württemberg. To recap: I established a university in Egypt which captures the Egyptian needs as well as the interests of Germany; if I'm not respecting the interests of my partners then we can't cooperate and for this reason I should look to the local market as well as to the German market.

Hasn't this bilateral system that you've created as a way of driving social or economic development traditionally been the province of governments? And now you're doing it as a private university...

To make something new you need not only a good idea and good human resources, you need financial resources, and if you rely on the state then it will be a problem. For this reason I decided to make the way shorter and to shape the idea according to my vision – even though some said I was crazy to try and establish a German university in Egypt with its different legislation, lack of infrastructure etc. After all, I had to achieve the same levels of accreditation, knowledge, recognition and socio-commercial acceptance of the graduates themselves. But I am proud to say we have achieved that, and we even receive national German certification, which is not offered for any other institution outside Germany.

Do you see it as a model others in the African country will follow?

It is very difficult because I'm not talking about African countries, I'm talking about the whole world. Most of the other initiatives depend on financial agreements with the government so that you have a lot of bureaucracy standing behind and in the decision-making process. For us the planning started 20 years ago, in 1994, and we got the presidential decree as our first certificate in 2002 and in 2003 we started the teaching.

Do you believe it is the role of the universities to pioneer the industry? Or are you expecting the industry to come to you and say we're going to need this, this and this?

The GUC is truly a "full university" following Humboldt's principles, meaning that we unify teaching and research, in light of what is needed in Egypt, though. We found that in this region engineers and academics often don't like getting their hands oily or dusty. And for this reason we insist on a high dose of practical application. And this can be very tough and very funny. Even in the most modern countries they think that management or business administration is theoretical. But really business communities are practical. So we speak not of business administration but management technology. Every single student in our university takes part in at least 30 to 50 projects before graduating. This means that for example our engineers, pharmacists or managers are exposed to practical work, get their hands dirty and go to real workplaces to understand everything. This is now our model.

GUC has an absolutely unique technology park. This interaction with business, having business not just as a showroom – was that part of the original plan or has that grown as you have grown?

The whole idea started when we were visited by an eminent personality, Berthold Leibinger of Trumpf GmbH, the Rolls-Royce of laser cutting machines, who was one of the prime founders of GUC. When I asked him for assistance, he said, "Professor Mansour, you should understand we are business, we are not a social institution" – and so instead of simply donating something he provided us with an ultra-modern laser cutter. It is the first one ever exported from Germany. It's a win-win. We indirectly help them market their industry. And they help us give people practical instruction.

You get the very best students from high school and you give them a highly integrated education. You teach them to be persons and that's the old Humboldt idea of university education. Does that entail tuition fees?

The German University in Cairo is interested in talents – the top talents. It does not depend on whether they have money. We award a huge number of up to 50 percent of our study places through full or part scholarships. This year we saw almost 1,500 students graduate. We have and we will diversity in specialisation as well. We started with the most sophisticated technology, mechatronics and electronics. If we had 8,500 graduates then they'd soon be working in other universities and competing with us. Universities thrive on competition, and if the atmosphere is really healthy then we are healthy as well.

We are a transnational university and we are implementing this as well. You'll find how our students understand other nationalities, how they develop and which languages they are speaking because they are full of languages. And also they have interaction with German and European countries. This is somehow even more valued than the talent itself because if you are a good global citizen then you achieve a lot.

"Every single student in our university takes part in at least 30 to 50 projects before graduating. We think it is important to get your hands dusty."

What do you see Egypt's role being in Africa?

I believe Egyptians should contribute more strongly to the civilisation of the region. It is very important and this can only come from education, from tolerance, from open minds – and in fact Egypt has a very unique point which often gets overlooked. A famous blind Egyptian Minister of Education once wrote that "we are all African, but we have a European side to us." You can't classify Egypt so simply. Neither geographically nor in terms of religion or culture. It is a very complicated identity. This is a melting pot of many kinds. We are Arab, we are African, we are somehow European. I'm speaking about the dialogue between cultures and this is our natural habitat. And this gives us the natural ability to interface and promote dialogue, an exchange of ideas. That is after all also the basis of the Humboldtian view of education.

I think of your university as a flagship or as a lighthouse of how to bring industry and scholarship research into the future together. Should agriculture follow the GUC focus on technology?

If you have a highly productive company which is highly automated then you have a large number of products that you can sell. High precision such as robots spells low costs. It's the same for agriculture as well. We should have high production and not think about employment of unqualified persons for employment's sake. We should shed that old-fashioned concept. I do believe that Egypt should concentrate on both highly technological and highly productive industry, but also on upskilling agriculture: you need high automation, you need infrastructure and you need to have a new concept.



Graduation ceremony, class of 2014, German University in Cairo, Cairo, Egypt.



Linking TVET up with industry – A success story

It is easy to imagine Egypt as a primarily agrarian economy, with images still abounding in our minds of the ancient world in which the fellahin farmers waited for the silt to come flowing down the Nile. However, while 32 percent of the labour force is still active in agriculture and over 50 percent in the service sector (where tourism is the single largest driver of growth), the remaining 17 percent of the employed population work in industry. This is a remarkably high figure for an African country and says a lot about Egypt's past. Today, the nation on the Nile is home to many major players from textiles, food processing, chemicals, pharmaceuticals, oil & gas, construction and cement active in the industrial sector.

In view of a burgeoning population, the government has for some years now been firmly targeting improvements in education, to which in 2011 some 11 percent of government expenditure was committed – or 3.8 percent of GDP. There are various country-wide programmes in place, such as the National Action Plan on Youth Employment (NAP) and the Higher Education Reform Strategy, one pillar of which is the Egyptian Technical Colleges Project (ETCP), another the Higher Education Enhancement Project Fund (HEEPF). At the secondary level, 18.5 percent of secondary enrolment is in TVET, whereby 42 percent of those signed up are female. However, these admirable figures gloss over the fact that TVET results have hitherto fallen well below expectations. So what have been the hurdles?

Dr. Reem Derbala, Director of the Strategic Planning Unit at the Egyptian Ministry of Higher Education, has endured the morning traffic jam to somehow get to work. Unlike her own tasks, planning transport retrospectively to free up traffic flow would seem to be nigh impossible. She is busy at her desk on the 6th floor of an unassuming building in the bustling Mohandessen district in central Cairo. She is busy surmounting budget challenges, changes in government and intermittent power cuts in an effort to drive higher education. Speaking in the wake of a joint EU and Egyptian project to improve TVET outcomes by reforming the system, she discerns challenges of a different nature: "One of the big hurdles we are trying to overcome at this very moment is to enhance the governance and administration of TVET institutions at the different levels. We desperately need to get an umbrella council in place that coordinates everything." (For the Ghanaian example, see the interview with Sebastian Deh on p. 144.)

Dr. Derbala goes on to say that at present there is significant fragmentation in Egypt, with the various institutions coming under no less than four different



Dr. Reem Derbala, Director of Strategic Planning, Egyptian Ministry of Higher Education, Cairo, Egypt.

ministries, namely the Ministries of Education, of Higher Education, of Manpower, and of Health. “We are working hard to get a uniform accreditation system into place and to standardise things,” she continues. The foundations for such an overarching council are being laid, but it is still unclear to which ministry the unit will be attached and how incisive its powers will be. At the same time, the Egyptian government has provided additional budgetary resources to the eight mainline technical colleges to enable them to meet the standards, an ongoing process slightly derailed by the social changes underway in the country. Nevertheless, it is a vast improvement on the situation at the turn of the millennium, where there were no less than 45 public institutions active in the sector.

Dr. Derbala, who did her Ph.D. on the benefits of virtual universities and has since immersed herself in the UNESCO methodology for strategic planning for education, is convinced that the new sector-based approach potentially offers a recipe for balancing the social demands for higher education with the labour market’s needs. Egyptian middle-class families tend to think their offspring should get to a university to better themselves, and if they do decide to send their scions to TVET colleges, it is often only to use this as a launchpad into university. “We must make very strong ties between the TVET system and the labour market,” Dr. Derbala insists passionately. “And demonstrate vividly for all to see that TVET graduate employment rates are surging. We should ensure people are aware that TVET graduates get into employment fast and tend to earn the better wages or salaries.”

Mona Ayoub, Deputy Director at the German Academic Exchange Service’s Cairo Office, has seen many a minister come and go. She explains that one of the difficulties she perceives as dogging the current system – and she is happy to propose that maybe this can be generalised for many African countries – is the adverse effects of the parameters governing state technical colleges and universities. Of the four key parameters, namely administration, academics, financing and organisation, in many countries the administrators cannot be readily changed, as they are simply civil servants and thus potentially in their positions ‘for life’. It is hard then to encourage talent or innovation, let alone introduce things like performance indicators into an unwieldy central system. Moreover, as regards academic admissions, if these are a matter of national decision-making, the system slows down, too. Adapting curricula to specialised labour market needs as these evolve becomes difficult, especially if plans are rolled out only once every ten years, for example.



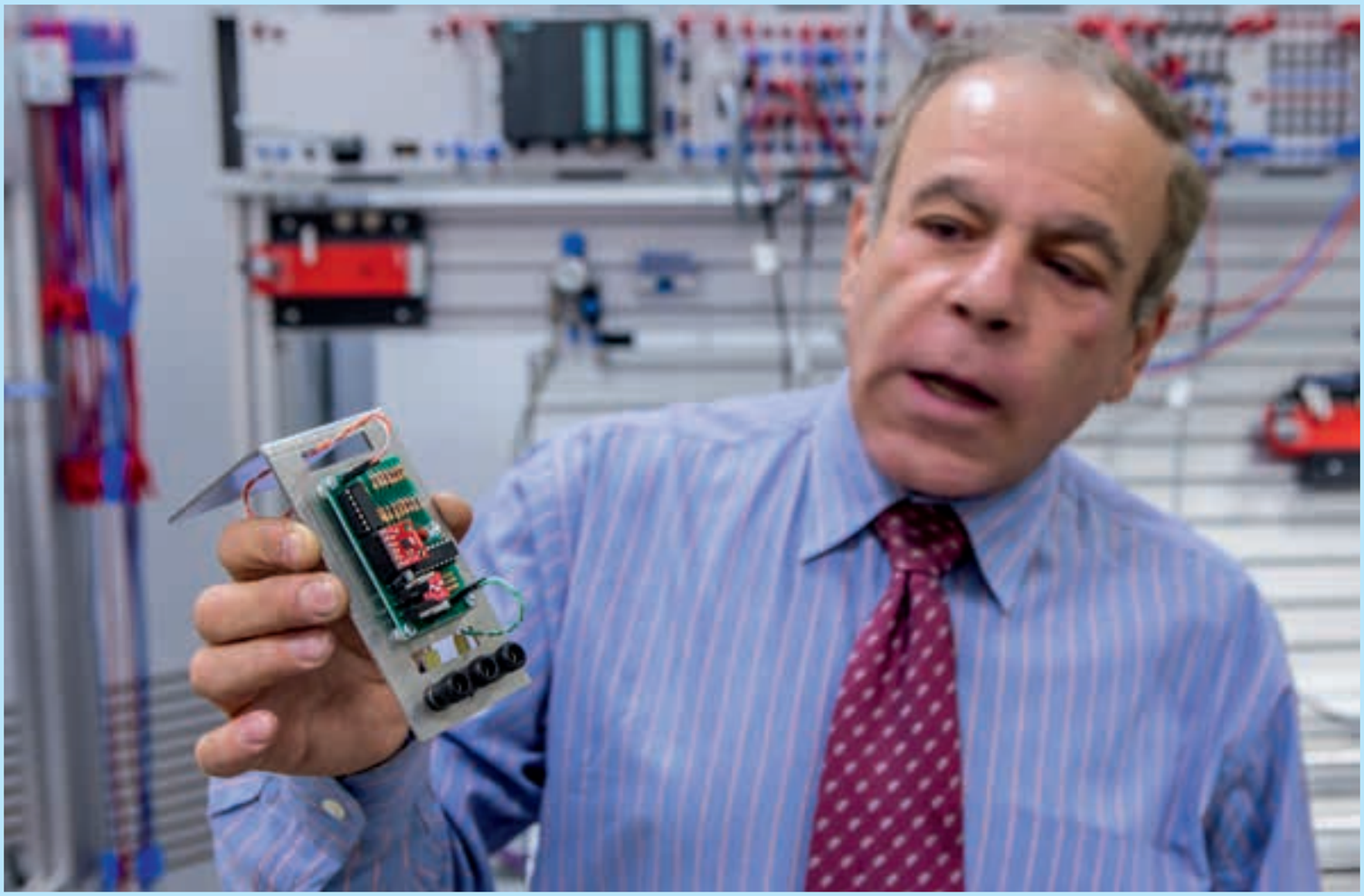
Female post-grad tutoring students at the German University in Cairo, Cairo, Egypt.

Back in the Ministry of Higher Education, Dr. Derbala shares this view. It is a dilemma, she says. To foster interfacing to industry, one of the main TVET initiatives she thinks is most promising is the ETP programme, short for Enterprise/TVET Partnerships. There are 12 ETPs now in place in different sectors, bringing together representatives from the education institutions with representatives of the labour market, usually members of chambers of industry and commerce. The bodies dedicate themselves to what is the fulcrum of TVET success: designing the curricula to make certain they are in line with what the labour market requires going forward.

* See interview with Prof. Ashraf Mansour, p. 72

One solution is to be found in New Cairo – and the district could not have been better chosen, not only because of the infrastructure it offers, but because its name captures the very fabric of the institution in question. Rather than public, it is a private initiative, firmly in the tradition of such august institutions as the American University in Cairo, established almost a century ago. Like its elder sister, the German University in Cairo is an independent, not-for-profit oriented Egyptian private institution with a university charter. That is pretty much where the similarities end. The reason: it is managed by a consortium of Germans and Egyptians under the aegis of a Board of Trustees and with the vision of building a leading centre of excellence in teaching and research on the Humboldt model of universal education coupled to a technological focus.* In this endeavour it has been strongly supported by the State Universities of Ulm and Stuttgart in Germany, as well as by the German Academic Exchange Service and the Arab/German Chamber of Industry and Commerce. The idea is to “effectively contribute to the general welfare nationally and internationally and endeavour the scientific, technical, economic and cultural cooperation between Egypt and Germany”. At its inauguration in October 2003 it was the first integrated German university outside Germany that offered B.Sc., M.Sc. and Ph.D. programmes across 71 fields of study.

However, the idea is definitely not to parrot a German university of technology, but to adapt the model to the Egyptian environment. It was with this in mind that an industrial park was set up on campus over an area spanning no less than 40,000 m^2. The original idea was to make certain GUC students and graduates would benefit from unprecedented technology transfer. It comes as no surprise that the GUC Industry Park facility includes among its permanent partners such German stalwarts as Trumpf, Festo, DMG, Walter, Zeiss, Felder etc. One of the



Dr. Hisham el-Sherif holding an improved teaching transistor he and his students developed,
German University in Cairo, Cairo, Egypt.

mechatronics post-grads insists that "I chose the GUC because of the quality of the labs and the machines in the industrial park. Those robust German machines are a real eye-opener. What I get here is a mixture of research and industry. It wasn't really what I associated in the past with academic work. I get the feeling I'm going to be able to help my country's industry move forward. That's a real privilege." And the foundations for doing that are very close at hand, as the GUC Industry Park facility is set in its next phase to house 80 multifunctional "Incubators" for new joint ventures, with graduates and post-graduates thus getting an additional opportunity to turn ideas into technology into business.

At GUC one thing that immediately strikes the eye when you wander around the spacious campus is the number of female students. Among the Mechatronics graduates that have gone on to become trainers in the well-outfitted labs, two of three are women, as opposed to the statistical average, which would be three men for every woman. Dr. Hisham El-Sherif, his eyes ablaze with pride as he discusses a lab setup with two female trainers, is intrigued by how the presence of women in the field of pneumatics and electronics has become the norm. In fact, together with them he has also seen how quickly learning can lead to doing. "My students and I found there were things we wanted to do in the labs that the equipment didn't completely let us do. So it seemed obvious to start a project to modify the instrumentation and come up with a tailor-made solution. I'm very proud of our achievement, but essentially it is only to be expected, as that is the precise goal of what the GUC curriculum is all about: applying science."

One of the pair explains that what she appreciates most is the emphasis on hands-on learning: "We do a lot of projects. In other words, the theoretical work we gather from lectures and books actually gets implemented in the labs. For example, when studying pneumatics I did a project on metal and non-metal objects. It was fascinating. And all the things we learn here, we learn in detail – practically. That way we understand things better." Essentially the GUC is already practising what the senior ministry staff are preaching: the university has successfully linked up industry and technical education in a move to produce graduates who can take Egyptian industry to the next level – which will doubtless impact on Africa as a whole.

Young Lions
Demographics & education for Africa

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Young people playing football on an open space, Sunday afternoon, Antananarivo, Madagascar.




WBY 120

New wave in Walvis Bay



Long gone are the days when Walvis Bay, Namibia, was a tranquil little harbour: In fact, plans envisage the port's size being increased dramatically in coming years.

To keep the booming port on the Atlantic seaboard staffed with skilled personnel, the maritime and fisheries institute NAMFI is busy diversifying its vocational training programme

To get an idea of the tasks facing African education policymakers it bears heeding a word from Cornelius Bundje, Director of NAMFI, the Namibian Maritime and Fisheries Institute in the port town of Walvis Bay. Cornelius Bundje sits in the meeting room at NAMFI in front of the Namibian flag and narrates that with the upcoming holidays there'll be a lot of traffic on the roads "with people travelling home to their families". Cornelius Bundje will be driving many hundreds of kilometres to his home village on the border to Angola: "I am a villageman, my roots are grounded in my village." Many of the inhabitants live simply alongside their cattle, Bundje says, and then comes the noteworthy sentence: "Not rarely, young people from these villages want to train here to become deck officers or engineer officers, but they've never clapped eyes on the sea or a ship, let alone a harbour."

Cornelius Bundje is the living proof that under such conditions you can still have a career at sea, as he qualified as a third mate and then graduated in maritime transport and port management – in France and Egypt. He returned from exile to Namibia after independence and worked as a Superintendent in the Ministry of Fisheries and Marine Resources where, amongst other things, he was in charge of setting up the training programmes for fishery inspectors and observers that monitor regulatory compliance in Namibian waters.

The fishery inspectors and observers train at NAMFI: Cornelius Bundje was appointed Deputy Director in 2004 and has been Director since 2013. However, they are a fairly small slice of the total intake of about 1,000 students who have graduated there since it was founded in 1996. NAMFI provides safety training for everyone going to sea, whereby the training is categorised into officers and



Cornelius Bundje, Director of the Namibian Maritime and Fisheries Institute (NAMFI) in Walvis Bay, a major African shipping hub.

crew. The officers are divided into two professions: the deck officers, who navigate and are at the helm at sea, and the engineer officers, who are in charge of the engines and all the rest of the ship machinery. The courses run for several years each and include many practical sessions at sea as well as theoretical instruction back at the NAMFI – for example in maritime law or maritime English, not to mention maths, electrical engineering, engineering drawing, welding and mechanical science. "Ships today, be they fishers, freighters or passenger liners, are full of sophisticated technical equipment," Bundje explains, "and we prepare our students to use them." Pride fills his heart each time he hears that one of 'his' graduates has been appointed captain or chief engineer somewhere.

In the past, the chances of that happening were not that great. Crews are getting ever smaller the more modern a ship's equipment, and they often fly under foreign flags with foreign crews – which is why the Namibian government put pressure on ship-owners to employ more locals. For a couple of years now, NAMFI graduates' career prospects have also improved dramatically for another reason, namely the port at Walvis Bay, only a few hundred metres from the institute. Cornelius Bundje can remember how only 20 or 30 years ago almost all the fishing boat moorings were in Walvis Bay. However, those idyllic days on the Atlantic seaboard are long since a thing of the past: plans envisage the port's total area being increased twelvefold in coming years, and the forecast is for Walvis Bay's population to double by 2030 to 120,000. This is "one of the largest infrastructure projects in the history of Namibia," or so the then Namibian President Hifikepunye Pohamba said at the end of 2014. The port has the potential to become one of the largest deep-sea harbours in Africa.

Under construction or planned are the renewal and expansion of the old harbour basin to accommodate even larger cargo ships and liners. When the giant Queen Mary 2 put in to Walvis Bay in 2012 for the very first time at a quay where normally three container ships get on- or offloaded at once, it heralded a new era. A new waterfront and marina are in the making, as is a new container terminal for which sand is being dredged to create a peninsula more than one kilometre long. The turnaround of containers and other goods will not only be faster and more efficient, but the throughput will rise by a factor of three. Specifically the Port of Walvis Bay SADC Gateway or SADC Gateway Terminal will drive the new era north of Walvis Bay proper. A local journalist quipped that the project "will go far beyond anything that ever existed before". The entry channel for the



A Level 1 trainee in a workshop of the Namibian Maritime and Fisheries Institute (NAMFI), Walvis Bay, Namibia.



new North Port is already being dug, to be followed by a new tanker dock, a gas terminal, a new power station, a large repair wharf and a coal terminal complete with coal storage area. There will be a huge turnaround point for sulphur – needed for ore processing in the nation's mines. There's also talk of locating chemicals factories nearby to liberate the country from the thrall of imports from Asia and elsewhere.

The new container terminal and SADC Gateway Port will transform Walvis Bay into nothing less than the import/export gateway for all of SADC, the Southern African Development Community, and an alliance of 15 countries. To handle the greater freight volumes, the road network will have to be expanded and railways put in place serving landlocked neighbouring countries. In other words, billions of dollars will be invested not just in the port, but also in infrastructure, creating countless new jobs into the bargain. In addition, Namibia has plans for other harbour projects, in Cape Fria in the North (exporting iron ore from the interior) and in Lüderitz in the South. Once again, this will go hand in hand with new rail tracks and a new wharf. "I've seen countless ports the world over," comments Bundje, "which is why I can truly say: what's fast becoming a reality here in Walvis Bay can easily bear comparison with any other port in Africa."

Just as Walvis Bay itself is changing, so too is the NAMFI. If young men now find on putting to sea on their maiden voyage that deck or engineer officer is not for them after all, they can look to countless alternatives: be it in port construction, in the fledgling fish processing, chemicals and logistics industries, at the power plant or the port authority, in commerce, in service or maintenance in the wharf, as crane drivers or fish farmers, or even on a platform offshore mining diamonds. "All these industries are crying out for qualified staff, on land or at sea, and we're diversifying the courses we offer to provide customised training," Bundje says. "Apartheid is a thing of the past, our children now all go to the same schools, and they no longer care who is what colour. So we have to keep trying to narrow the gap – and education and knowledge is a great instrument to that end."

Demographics – Dividend or burden?

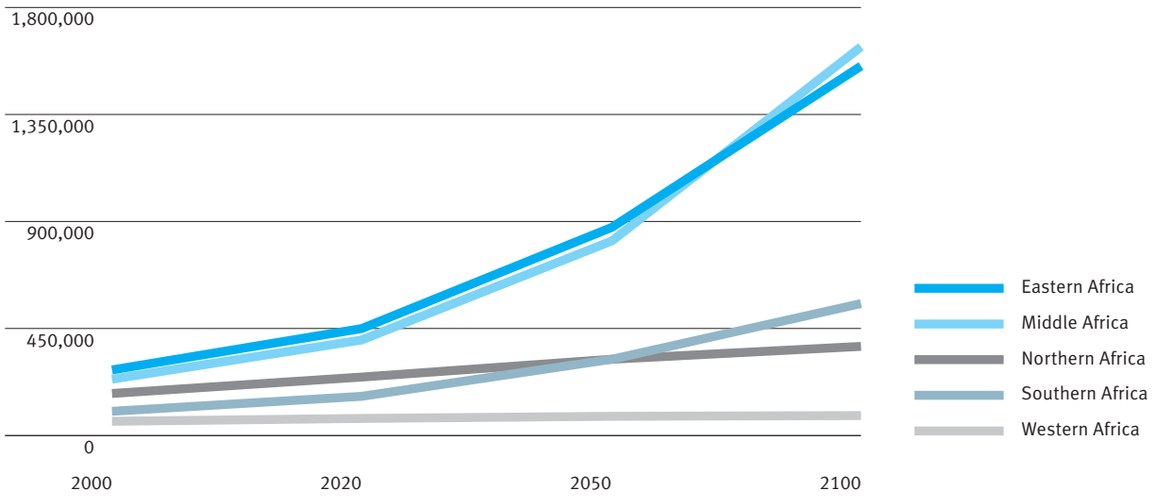
The world's fastest growing population and the world's youngest population: a full 60 percent of the population is under the age of 25. Forecast for 2050: the populations of Ethiopia, Egypt and Nigeria will reach 267.75, 176 and 509 million respectively

A major future driver of African economic growth will be its population. Africa has the world's fastest-growing population and is projected to account for more than 40 percent of global population growth in 2030. The latest United Nations report suggests: "Africa is the fastest-growing major area. More than half of global population growth between now and 2050 is expected to occur in Africa. The continent of the Lions has the highest rate of population growth among major areas, growing at a pace of 2.55 percent annually in 2010 – 2015 […]. Consequently, of the additional 2.4 billion people projected to be added to the global population between 2015 and 2050, 1.3 billion will be added in Africa."[25] This implies a major structural shift in employment ratios: by 2040 Africa is predicted to have the largest working population in the world, accounting for 36 percent of the global workforce by 2050 and a staggering 55 percent by 2100.[26]

The United Nations report goes on to say that among the fastest-growing countries, ten will be in Africa. "The populations of Angola, Burundi, Democratic Republic of Congo, Malawi, Mali, Niger, Somalia, Uganda, United Republic of Tanzania and Zambia are projected to increase at least five-fold by 2100."[27] Since these are among the poorest countries on the continent, it will become all the more difficult for governments there "to eradicate poverty and inequality, combat hunger and malnutrition, expand education enrolment and health systems, improve the provision of basic services and implement other elements of a sustainable development agenda to ensure that no one is left behind."[28] It also means that policy-makers and businesspeople alike need to square up to the fact that the human face of particularly East and West Africa is set to change dramatically in the immediate future. Assuming constant fertility rates, the prediction for 2050 for the populations of Ethiopia, Egypt and Nigeria are 267.75, 176 and 509 million respectively, meaning Nigeria would surpass the European Union in this regard.

If these projections come true this would be one of the most dramatic demographic shifts in history. By the end of the century, if current demographic patterns continue (the estimate is that the African population will reach 2.478 billion by 2050 and as much as 4.387 billion by 2100), Africa will have 4.2 billion people, against 1.1 billion today, with major population growth in Eastern and Western Africa. Nigeria, which is similar in land size to Pakistan, would see its population rise from 185 million today to 910 million, meaning one out of every 12 children born would be Nigerian. By 2050, Nigeria will be the country which is the single largest contributor to population growth globally, and it will be contributing a fifth of

Regional population (thousands)



all population growth of the world by that point. The numbers in other countries are equally staggering. Ethiopia's population passed through the 100 million mark when this book went to press, seven million more than at the beginning of the year, an increase not far short of the entire population of London. Nigeria's population has increased no less than 14.5 million on the year, with eight Nigerian cities over the one million mark, led by Lagos of course, but both Kano and Ibadan are larger than Berlin… Third-placed in the African population league tables is Egypt, with 85 million, and home to both the Cairo megacity and the massive conurbation of Alexandria.

If the pundits' forecasts are right and Africa's population does surge in this way, then on current rates by 2100 almost half the children under 18 in the world will be African. At the moment, the share is only a quarter. Irrespective of what exact shape fertility trends in Africa take, the huge number of young people on the continent will reach adulthood in the next decade and have children of their own. And the arithmetic is easy: the more young people there are, the greater the need for education becomes. Indeed, the composition of the African population is already out of kilter compared to the global North in terms of its youth. The UN report states that a full 60 percent of the population is under the age of 25, with no less than 41 percent under the age of 15.[29]



Hon. Min. Albert Nsengiyumva

Minister of State in Charge of Technical & Vocational Education & Training, Kigali, Rwanda

As the state minister responsible for the implementation of TVET policy in the country what do you regard as the key next step in TVET for Rwanda?

If you look at the last four years our focus was mainly to start or to expand access to TVET. We were focused on building new TVET schools, rehabilitating existing schools, and looking at revisiting the connection between the supply and demand, linking up with the private sector so that we can articulate on the demand side as we planned for the supply, meaning bringing in private TVET providers. We were very much looking at learning from other models from TVET.

Why would a private provider be interested in doing that?

We understand TVET as an interface between general education and the labour market. People who go to TVET believe that they have greater chances to get a job, so there is demand and people are willing to pay for it. Of course it's still expensive compared to general education, but we are getting more and more interest from private universities because they see it as an opportunity for business.

Approximately 90 percent of the Rwandan population are rural, work as smallholders and will of course think it's better to move to a city. Can you use TVET to keep them in agriculture?

Indeed. But not with TVET on its own; you need a combination of different things. With the guidance of central government we have been working at the decentralised level of the districts with a number of projects and programmes to support rural transformation. The way we've been involved in agriculture has been more subsistence agriculture oriented, but we are now moving more into modern agriculture, meaning irrigation technologies and in some places mechanisation. All of which requires skills. In addition most of these places need infrastructure (houses, and water and so on) so the need for artisanal skills is key, even when it comes to cooperatives engaging in rice production.

How flexible is the curriculum? Can you adjust?

That's really the beauty of TVET. You can adjust the curriculum very easily, because the curriculum is adapted to the technology that is going to be used. For example if we are talking about rice production, we know it starts with the farming itself and then the production, with the plant as a second thought. So we normally work with the technology providers on the kind of skills that are required and articulate on the curriculum as well. Most of these firms already have programmes for training; when they bring the technology they also bring the curriculum with them and the training programme per se. We've been learning from a number of countries including India, where rice is also very present, so that gives us an opportunity to learn from others. Most of these things can be imported and adapted in the context of Rwanda.

Is the intention to move into exporting agricultural produce?

It's very important to have a good balance, because we are dealing with food security, which is so critical, given the shortage of land in Rwanda, which is highly populated. We need to make sure that land is utilised properly and part of the land we are going to use for food that is going to be consumed locally. The other part can be used for exports, but only at the quality end, as we can't compete at the quantity level. We are not going to compete with countries like Brazil on coffee quantities, but we have a highly valued coffee that can actually compete worldwide. And that includes processing, which in turn requires modern skills. And here there's a disconnect with demand. So we really need to reform, and make sure that we address the specific needs of the labour market. If you look at most of the countries in Africa, the reason why in many cases we have forgotten to address the labour market and skills is that our focus was to train people to go to universities. We never look into lower-level skills. Because if you look at the labour market those are actually the skills that are required, particularly with a small economy. And also consider providing skills that are exportable, as that is an opportunity for a small country like ours.

One of our major challenges is really to train the trainers, particularly in TVET. Because TVET is different from general education. The trainer in TVET requires skills – technical skills that are logical skills, but also communication skills and an understanding of the industry. Most of the trainers that we get come from general education. They are graduates from universities but they don't have experience with the industry. We're just building our industry. So how do we develop the skills for the trainers to understand the requirements of the industry as we train in TVET? It is quite a big challenge. So what we are doing is even to import what we call master trainers particularly from Germany. We have a good programme. If TVET in Germany has succeeded it is because it is driven by industry. Industry there understands this and therefore supports TVET programmes. In our context we have an agriculture system and don't have sufficient companies. So how to create something like Germany's dual system in a country where industry is still low? It's a critical issue. You need a backbone of SMEs and that in turn hinges on a competitive economy. Which is not the case. So building a competitive environment is a very big programme. You cannot evolve TVET in a market that is not competitive. For TVET we will bring the quality and the innovation. Take my desk, for example. It's imported, although we have good wood here in Rwanda. We need to upskill our carpenters.

“If you look at most of the countries in Africa, the reason why in many cases we have forgotten to address the labour market and skills is that our focus was to train people to go to universities.”

How can TVET reach more women?

To me where we fail is understanding the value chain as a whole. Take our local substitution strategy. Things that you can produce locally must be produced locally. But this requires an understanding from the private sector, it requires support from government and so on. And this is where quality comes in: when you tell someone “this is made in Rwanda” they should be able to believe they’re getting good quality. After all, if you tell them that it comes from Germany they are ready to pay the high price. It’s a matter of persuading people to think longer-term, too. The businessman here, when he sees the investment required to produce locally and knows how long it may take for him to get a real return, may simply prefer to go into the export.

This is something we consider very seriously. In the past there were many specific trades where only men could actually apply, particularly in the construction sector. But I was happy to see the new statistics showing the growth of women actually in TVET. But we need to continue. I’m working with the Ministry of Gender and Family Planning to try and put out some initiatives for females. We have specific problems, some of which are more social. And we have a number of young girls who have dropped out of school for one reason or another. We take them back to education, particularly in TVET, and we give them an opportunity to get skills. We are using them then to actually market TVET. Of course if you go into a sector like hospitality then you can attract more female applicants. But we are doing everything possible to try and grow the number across the board, particularly as in Rwanda there are actually more women than men.

98 **What is your own background, Honourable Minister?**

I studied electronics automation in Belgium, but most African countries were not into automation at that time, so I went on to further studies in IT, specialising in networking. I came back to Rwanda and that was late 1997. I started working with the National University of Rwanda and that was a few years after the genocide in Rwanda. The university was completely damaged so we had to start everything from scratch; my job was to establish a computer centre and I was its director for 19 years.

Basically I was focusing on building the required infrastructure. That was in the early stage of the Internet in most African countries. So I was among people that initiated connectivity to the Internet by satellite. The capacity was way too slow. Actually we were starting with 64 kB for the entire university so when I look at the capacity today it's incredible. We were looking to use information and communications technology (ICT) to support access to education as a whole, but higher education in particular, to try and address the issue of lack of qualified teachers and trainers by relying on distance learning programmes. Those are particular programmes that require the African digital university that I was a member of and that was initiated by the World Bank.

When I left the university I moved into a new project called Rwanda Research Education Network. The idea of the project was to connect universities and institutions so that we can use a common electronic network where we can share research, application, connectivity and so on. We've managed to create a region now with a research and education network across the East and Southern African countries known as the UbuntuNet alliance that allows connectivity to the European research and education network called the Géant. So that was one of many things that I was involved in. The project has been rapidly expanded, even to the West African countries. The idea was really to leverage on the fibre-optic submarine cables to see how universities can benefit from interacting with other universities or the research centres in the rest of the world. In a sense I only wish we could use something similar in the field of TVET, particularly by using ICT to support teaching and learning. There's scope for imagination here.



People who live off-campus going home from university in the afternoon, Debre Markos, Ethiopia.



Student in a Kalka + Partner Ltd. carpentry workshop, Kigali, Rwanda.



Against all odds – A new generation of artisans

TVET is playing a pivotal role in getting the country back on a confident track and providing employment at the same time

When Director Kiba Muvunyi arrives at the SOS Hermann Gmeiner School in the morning he knows the importance of his profession. Tucked away behind a wall covered in bougainvillea the complex is located in one of the central districts of Rwanda's capital, Kigali. It is home not just to a buzzing primary school, but also to the SOS Vocational Training Centre (built in 2005 by SOS Belgium, with support from Norway and Germany), which operated in conjunction with Rwanda's "Technical and Vocational Schools Association", TEVSA. As Muvunyi explains, the institution has a crucial function. The country has over the last decade committed vast resources to improving primary school education, but has been hard put to match the pace of the massive population expansion. After all, in many senses post-genocide Rwanda had to start from scratch, and over the last decade achieved initial successes at the primary level. The next step logically is to nurture the provision of secondary schools, and here technical and vocational training is critically required. Youth unemployment is at 42 percent and Minister of Education Vincent Biruta has gone on record as saying that "a more learner-centred approach in education is needed." Part of centring on learners is to support them in acquiring the skills that will enable them to have a future – by having a job.

The SOS training centre offers secondary-level TVET classes in five main fields: Advanced Pneumatics; Electrical/Electronics; Computer Sciences; Accounting; and Woodwork. The spread is in keeping with the April 2008 ministerial TVET policy document pronouncement: "The overall objective of the TVET policy is to provide the economy with qualified and competitive workers and to train citizens able to participate in sustainable growth and poverty reduction by ensuring training opportunities to all social groups without discrimination. To achieve the goals of democratisation and social, cultural and economic development, the empowerment of people to contribute to environmentally sound sustainable development is decisive."

While on paper this sounds obvious, making it a reality is not so simple. In fact, the process starts with the choice of language of instruction. Director Muvunyi explains that teaching was switched over to English in 2001, having previously been in French. But neither is necessarily an obvious choice, because for many children English is not their first, nor even their second language, as what they speak at home is Kinyarwanda. Progress has been made at least at primary school level, where most books are now in English, and children therefore learn through English, but it is still a challenge.

Another mountain facing the education sector, and particularly the TEVSA administrators, is the clear skills gap in key sectors of the Rwandan economy. In terms of quantity, the government is undoubtedly doing its best: currently, Rwanda has no less than 307 TVET schools, with each district having at least four schools. The national target that has been set is to have 60 percent of students graduating from nine-year basic education (9YBE) enrolled in technical or vocational education of some sort by the year 2017. However, meeting that objective will be tough, as the 2014 enrolment level was only 40 percent. Moreover, simply opening schools is not in itself enough. First of all, teachers have to be recruited or trained.

Rud van Neveren, one of the TEVSA training advisors at the SOS school, explains that teachers are of course only as good as the pay they are offered. Pay grades differ greatly, such that it is very hard to find anybody who will want to teach in a village or small town, where salaries are very low. Even many of those who work in Kigali have to give private instruction on the side to make ends meet. Nevertheless, with the government's education drive, the country has succeeded in recruiting teachers from abroad, in this case often Ugandans and Kenyans. Ironically, in this regard the fact that the language of instruction is English helps…

Van Neveren comments that surveys show that the quality of TVET graduates can leave something to be desired, despite the extensive programme, because the further away from the capital one gets, the more equipment tends to be lacking. And TVET depends heavily on equipment – so how to impart skills without tools? Word has it that in some of the 90 technical colleges, for example, they do not even have toolboxes. The shortfall in equipment does at times lead to students learning to improvise, which may not be a bad thing in a country where supply infrastructure is often overstretched. Here at SOS the situation is nigh ideal by comparison, he says with a smile. This is certainly the case in the carpentry

workshop, where the facilities were provided by international donors and the class is busy learning the ins and outs of cabinetmaking and joinery. Such professions are in fact key to Rwanda's future as the country is having to relearn many artisanal skills that were simply eliminated in many places by the genocide.

The landlocked country is crying out for a new generation of artisans rather than graduates. For Rwanda, given the distances to market and the lack of many competitive advantages, industrialisation will be difficult, meaning that the economy will remain heavily agriculture-driven and hinge on SMEs. For all the challenges, industry in Rwanda is well structured at the level of the small and microenterprises. These have been evolving swiftly, primarily thanks to the government's business development fund, which offers them preferential financing terms. And carpentry is a case in point, possibly as opposed to more complex professions. Timber and wood are in strong supply, and using them is in many instances cheaper than importing metals or plastics. Indeed, some would say that wood is better suited to the tropics anyway.

Centrally speaking, there is not yet a tracking system for graduates, enabling national insights into where the best opportunities are being exploited, but the SOS Vocational Training Centre's carpentry class has kept track to a certain extent of how its students have fared, and the instructor proudly narrates that a few graduates have found employment a few kilometres away in one of the capital's many hilly districts – at KALKA + Partner Ltd. The company is located on KG 697 St. in Gasabo district, and forms part of the second floor of a mall: it sells second-hand tools and does woodwork on commission. While the frontage may look unassuming, the impact is great, as a glance inside the cabinetmaking workshop across the road soon shows. There, the machines are humming, and the high-pitched sound of circular saws and planes fills the air. KALKA + Partner employs five main staff members here, plus assistants. The workshop is sited directly next to the Againjiro timber and wood market, where you can buy not only the raw materials, but many finished products as well – from bedframes to coffins, from tables to windows.

Four of the cabinetmakers at Kalka studied at SOS Hermann Gmeiner, whereby the foreman, Emmanuel Kalisa, finished his training as short a time ago as 2012. Two of the graduates are now under long-term employment contracts. Emmanuel Kalisa trained at the SOS and is thus familiar with many of the tools he uses.



Students training on a diesel engine system at the Integrated Polytechnic Regional Center, Kicukiro Campus, Kigali, Rwanda.

The workshop relies on used equipment from Europe that thus sees a new service life here in Rwanda. There are lathes and measuring frames from Germany and milling equipment from the Czech Republic, whereby the machines were installed by experts from the original manufacturers. In this system of waste not, want not, it is hardly surprising that even the sawdust gets used, as animal fodder. Some of the more elaborate cabinets are destined for outfitting one of the international hotels.

In many respects Kalisa was fortunate, as he was able to familiarise himself with the equipment while still a trainee and came here knowing how to use it. And now he works six days a week.

Back at the SOS Hermann Gmeiner Vocational Training Centre, where the holiday break has started, the mechatronics workshop is a hub of activity. The school benches are all taken by trainers, who have in part travelled many hours to get here. During vacation time, the centre is busy training trainers, quite simply because it has the right labs. Supervisor Innocent Mbonigaba explains: “Fifteen students have come here from TEVSA schools around the country, some travelling as many as six hours. They’re mainly electrical engineering graduates, all of them with hands-on skills, though. It’s a ten-day course, with eight days of intensive teacher training, and two days spent on curriculum harmonisation.” The latter takes place at the weekend but is crucial as the only way to bring standards into line and keep them strong in reality.

Mbonigaba comments: “The big problem is that most of the trainers here today don’t have the basic equipment at their own schools. It’s simply too expensive. So the only realistic option is for them to bring their students here for between one and three days to do the practicals – using the same equipment they have been trained on.” TEVSA supports where it can by supplying materials, for example domestic insulation and the like. But the actual pneumatic and hydraulic teaching equipment is only to be found here in the SOS compound. Even then, a degree of improvisation is necessary to adapt some of the Festo equipment to local needs.

This is less of a problem one rung higher up the teaching ladder at the Integrated Polytechnic Regional Centre in downtown Kigali. It was established in 2008, having first been a secondary school and then enduring one of the ghastlier massacres during the genocide. In one of the halls, a one-year vocational training



Students reconditioning school furniture at the SOS Vocational Training Centre, Kigali, Rwanda.



course on engine maintenance is ongoing – that said, some of the students can only afford to attend for a month. Because the one or other learner is illiterate, instruction is truly hands-on or by drawing on the flip-chart. The students stand in groups round trial engines – the South Korean government sponsored the project and provided engines for the young men to practise on. Today's class totals 20 and they are all eagerly learning how ignition systems work.

The one or other of them may be lucky enough to put the skills he acquires to work at Tip Tac Auto Ltd., located not far away, quite literally down the road. There, two young mechanics and a foreman are down in the pit under a Mercedes, while another set of three are gathered round a laptop running diagnostics on another vehicle. At least three of the newcomers in Tip Tac's total payroll of 25, or so the manager reports, trained 'up the road at the IPRC' and he is pleased with the quality of young staff he is getting. The company on average repairs five to six cars a day and word must have got out on the quality of their services, as there are two trucks from Uganda in the yard awaiting maintenance. In a city which is rapidly succumbing to car traffic, the future most certainly belongs to the young men here.

Urbanisation – Blessing or conundrum?

Urbanisation is set to top 50 percent by 2030. Challenges to agriculture, opportunities for modernisation, industry and the consumer sector?

Where exactly will this demographic growth take place and what does that imply for the politicians? One projection is due to materialise soon, namely by 2016: that over 500 million Africans will live in urban agglomerations. At the same time, the number of cities with more than one million people is expected to reach 65, compared to 52 (the same number as in Europe) five years earlier. This century is going to be the century of the African city and megacity. After all, today 40 percent of all Africans live in cities, meaning the continent is more urbanised than India (30 percent) and not far behind the oft-discussed figure for China (45 percent). The African Development Bank (AfDB) suggests that in only a decade and a half, by 2030, urbanisation on the continent will surpass the 50 percent mark.[30] In other words, another 350 million persons will migrate to cities or be born there. Although the African rural population will increase fastest worldwide,[31] the sheer number of people living in megacities of over ten million will be astonishing. The pace of urbanisation looks set to translate into an urban planner's nightmare. Unbeknownst to many, Mogadishu is the world's fastest-growing city of over one million people, and the pace at which Dar es Salaam and Kinshasa (8.8 million in 2011 and forecast to rise by 46 percent over the next ten years) are growing is breathtaking.

That said, or so the consultants at McKinsey comment, rapid urbanisation is largely responsible for the economic growth in Africa in recent years. "Cities encapsulate exciting new growth prospects around demography – and the booming, youthful population, urbanisation and the burgeoning middle class, all of which bodes well for consumer spending, investment and a growing labour force. Cities also encourage modernisation, openness and connectedness which are important pre-conditions of sustained economic success."[32] Visible examples of the economic transformation can be seen in the continent's megacities such as Cairo or Lagos, where one shopping mall seems to open after another, or in the surge in Kenya's oft-cited e-economy. Moving money electronically becomes ever more convenient an option the more awkward physical travel becomes in fast-growing conurbations.

Growth in education and educating for growth

With populations, and most of them very young, streaming into the cities, the African nations are already facing the challenge of providing enough education and training. In the process, some are dedicating a significant percentage of their total revenue to the sector. The question is whether this will be enough. Some eight years ago, the African Union wrote that "African economies face the daunting task of finding productive employment for 7 to 10 million annual new entrants into the labour market over the next few years. This huge deficit in the employment statistics is not unrelated to the high population growth rate of African countries and the increasing number of school leavers arising out of national initiatives of the past decade or two to achieve universal primary education."[33] However, on an international comparison, government expenditure on education (as a proportion of GDP) is well below the OECD average in African countries.

Government spending on education – the best in Africa

	% of GDP	Year
Ghana	8.1	2011
Swaziland	7.8	2011
Malawi	7.7	2013
Mozambique	6.6	2013
Morocco	6.3	2013
Tunisia	6.2	2012
Congo, Rep.	6.2	2010
South Africa	6.0	2013
Burundi	5.4	2013
Rwanda	5.0	2013
Benin	5.0	2013

In other words, almost paradoxically, the more training and education opportunities are offered which young people avail themselves of, the greater the need to create jobs. At the same time, as urbanisation burgeons, the need for food production will rocket (without an appreciable effort to at the very least mechanise, if not industrialise agriculture, African cities will find themselves unable to sustain their populations physically) quite apart from the need for water, electricity etc. Such a development in agriculture signifies a move away from smallholdings, a tendency that will in turn lead to people moving away from rural communities where they have lived for generations and into the cities, exacerbating the problem.

As with many things in life, there is another way of framing the terms of this challenge. The African Center for Economic Transformation in Accra, Ghana, puts a positive spin on the issue of youth labour market entrants. In its latest report it writes: "By 2050 Sub-Saharan Africa will have a larger and younger workforce than China or India. With the continent's abundant land and natural resources, that workforce can be a global competitive advantage and a great asset in driving economic transformation."[34] Needless to say, this will require formalisation of technical and vocational education and training (TVET) on a quite unprecedented scale and calls for solutions to the various bottlenecks that have to date dogged the system.

* See case study on Ghana, p. 238

Perhaps surprisingly, one innate difficulty* has been that of the language of instruction. One example is Ghana, where Twi or English are typically the languages of instruction, but many students from the North of the country, or even from the Volta region, do not speak, let alone read these languages. It is a conundrum that was also encountered in Morocco, where Arabic was introduced as the language of instruction to replace the French associated with colonial subjugation, but without there being sufficient textbooks in Arabic to meet the burgeoning needs of an ever greater number of young people entering the TVET system – some of whom prefer to speak Berber.

Then there is the difficulty of getting the choice of training system right. Are apprenticeships the solution? It is a dilemma: how can one assume apprenticeships are the key to progress if there is not a sufficient number of SMEs that can afford to train young people? Where policymakers are trying to provide microfinancing options for people to establish their own businesses and thus to strengthen the formal economy, the odds are that there are not enough businesses

large enough to sustain the costs of apprentices. The much-vaunted dual system in Germany might look at first sight like an export bestseller, but it bears remembering that it arose against the backdrop of a raft of existing companies and a strong system of chambers of industry and commerce that had evolved from the guilds. And where companies can afford to have apprentices on the payroll, the young people often do not study with the latest technologies as the master artisans teaching them are simply not familiar with such tools.

Irrespective of whether young people are learning in-company as apprentices or in colleges, the question of curriculum is key. How to devise the right curriculum in the absence of a linkage between education administrators and the business world? Central education ministries are inevitably at a far remove from the companies that seek new employees. Likewise, companies focus on profits and therefore on profitable sectors, and these may not be the sectors that can best absorb a large number of young people. A case in point is agriculture: how to encourage agricultural industrialisation and training and thus keep people in rural settings when cities attract young people like moths to a flame?

In a paper entitled "Skilling Africa: The Paradigm Shift to Technical and Vocational Skills Development" and posted on the website of the Association for the Development of Education in Africa, which is dedicated to a dialogue on education for leadership and change, former Secretary General of the Commonwealth Association of Polytechnics in Africa Dr. George Afeti put his finger very poignantly in the wound: "The formal TVET system has not measured up to the expectation of equipping young people with the skills that coincide with the needs of the employment sector. The reasons for this skills mismatch are not difficult to find. Formal TVET delivery systems tend to be largely school-based and driven by a rigid supply-side curriculum. TVET in the traditional school system tends to be dominated by theory lessons and examinations and the quest for certificates rather than the acquisition of the practical skills and competences in demand by the labour market."[35] So the question is how to find and establish a happy medium that takes into account the needs of a national economy and of business. Dr. Afeti believes the solution lies in encouraging a paradigm shift away from TVET towards what he terms "a holistic and inclusive system of technical and vocational skills development (TVSD)".



Hon. Min. Mduduzi Manana

MP, Deputy Minister of Higher Education and Training, Pretoria,
Republic of South Africa

Where to start with TVET – with learning simple skills or with highly technical skills?

Well, given the skills needs of not just South Africa but of the SADC member countries of the continent it's important to remember education is a constitutional right, starting with the right to basic education. You do need mid-level skills and we all need people who are able to support the growth of the economy. But the difference to which you allude is something that is often not brought to the fore. We used to have many technical high schools. We still do have technical high schools, but they are looking at expanding and establishing more technical high schools so people are more oriented towards technical education.

How to quantify a country's needs and how to ramp up TVET offerings accordingly?
How do you scale a system up to absorb very many young people – is this Mission Impossible?

The team that was working on the blueprint plan – the National Development Plan – had consulted intensively about the number that we should be producing as a country. It says at least by 2030 we should be producing 30,000 artisans, but the figure is very likely to grow. We must also appreciate that producing artisans is not as easy as we say. It is a much longer, complex process. And it involves the participation of industry and employers. Now if they do not participate as actively as expected then this whole vision will not happen. Behind the vision of that plan obviously there is government; we must take a lead but we need to bring in local industrial support because artisans are not developed into colleges. Employers must now start to open up their own places so these young people can get exposed.

How to promote the PPP side in imparting skills?

We are busy developing all kinds of strategies. We have the TVET college system: these are now structured as vocational centres and we have said to them that because each has its own council, there is a stronger, urgent need to ensure that when the councils are appointed we bring industry on board, so that they can also participate. We've just taken the decision that when we put together these councils we must ensure that industry representatives are on board so that they are able to speak on behalf of industry, be it chambers of business and commerce or business associations. They can then contribute much more meaningfully to what we do as a technical educational centre.

The same applies or course at the national level, with close interaction now occurring with the national chambers. We are pleased with the progress achieved here as the improvements are tangible, but we need things to step up to the next level. We need the business representative to be part of the bigger vision, meaning we want to get to a point where it is not 'us' and 'them', because this is for our nation.

How do I make sure as a policy-maker that there are still people like carpenters who make tables?

We have embarked on a variety of awareness campaigns. We are running an activation programme around what we declared to be the "Decade of the Artisan", namely from 2014 to 2024. This is an advocacy programme where we are trying to reach out to younger people, to those young people who are in the schooling system in particular. We go there, give them the information and also tell them about the value of becoming an artisan. Of course if they want to proceed to become an engineer it's possible, but we need more artisans in the country. The message I put across when I'm engaging and interacting with the young people is that for every engineer we need about three or four artisans. So of course we need engineers but we need more artisans. We are getting this message out to young people. We have seen increasing enrolments in our technical and vocational educational colleges. Three years ago we had about 300,000 students but now it is about 750,000. This is more than double.

As a point of fact, post-school education does not mean just university education. We need more of our young people to get into the technical and vocational streams if we are serious about improving their employability and their employment prospects, and if we are serious about stimulating the growth of the economy. So in this "Decade of the Artisan" we are hoping really to reach as many young people as possible. We are targeting rural areas of the country and we want to bring information to those areas. Actually the "Decade of the Artisan" was born of a successful programme that we ran in 2013: we declared 2013 the "Year of the Artisan". We picked up from our visits to schools that actually young people don't know about artisanship and what it can give them. They perceive artisanship as something that is done by people who are not educated, wearing overalls and lowly. In our Decade we are hoping that at least by 2024 we will have had a major impact in terms of shifting the mindsets of not just the young people but also of parents and teachers. It is often the parents who insist that their kids go to university because they feel that university is the place. We have many more young people who exit the system and do not find employment. Industry is looking for particular skills, and those skills can only be produced by colleges. And that means if you have the skills you get the job. That is why we have to strengthen the TVET sector and ensure that it is able to speak to the needs of industry so that when our young people exit the TVET system they go straight into employment.

“Declaring the ‘Decade of the Artisan’: we can surmount many challenges if we have a skilled nation.”

You know when one talks about mindsets you equally find academics who still do not grasp the true value of technical and vocational training. So we also have to reach out to them. We have to work on everybody and I think by the end of this “Decade of the Artisan” we’ll have reached the point. We just have to double our efforts every year and look at the different strategies, consult the recipients, the young people, and talk about whether we’ve made an impact and what other strategies we can evolve. One of the things that we also see is the fact that more and more women are getting into the system, especially in the engineering-related fields. Which is interesting because in South Africa plumbing, electrical engineering and the like tend to be perceived as the sole domain of males. That picture is changing. We have 50 TVET colleges in the country with 264 chambers and I try and visit them. When I call at an engineering campus I now see more women involved and I get to interact with them. When I ask them, “Don’t you want to go to university? If you were accepted at a university – would you go?” they all say, “No we are fine here.” So obviously things are slowly changing.

It bears mentioning that if you are an artisan you can also establish your own business so I want not only to create job-takers but also job-makers. In South Africa there’s still on occasion a reluctance to get your hands dirty. These are perceptions we must change so that indeed all of us move together in terms of getting a skilled nation. If we don’t have people who are skilled artisans then we will never have a stable economy. We can surmount many challenges if we have a skilled nation. Take the example of Germany. I can imagine Germany is also affected by the global economy but it is quite stable. Employment there is going up despite the global economic problems. So it tells us that Germany is doing something right at the skills level and that bears emulating.



Ambassador Godknows Igali

Former Permanent Secretary, Federal Ministry of Water Resources,
then Federal Ministry of Power, Abuja, Nigeria

What is the basis for vocational and educational training in Nigeria today?

The foundation of industrial development is to have a workforce that is skilled and has the right training knowledge. President Goodluck Jonathan did two major things in this regard. He instituted the Nigerian Industrial Masterplan and the Nigerian Automotive Masterplan. These are two major policies that will ginger industrial development in a rapid and sustainable way. And for that we need workers who are trained, who have the knowledge base and the right skills sets. To our mind the reason why industrialised countries have developed is their emphasis on vocational education, not only white-collar, but also as regards the blue-collar jobs, the jobs on factory floors. We urgently need to train the people who have these skills at the lower and intermediate levels. We must counteract the current tendency to forget artisanal skills and prioritise only university education. OND holders have too often been considered persons who had no education, or only sub-standard education, instead of being welcomed with open arms. Now we are emphasising hands-on education, where people can take down an air conditioner, take it apart, repair it, and it functions perfectly. That is the mindset and the skills set we must promote.

How to do so at the institutional level?

Industry-based polytechnics are what we in Nigeria need. And I believe this is true for Africa as a whole. Polytechnics started off being like that but after some time they also become overly theoretical, which is at odds with the original intention. In response to this predicament and out of a wish to turn the clock back for the sake of the country, I established the Foundation for Vocational & Educational Development, and there the focus is to train people hands-on. I want our polytechnics to once again appeal to many, to mop up that portion of the young people who otherwise could fall by the wayside. Here in Nigeria, we have about 140 universities with the new approvals, meaning the uni intake can by no means cover demand. Some 500,000 young people simply can’t make it. They understandably get frustrated, especially as at the same time there are no other schools for them. It is imperative that policymakers find ways to absorb them and make them useful. To spark development here, with the help of my Foundation I have personally been busy setting up a polytechnic that will follow these principles.

What about the girls?

Our new polytechnics must reach out to young women just as much as they appeal to young men. Students must be equipped to focus on industrial development from the point of view of practical application of knowledge, not theory, irrespective of gender. What we intend to do is to introduce a sandwich system, with the classroom part being very little, and placements with industrial corporations the mainstay. Take my own backyard: the power sector. What does industry want by way of staff to run power plants? Or what kind of people is the construction industry looking for, for that matter? The emphasis must be at the factory-floor level: take the construction of a flour mill, for example. Construction is a key sector, as is the flour mill itself. We want our young people to be there when the construction starts through to when it is finished. They must be part of it as then, and this is my firm belief, they will properly understand it. They will grasp how such construction is done. That example needs to be emulated across all the main economic sectors.

What will the student composition at your new polytechnic be?

We intend to attract students from Bayelsa and River states, and to a lesser extent from Delta state. That reflects the local catchment area and we will be interacting with the chambers of commerce and industry in all three states. The polytechnic will be located on a river, a tributary of the Nun River: Silver Creek. Which is why we chose the name Silver Creek Institute of Technology. Like the above-mentioned foundation, the institute will itself not be profit-making. Students will only pay what it takes for them to be there. I don't believe in education as a vehicle for making money; it is a fundamental right for all our young people. All I want is for Silver Creek to cover costs so that it is sustainable. Which implies that we need corporates to give us the equipment for the classrooms!

Remember, Silver Creek is a bit of a flagship, as it's a not-for-profit undertaking, which is doubly important as the young people in the region are poor. Thankfully, various senior Nigerians have joined the Foundation's board. Yet companies could to do the same, especially foreign companies. If they are on the board it will expand all our thinking and also guarantee we know what such companies need and expect.

“Industry-based polytechnics are what we in Nigeria need. And I believe this is true for Africa as a whole.”

Geographically, the three states are core states in what the outside world calls the Niger Delta, which hit the headlines for all the wrong reasons with acts of arson and kidnapping a few years back. The militancy was successfully alleviated in the form of an amnesty, as we all know, but what remains critical in the post-amnesty period is that it has left a lot of young men and women from the Niger Delta without skills or a sense of inclusion. So what Silver Creek IoT will try and do is reach out to them. This is a real shift from the Amnesty Programme, which took over 7,000 people outside the country for training. That is unnecessary and creates the wrong incentives. We can train these youngsters right here in Nigeria.

At the same time, that ensures companies always have a strong indigenous workforce. This fact has in the past not been sufficiently reflected in our education system. The local content laws mean foreign companies need to employ Nigerians, but there are times I am sorry to say when Nigerians with the right skills sets are not at hand – with the Silver Creek model we can train those people up in advance, which is to everyone’s advantage. Companies can operate profitably, young people find jobs, and the communities as a whole benefit from stability and growth. We can train them to be useful rather than having them trained for unemployment – because often the skills acquired abroad are not what is needed on the ground here. In this context, I need interaction with the chambers, with the corporations, when fine-tuning the curriculum. I need to know what kind of people the Shells, Agips and Chevrons of this world need to man their flow stations and well heads. We can then train precisely those skills for industry. We need industry to work closely with us.

It will be the first polytechnic in this mould, and I deeply hope it will soon be emulated. The Federal Government wishes to establish a maritime academy for the same reason, whereby the emphasis will be but one step higher up the education ladder. Silver Creek IoT will be the educational institution that is furthest south of them all, the one deepest in the creeks of the Niger Delta. Which is why its mandate will be to help solve the problems of the Niger Delta, so that the young men and women have hope, are trained, Nigeria locks into their energy and uses their resourcefulness, and no one resorts to guns again.

So what composition will Silver Creek have?

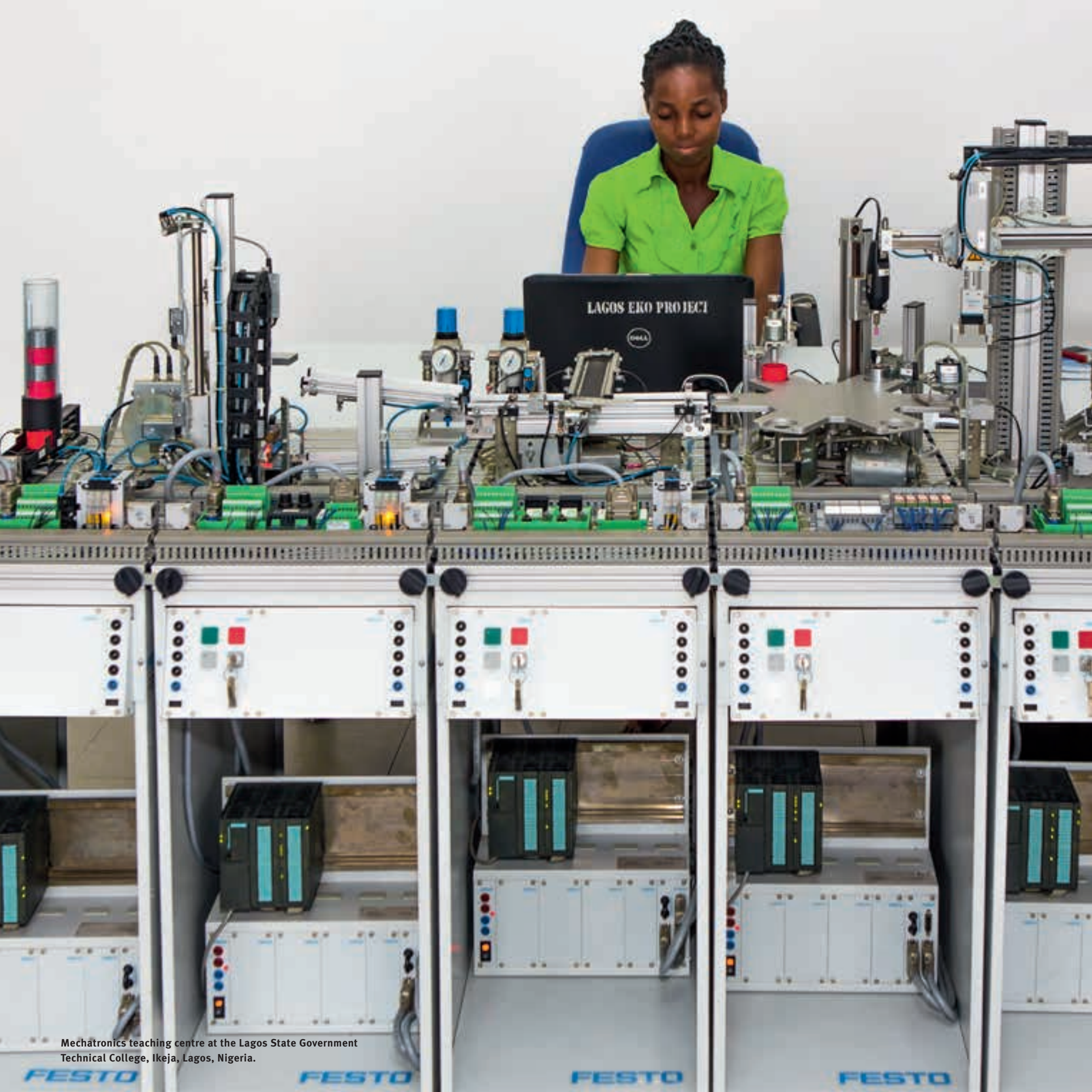
I want to train people in things that local industry, which happens to be oil and gas, need. We will have a School of Computer Technology, a School of Applied Sciences and a practically-minded School of Business and Management to help young people learn how to start their own businesses. But there will also be a School of Agricultural Technology, the sector that is the biggest employer of labour and the backbone of the country. People must be trained in how to run fish farms and so on, best suited to local topography. There will be a School of Engineering Technology and we'll have our own boat yard where kids can learn boat building and maintenance.

I want the polytechnic to hinge on partners from industry who will become involved as sponsors, for the labs or the student halls. It's a win-win for them, as they get the people they need, and we get the facilities faster. I can only appeal to the European business and political world to weigh in and support this and similar projects. While the European Union has allocated massive financial resources for the Niger Delta, as it does I am sure in other areas in Africa with such a history, I believe the single best way forward is to get the young people into meaningful education, and that is where some of the monies should surely go.

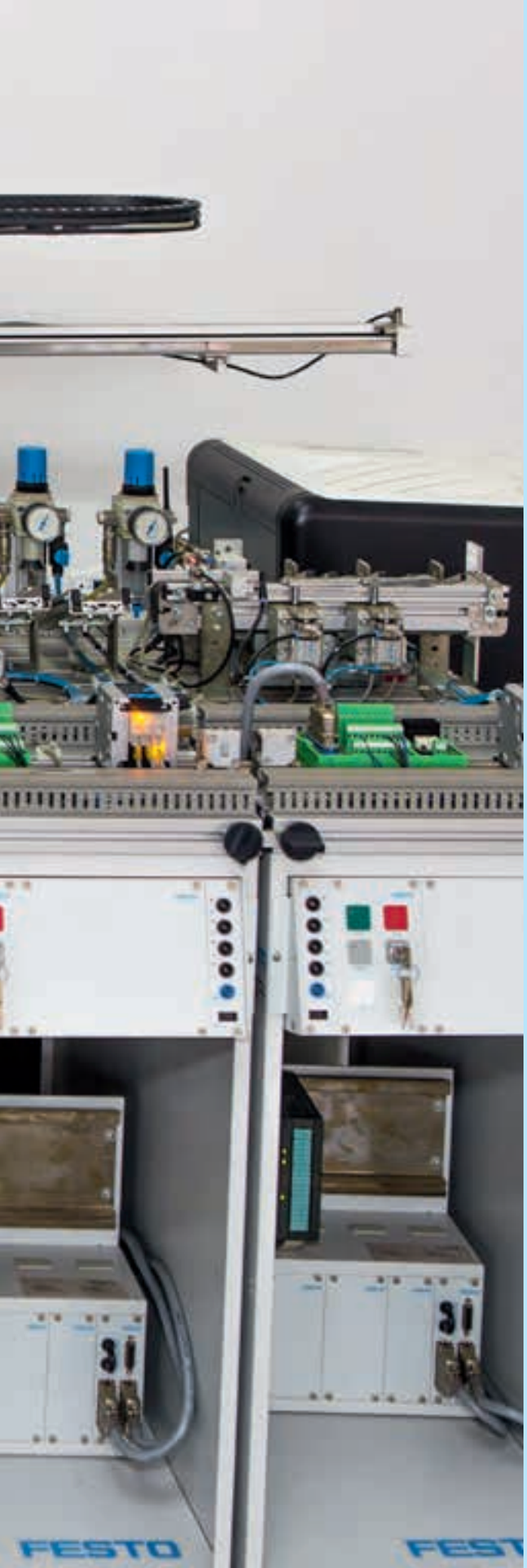
This is the only way forward to make sure our society looks after the poor and disadvantaged. I met a girl who was employed by a catering company to provide food to oil companies. She is from a village. One day she said to herself: "Well, the food the large company is selling, I could cook it myself." But she didn't know who to talk to or how to go about it. One day, by the Grace of God, we met, and she told me her story and her aspirations. In a village in the creeks, where there was a boat, she could move the food out to the flow stations and oil infrastructure formations. She felt certain she could do it with the right training in hygiene, food preparation etc. and a little start-up capital. We arranged that. And today? Today, she is providing the food to the local staff in the oil facilities, produced and packaged in the local way – which is what her clients want to see on their plates. Her village and family have prospered. Now the companies have a local source. Sometimes, education makes such a huge difference.



Ambassador Godknows Igali explains the layout of the new Silver Creek Institute of Technology campus, Bayelsa State, Nigeria.



Mechatronics teaching centre at the Lagos State Government Technical College, Ikeja, Lagos, Nigeria.



Powering up for a brighter future

In Nigeria, various institutions are committed to improving the country's technical and research prowess in a conscious effort to support industrialisation

Ever since its return to democracy in 1999, Nigeria has been having to contend with a severe shortfall in generating capacity. The country that boasts by far the single largest GDP in Africa is quite simply bedevilled by a lack of wattage. Policymakers have long since recognised that the country's rapid growth will soon come up against insurmountable difficulties if there is not a significant leap in electricity generation. This has gone hand in glove with an understanding that you not only need power plants, you need trained staff to operate and maintain them, too.

Reuben Okeke, Director General of NAPTIN, the National Power Training Institute of Nigeria, recalls how fast TVET for the sector took off. The power sector itself had been moribund for many years and so when the federal government resolved to privatise it, funds were logically also invested in training. He remembers how, at the end of 2009, the former "in-house training at the government's Power Holding Company of Nigeria was excised out and established as a parastatal entity in its own right, with the mandate to upgrade the skills of power-sector workers, be they technical or non-technical." Okeke took delight in the onerous process of midwifing the process of creating intervention courses to upskill workers such as cable joiners, fitters, linesmen, engineers and technologists to reduce equipment failure. This first wave of short-term courses reached about 1,000 workers and included, for example, an on-site seminar at Nigeria's largest hydropower plant, the Kainji dam, for 30 technicians, helped by financial resources from the German Climate Change Fund.

However, Okeke and his team soon realised that they needed to go one step further, and so they instituted a graduate skills programme, with a first intake of



Director General Reuben Okeke addressing a class at National Power Training Institute of Nigeria, Abuja.

some 230 graduate mechanical and electrical or electronic engineers, followed in 2014 by a second group about 50 percent larger. At the same time, with the generating and distributing companies privatising, state governors and distribution company owners up and down the country realised they should be sponsoring young graduates to make certain there would be sufficient skills locally, adding another 300-plus graduates to the NAPTIN list. Today, the institute can boast of having helped upskill 1,000 graduates and about 5,500 artisans in the various professions involved in running a power station.

This was still not enough, Okeke recalls. NAPTIN carried out a manpower planning survey back in 2012 which revealed that if the government target of 20,000 MW were to be reached, in excess of 17,500 technical staff would be required to operate and maintain the infrastructure, about 6,000 of them engineers, the remainder craftsmen and technicians. The calculation was done on an "as-are" basis and did not reflect potential automation in the sector post-privatisation as company owners sought to improve equipment and profitability. Nevertheless the challenge for NAPTIN remains immense. Okeke proudly comments that all the utilities in the Federation have signed MoUs with NAPTIN now, so that field training is possible for his students on site, with the equipment they will use in their professions. The tasks trainees learn extend from installing metering on behalf of the new distribution companies (the utilities) through technicians calibrating the grid to technicians able to service and maintain the thermal power stations. Despite "funding always being difficult", only in this way can the country's future power sector backbone be secured, he believes.

This close engagement with the need for vocational training prompted the Permanent Secretary at the Ministry of Power, Ambassador Godknows Igali, to look beyond the ambit of the ministry he has successfully guided through thick and thin for the last four years. On the back of the insights he has gained, he recently set up a foundation for a non-profit-making polytechnic: it will be named Silver Creek Institute of Technology. Ambassador Igali comments that one key ingredient polytechnic education offers the nation, in addition to the emphasis on practical skills, is that it closes the gender gap: "By promoting polytechnics and not just universities we can make certain that the scientific and technological subjects taught do not just attract young men. There are other countries outside Africa that have led the way here and set shining examples. We have to ensure education empowers all young people, not just the boys, as only in that way can we give



Student at the University of Ibadan campus bookshop, Ibadan, Nigeria.

everyone a seat at the future table, and make certain we maximise use of our human resources in our efforts to develop."

See interview with Dr. Igali, p. 116

Dr. Igali is convinced that the institute must offer skills that are not only urgently needed in the oil and gas industry, where local content regulations have often been thwarted by a lack of indigenous skilled labour, but in many other fields besides. He cites the example of catering: people often forget that workers need to be fed, and fed well, so why not train young people as caterers to the oil and gas industry, not just as technicians, he suggests.

One example of how polytechnics are trying to ramp up to meet the future need for expert training can be regularly encountered at the FACT centre (Festo Authorised and Certified Training Centre) attached to the Government Technical College Agidingbi in Alausa, Ikeja, Lagos. The college is ideally located as it is only a few kilometres north of the large Lagusian industrial estates in Mushin, where there is a constant need for graduates who know the ins and outs of one of the two areas the centre covers: Basic Mechatronics or the more advanced courses for Factory and Process Automation. Dr. Okechukwu Innocent Nnamdi and his colleagues from the Federal Polytechnic Nasarawa (FPN) are on site to study what the equipment deployed in the centre actually offers, as the FPN seeks to install state-of-the-art training facilities itself. The idea is specifically to cover mechatronics and turn out graduates ready to work in fields such as air conditioning or auto maintenance, power engineering or the agro-industry, as the Vice Chancellor of the FPN insists this is where the West African giant's future lies.

* See interview with Vice Chancellor Prof. Isaac Adewole, p. 130

The pinnacle of training the next generation of applied scientists in Nigeria is to be found in Ibadan.* The august University of Ibadan campus is home to one of the African Union's five centres of excellence established under the umbrella of the Pan African University. The University of Ibadan was selected to represent West Africa, and the disciplines chosen for West Africa are the Life and Earth Sciences, whereby subjects such as veterinary studies and the geosciences impact immensely on life on the Continent. PAULESI (the "I" stands for Institute) is busy developing ideas for West Africa and Africa as a whole – and indirectly setting the research agenda for the next decade. The institute is supported here, as PAULESI's sprightly but wisened Director, Prof. Matthew Abatan, a specialist in veterinary pharmacology and toxicology states, by the Internet. The spread of the World Wide Web has strongly facilitated exchange between academics in



Students at the University of Ibadan campus, Ibadan, Nigeria.



Africa. Abatan, who is actually a 'local lad' from a neighbouring state, says that applications for the post-grad courses have increased by more than a factor of ten since their inception and whereas first time round there were some 200 applicants, the number of candidates for the next intake is well over 2,000. The veterinary scientist is ideal for the job, as he is well versed from his own studies in international programmes: he has previously taught in Ghana, Zambia and Zimbabwe and is a past scholarship holder from the prestigious Humboldt Foundation in Germany. (Incidentally, Germany is through the German Academic Exchange Service and GIZ strongly assisting the North African arm of the PAU programme, which is based at the University of Tlemcem in Algeria: PAUWES – the PAU Institute of Water and Energy Sciences, which includes climate change.)

The PUALESI student intake comes from a total of 13 countries, from all over Sub-Saharan Africa. This thrills the director, as he says when the African Union decided on the PAU it was because the policymakers saw "the need for Africa to effectively compete with the global community in terms of the standards of academic education. Today, and I see this happening with my own eyes, PAU is a model for other African universities to follow – a dream that is now gradually becoming a reality. Our students must have the African dream in mind." This is why although the students are working towards an M.Sc. or Ph.D., are learning plant cultivation or the geosciences (the programme has two options: mineral exploration and petroleum exploration), they have to do compulsory modules on the general history of Africa, human rights and gender issues. Professor Abatan comments that it was not until he started running the PAULESI programme he came to feel that in his job at least he was African first and Nigerian second. "With the job and the administration has also come a realisation that we must africanise our curricula if the continent is to grow. If we make some headway here I will be able to retire a happy man." Here, he is a companion-in-arms with Director General Okeke, for NAPTIN has been chosen by the West African Power Pool as the West African centre of excellence to run regional training under the aegis of ECOWAS. At this very moment, NAPTIN is ramping up its equipment to cater to the future intake of West African graduates. If Nigeria, the powerhouse of ECOWAS, thrives, so will the remainder of West Africa, one can safely assume.


UNIVERSITY OF IBADAN

Hon. Min. Prof. Isaac Adewole

Minister of Health, Federal Republic of Nigeria
Former Vice Chancellor, University of Ibadan, Nigeria

What is the idea behind the Pan African University?

The entire project is an initiative of the African Union Commission based on the insight that we need to develop the human resources for Africa within Africa. Because we all know full well that when you send Africans out from the African continent many of them do not return. When a Nigerian, for example, spends more than six months outside the country, or so a recent study shows, then the chances of that person coming back are far slimmer than if they spend three months. So we in Nigeria started limiting scholarship stays outside the continent to six months. An even better idea of course was therefore to develop our human resources in Africa because then our new generation of scholars will be more likely to stay in Africa. The AU Commission, in approving PAU, identified five thematic areas and assigned them to the geopolitical zones of the continent: “Life and Earth Sciences (including Health and Agriculture)” was zoned to West Africa; “Social Sciences and Governance” to Central Africa; “Science, Technology and Innovation” zoned to East Africa; “Space Science” to South Africa; and last but not least “Water and Energy” zoned to North Africa. The University of Ibadan stood up and entered a bid and we won the hosting rights on behalf of the West African sub-region. It is worth noting here that Prof. Ruqqayat Ahmed Rufai, then former Minister of Education, ably led the Nigerian team. She was well supported by Dr. Jamillah Shuarah, who was Director of Tertiary Education at the Federal Ministry of Education. That big support made all the difference.

What role does PAULESI, the PAU Life and Earth Science Institute play in the life of the University of Ibadan?

Currently PAULESI is at an evolutionary stage. For us in Ibadan we consider it essentially a work still in progress. At the same time, we consider it one of the pillars that will enhance our ability to achieve our strategy for internationalisation. Currently we have 97 students from all over Africa studying at PAULESI and this is surely an affirmation of our potential to provide support in developing resources for Africa. The programme focuses on four key areas: Plant Science, Environmental Management, Reproductive Health and Geosciences. To us we are not just helping Africa and thus fulfilling one of our core mandates as a university, but much more importantly we see it as fulfilling our mandate as a research-intensive university. Our vision is to become a postgraduate university and centre of research excellence. If we can reach that goal and at the same time assist the African Union and by extension Africa, then all the better.

How to connect different nations in research?

Actually, this starts at the very level of the language of instruction. For now, English is the lingua franca of the research community. Specifically America and the computer have helped to propel the English language into this role. We have therefore instituted a module to enable all students on the PAULESI programmes to learn English in the first six months if this is required. But as a university we are cognizant of the need to develop other languages, we are keen to develop French and German, and that will further drive our ability to interact with the leading scholars internationally.

What is the role of future Pan African collaboration?

We've actually started here. There are two solid initiatives in Africa. There is a standing partnership between Australia and eight research-intensive universities. And at our Dakar meeting in March 2015 we also started a consortium of research-intensive universities in Africa (ARUA), whereby there are now 13 already on board. We are talking to one another in earnest and are fully aware that we need to share resources. No single university can go it all alone. We need to pool ideas and share best practices to develop Africa. We firmly believe Africa can only be developed by Africans. We need assistance from outside but we've got to make the jump. The Internet undoubtedly helps here. It has reduced the distance between nations, between institutions, and between individuals. To me, nothing contributes more to the concept of the global or African village.

Should there be an African research curriculum?

We must work on such a curriculum, but we must respect the independence and individuality of each institution and each country. We are therefore focusing on country-specific research that has global and continental applications. For example at the University of Ibadan we are concentrating on food security, technology and health. As academics and as patriots we are quite worried particularly on the issue of food security. We are of the opinion that Nigeria as a country with 180 million people cannot move on without a well-grounded policy of self-sufficiency in food production. This requires good research, planning and then policy-making. We are therefore partnering with international and federal bodies to foster a culture that will contribute to food security. One avenue we have taken is to engage in fisheries and aqua-culture as well as fish farms. We are eager to see how this can improve the nation's ability to feed itself. And while this is a national focus, it of course has continental ramifications. Our researchers are also looking into tomato, yam and corn production, where much improvement is needed, but the potentials are there.

“We firmly believe Africa can only be developed by Africans.”

While I am speaking here as the Vice Chancellor of a premier research university, my colleagues and I firmly believe that we need to strengthen our polytechnics and technical colleges nationally. There is a problematic gap if a country only concentrates on producing university graduates. You then fail to develop your mid-level human resources, resulting in a disconnect. We need the technical resources to back up our university graduates if they are to impact optimally on improving society. Nigeria needs to retrace its steps to overcome what has become a system that is out of tune. Our education system would then be able to serve the country better. The disconnect runs through to the way HNDs and Certificates of Education holders are perceived. As a nation we must accord polytechnics and technical colleges the priority that they deserve as a key link driving the value-added chain from which all benefit. In the process, we should all recalibrate our relationships to industry. Indeed, all of us should work with industry. It’s the only way to impact on society. All of us, be it as polytechnics or as universities, have one single mandate – contributing to societal development.

Is the University of Ibadan a lighthouse in West Africa?

It is, historically and in many ways academically, but we need to do more. When UI was set up in 1948, it was the lead university in the region. It was designed as the University of West Africa. The late Kwame Nkrumah, that influential champion of Pan Africanism, with a deep interest in culture and education, attempted to beat the then British colonial masters to the game by setting up the University of Ghana, Legon, one week before we were founded. He was dedicated to education. We still have a robust relationship with the University of Legon and we are busy fostering the same spirit of cooperation in West Africa. The Pan African University will further help us to achieve this laudable dream. We think there is a lot we can offer our fellow West Africans.

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You are not a technology university, but you are building a large solar-power plant.

The idea behind the solar-power plant is simple and yet all-embracing: it will really reposition the University of Ibadan as the foremost university in Africa. Power supplies are the major challenge we collectively face today. The solar plant will enable us to address the difficulties this causes us as an institution and will help us more or less resurrect the past while launching us into the future. Some of us remember vividly the golden days when dedicated researchers could work in the labs all day and night. Those were the days before the bane of power outages. The solar power plant will enable us to ensure the renaissance of that tradition. We will be able to minimise loss of equipment through power outages, or surges, loss of time in research, loss of samples in process, and use of budget not for expensive electricity purchases but to promote academia. In this way, the power plant will also foster a spirit of cooperation, will ensure a spirit of peace, encourage security and promote good research. In fact, the cutting-edge plant aptly describes our role as a university. Nigeria's Tertiary Education Trust Fund has duly recognised the validity of the project and its Chairman noted that it was logical that the University of Ibadan should take the lead here, with the caveat that others will come on board. It is for us to demonstrate vividly that it not only works for UI but how it works at all levels. We are quite confident that this is one project that will forever shore up our role as the leading university in this country and continent.

Diversity and filling the gap

Lack of data on TVET and of comparability needs to be overcome to calibrate TVET services to the labour market and future policy requirements. Countries need to conduct clear reality checks

Whether the emphasis is on "TV education and training" or on "TV skills development", the solution needs to be local in each case and yet linked to insights gained at the continental level. The fact is that there are 54 countries in Africa, each with its own specificities, meaning that there may well be little common ground for shared plug-&-play solutions. Before that can happen, there is the 'simple' task of assembling a pool of comparative data to allow policymakers in each country to see whether and where they can learn from one another.

UNEVOC, which is based in Bonn, Germany, is UNESCO's specialised centre for technical and vocational education and training (TVET). It assists UNESCO's 195 member states in strengthening and upgrading their TVET systems and thus seeks to promote "learning for the world of work". To this end it runs a country database on TVET to enable precisely such comparisons to be made. However, to date only 15 countries in Africa are included, with a further 14 still in the validation loop. All the others remain 'under development'. Data on no other continent is as sparse. Similarly, the African Union Commission Website's section on youth and TVET stands out more for the white spaces than for the content.[36]

* See case studies on Rwanda, p. 100 and Tanzania, p. 170

Despite such shortcomings, there are laudable attempts to coordinate policy-making efforts and consult on the priorities, both by the AU's Department of Human Resources, Science and Technology and by the African Development Bank's agency ADEA. ADEA itself "is first and foremost a forum for policy dialogue. Established in 1988 as a framework for better coordination among development agencies, it has evolved into a Pan African institution built on a genuine partnership between African ministries of education and training and their technical and external partners."[37] The ADEA Website lists five Inter-Country Quality Nodes, one being on Technical and Vocational Skills Development (led by Côte d'Ivoire). The objective of the latter is to give public and private sector decision-makers engaged in TVSD reform policies the benefits of pooling experiences, analyses and evaluations in this field at the regional, sub-regional and continental levels, and thus enable them to take a concerted approach to the challenges they all face. To this end it regularly convenes conferences for ministers and their advisors. How this trickles down into action on the ground locally is a different matter.*

The African Union is certainly aware of the challenges TVET poses. This is manifestly evident from the "Second Decade of Education (2006 – 2015) Draft Action Plan" published by the Commission's Department of Human Resources, Science and Technology as long ago as June 2006. The plan covers seven focal areas, one of them being TVET, and shines a light on precisely some of the issues raised above. In the document the African Union declares that "a sound programme of TVET should be based on a foundation of (i) a sound general education, (ii) a sound general/introductory technical education, (iii) specialised technical training, and (iv) the possibility of credit transfer to further education and training.

"Quality TVET that responds to the demands of the labour market needs to be designed and delivered by educational institutions and other providers in close partnership with prospective employers. […] Given that vast numbers of young people are outside the formal school system, integrated non-formal learning consisting of literacy and TVET programmes, especially for girls and women, have the potential to enhance the well-being of communities throughout Africa. TVET will therefore be a high-priority area for investment in the Second Decade of Education for Africa. The actions proposed are expected to bring national TVET systems into synchrony with local labour market demands as well as to launch research and development mechanisms to take advantage of the work opportunities that globalisation may bring." [38]

Six years after the plan was launched, the Fifth Ordinary Session of the Conference of Ministers of Education of the African Union (Comedaf V) that was convened in Abuja, Nigeria (23 – 27 April 2012) took a "Report on the Implementation of Technical Vocational Education and Training". In its published conclusions, the conference stated that in light of the challenges to TVET it had identified and discussed there was an urgent and compelling need to establish a fund that could finance the implementation of TVET/TVSD activities. [39] The clear message to the continent was: if sufficient financial resources were not allocated for the task, then efforts would come to nought. The conference was firmly of the opinion that only if this were to happen would there be a realistic chance of managing the need for youth employment. While stating that this required central resource mobilisation, the conference also insisted that progress would be contingent on a public/private partnership in Africa to master the challenge of education for growth and sustainable development.

Praiseworthy as this recognition is, it again remained a central or centralised effort. As a consequence, progress has not been as fast as could be hoped, and a reality check (as offered by our case studies) indicates there is massive room for improvement, often simply owing to a lack of financial resources.

* See case studies on Egypt, p. 76 Morocco, p. 40 and South Africa, p. 62

The African Center for Economic Transformation, based in Accra, focuses in its "2014 African Transformation Report", which is subtitled "Growth With Depth", specifically on the need for an upskilled labour force. It argues there that "economic transformation demands a healthy workforce equipped with the knowledge and skills to be highly productive on farms, in firms, and in government offices." ACET insists that this task cannot be left to government alone, and goes on to say that "businesses have to be part of a technical and vocational education and training for practical reasons…" It cites various reasons, emphasising that curricula designed with the involvement of industry and commerce enhances the relevance of the skills taught to actual work, which facilitates apprenticeships, as the students can practise what they are taught. Business can also support teachers in making certain that they are familiar with the plant and machinery in use, which may well have changed since the days when the teachers trained. And the lasting benefit is that "businesses will be more confident that they can hire people with the skills they need to make investments profitable."[40] TVET in Africa must therefore hinge on a consciously African curriculum, and to this end the needs of businesses need to be identified and taken more strongly into consideration.*



Dr. Donald Kaberuka

Past President of the African Development Bank, Abidjan, Côte d'Ivoire

Three years ago you said as regards education in Africa: "While the challenge of numbers is being addressed successfully, that of quality remains." Do you think that is also true of technical and vocational education and training (TVET)?

Yes, it is very important to enhance and strengthen quality- and demand-driven TVET. TVET graduates with the right set of skills based on the demands of the industry will be the driving force to accelerate the economic transformation of future Africa. Hence, human capital investment through quality TVET is key for sustainable development in Africa. However, progress is being made towards achieving this. In countries such as Côte d'Ivoire and Rwanda, the Bank is providing support for increased private-sector participation in building employable skills and their aptitude for jobs.

- Through the Côte d'Ivoire "Youth Employability and Insertion Support Programme (PAAEIJ)" approved in 2013, a school-business partnership development unit (CDPE) has been created and operationalised to serve as an interface between the education sector and industry on employability-related issues.

- Key reforms in the Rwanda "Skills, Employability and Entrepreneurship Programme (SEEP)", a multi-year programme approved in 2014, include (i) the review of curricula for TVET in 62 trades with close participation of the private sector; (ii) institutionalisation and operationalisation of 12 sector skills councils (SSCs) – to provide the private sector with a voice in the entire policy formulation process and the provision and evaluation of employment-focused training; and (iii) engaging the private sector in providing industrial attachment programmes for up to 39,000 youths/graduates.

140 **Under your leadership, the Global Agenda Council on Africa identified six key focus points, one of which is education. Do you think African countries have the resources to drive education strongly enough?**

It was a joint contribution, together with other leaders, to position human capacity development (education, entrepreneurship and talent mobility) within the priority area of focus of the Global Agenda Council on Africa. It came from the observation that Africa needs to identify quality growth models that increase competitiveness and employment while lowering poverty.

On the question related to resource availability to drive education, the Bank has explored these issues in recent reports such as the MDG 2014 report, a joint publication with other institutions such as the UNECA, UNDP and the AU. It is important to emphasise the following two issues:

- Public resource mobilisation for education is seemingly the same in Africa (4.8 percent of GDP) as in non-African developing countries (4.7 percent of GDP). While there may be room for mobilising additional public resources in some African countries, the global picture reveals a situation where countries should prioritise improving efficiency in resource utilisation to meet the growing demand for education services. There are still 33 million out-of-school children in Africa today, which represents 56 percent of the global number of out-of-school children. The effective use of ICT will reduce the cost of training teachers while increasing the quality of learning.

- Resource diversification is key. African countries need additional resources for the implementation of the post-2015 development agenda. Significant resources need to be mobilised from a variety of sources and the effective use of financing should also be ensured. These resources mainly include: better and smarter aid; and inclusive and innovative private sector resources that are emerging. These already play a critical role in service delivery in Africa. For example, 10.3 percent of primary school students are enrolled in non-government schools in Africa. Africa must build a vibrant private sector that supports the development of a dynamic education system and the acquisition of new skills and capacities by the labour force. There is a need for outcome-based and quality control mechanisms within the education sector.

How critical is the role that TVET should play in Africa today?

TVET is the missing link between basic education and higher education in Africa. The share of TVET in total secondary enrolment has decreased from 9 to 7 percent during the past ten years. Africa still relies on agriculture where labour productivity is very low, raising poverty issues. Economic transformation requires that those employed in MSMEs are equipped with the minimum TVET skills to move from subsistence entrepreneurs to opportunity entrepreneurs. Moreover, TVET will be the crucial bottleneck to produce the human capital who can wisely deal with natural resource development, which is the core for sustainable development in Africa today. However, we should make TVET an attractive career path for youth by building flexible and demand-driven TVET.

Should there be concerted Pan African efforts to develop 'African' curricula and an 'African' skills learning system that dispenses with possibly outdated colonial models?

It is important to develop the indigenous culture and education system of each African country. We must promote indigenous knowledge development and how global science can be a vehicle for modernisation. With its Human Capital Strategy 2014 – 2018, the Bank, through country-adapted approaches, promotes a New Education Model in Africa (NEMA) as a framework for education focusing on innovation and entrepreneurship. It is a call for African countries to rethink the foundation of their education systems, taking into account the new opportunities arising from technology and such challenges as rapid urbanisation and existing inequality gaps (gender and socio-economic). NEMA proposes to drive skill development through five components: (i) creativity and critical thinking; (ii) a participatory approach in policy formulation and implementation; (iii) an ICT-based structure; (iv) links with the labour market; and (v) public/private partnerships. For example, Africa should develop science and technology skills for extractive industries and natural resources – extractive industries are major players in the economic landscape of many African countries.

The African Virtual University has been a success, thanks to the AfDB. Is it a model that should be followed at a lower skills acquisition level?

The success you are referring to has been made possible because of the use of ICT, open distance and an e-learning approach for programme development and delivery. The project ensured the establishment of ten open distance and e-learning centres as country hubs for the development and design of ICT-enhanced instructional materials in five countries (Kenya, Mozambique, Senegal, Tanzania and Zambia); supported the training of 459 University academics; developed 86 ICT-enhanced modules in mathematics and science; and enrolled 4,000 students – including 372 females enrolled in science, maths and ICT programmes.

Is it a model that could be replicated at a lower skills acquisition level?

- The AVU project has valuable externalities for the whole education community: for example, the ten e-learning centres developed under the project serve as country hubs for developing and designing e-learning materials. Also, the science and maths teacher education course modules developed by the project have been uploaded on an e-platform (open educational resource) from which other institutions can access them. Zambia academics trained under the project have been requested by the Ministry of Education to assist in fast-tracking the up-grading of primary and secondary teachers.

- The AVU model should thus be adapted to benefit lower skills acquisition levels. The use of ICT has the advantage of scaling up the opportunity for inclusive learning by reaching out to the poor. ICT promotes the quality of learning, and also gives a second chance to those who dropped out from school by giving them opportunities for home education, including adult illiterates. There are already existing models of decentralised teacher training with the opportunity to train and build the capacity of teachers in remote areas serving the most vulnerable children. Going forward, lessons learnt from the AVU project were factored in the recently approved Pan African University project with the aim of linking campuses in three African countries (Nigeria for Life and Earth Science; Cameroon for Governance, Humanities and Social Sciences; and Kenya for Agriculture and Technology), and contribute in fostering regional integration.

What do you think of the idea of setting up a Global Fund for Education with the focus on Africa?

Progress in education has somehow been hampered by a lack of resources and uncoordinated efforts. While aid for basic education doubled from 2002 to 2009, it has since stagnated and even fallen in recent years. Even though many partner countries have increased their national budget allocations, progress in getting more children to school has stalled. Remember that there are still 33 million out-of-school children in Africa. It is a good opportunity to strengthen donor aid coordination and consolidate existing instruments such as the “Global Partnership for Education”. Because of economic stagnation in major donor countries, this is probably the best time for us to re-think the effectiveness of aid contribution.

“Quality TVET is key for sustainable development in Africa.”

Another aspect is that Africa’s narrative is changing from a continent in need of aid to a place of opportunity for growth and prosperity. Many African countries are seeking emerging-economy status within the next two decades, which they could achieve if they are able to sustain double-digit growth. We shall think of how to better support countries to reduce aid-dependency. This issue should be put in the broader agenda of financing development in general. As you know, the upcoming conference on financing development will be held in Ethiopia in July 2015.

Would you agree that it is important for Africans to realise that university education is not the be-all and end-all for young adults, and that artisanal skills are equally important and should be held in equally high regard?

Yes, the mindset change in this area is crucial. As I have already said, education should respond to the labour market and the socio-economic needs of Africa. Africa still relies on traditional agriculture and the informal sector, where labour productivity is very low, raising poverty issues. Given the size of the informal sector today (up to 90 percent of total employment in Sub-Saharan Africa), this sector is likely to provide employment opportunities to the 11 million African youths entering the labour market yearly over the next decade. Youths should thus be equipped with the appropriate skills and technology to boost labour productivity in the informal sector and catalyse changes toward competiveness and modernisation. However, a holistic and balanced development of the education sector, with all forms of education, is equally important. That is the essence of the AfDB Human Capital Strategy 2014 – 2018, which adopts both a vertical (from pre-primary to higher education, including TVET) and horizontal (skills development linked to different economic sectors) approach to education and training, based on the actual development stage of each African country.



Sebastian Deh

Executive Director,
COTVET Council for Technical & Vocational Education & Training, Accra, Ghana

How did COTVET come about?

It arose by Act of Parliament in 2006 as part of the country's drive to reform the education sector, as the politicians had realised this was key. COTVET was established as the regulator for TVET, with a Board and Executive Director. Its brief was to act as a direct interface with industry and to set the standards. Its governing board reports to government, which is key, as structurally we exist as an agency under the Minister of Education. And COTVET became the champion or spearhead of the TVET reform agenda the nation has donned. Indeed, it is fair to say that it was created as a result of and in response to the nation's desire to situate skills development and vocational issues within the context of economic development. As a development finance professional with over 20 years' experience in the industry and a focus on skills and enterprise development, I guess I am kind of a natural fit to move the Council forward as the second person to be at its helm.

So you interact only with the Ministry of Education?

No, as there are pockets of TVET in eleven different ministries and in countless agencies, so our work must involve engaging with them accordingly. Our coordination role involves cutting across all these entities and bringing them together, distilling the common ground and structuring it. We also coordinate the activities of the TVET providers from the pre-tertiary to tertiary levels, and that principally includes universities and polytechnics. From my own experience and observation, I think this multi-level coordination is a lesson for all African countries to learn: without it, TVET is likely to flounder. Recently, government decided to convert the polytechnics into technical universities, for example. This vividly highlights its emphatic focus on skills.

At the same time, given the fabric of Ghanaian society today, under our aegis we have to aim not just high in terms of the education system, but also low. Why? Because of the informal sector, where you find countless TVET activities, for example in the various apprenticeship systems. Again, I think this is not necessarily just a Ghanaian phenomenon. What this means is that standardisation is a huge challenge. As is consistent quality assurance. Studies show that as many as 500,000 persons are engaged in apprenticeships in Ghana at any single point in time, so you can gauge the gargantuan scale of the task of how to organise such an unwieldy structure as a coherent system. After all, there are master craftsmen and craftswomen, each of whom tends in some way or other to mentor about five or six apprentices. And this is true of all the trades, although there are huge differences between the various professions. The landscape is huge. But we still have to get the yardstick right.

Are TVET and artisanal skills held in high esteem?

Unfortunately not, as TVET is often not seen as a viable alternative to general education. But that is a challenge: we have to brand it and enhance its visibility. This involves two things. One strand is to make certain the infrastructure is provided, enabling TVET to proceed smoothly. The other is to help people who graduate with certificates to then get jobs.

To fulfil our brief in this regard we had to build significant human resources and ensure reforms in the curricula are being used, and all this calls for infrastructure, infrastructure, infrastructure. There's a huge infrastructure gap after all, wherever you look in Africa, starting with labs, classrooms and equipment. We are very grateful for the support we've had from governments, development finance institutes, donor agencies and the like, as this has facilitated our implementing projects.

How do you typically do that?

Let me cite the example of the Ghana Skills & Technology Development Project. It is a five-year programme coming to an end in June 2016. It essentially focuses on addressing the skills gap and technology improvement as is anchored by COTVET. We broke it down into different components to make it easier to implement. Component 1 focuses on capacity building. Component 2 addresses technology issues and marketing technology. Component 3, which has become the most popular, centres around the "Skills Development Fund". The latter has truly become a household name. Not only does it address the difficulty of covering the cost of upskilling, it tackles the skills needs of all priority sectors.

How do you prioritise sectors?

Here again you see the compelling argument for coordination. The priorities were chosen on the basis of the latest Ghanaian economic data, for example statistics gathered by the National Development Planning Commission (NDPC). Back in the period 2009 – 2010, Ghana's oil industry had not yet really taken shape, whereas now it is a major industry contributing so much to the economy. So TVET programmes needed to be adapted to meet this change. But we felt this should not occur on some piecemeal basis but in a structured manner. So we have been encouraging the Commission to incorporate TVET reforms into its strategy planning.

“Multi-level coordination is crucial for TVET, coordination across sectors and ministries. Without it, TVET in Africa could all too easily flounder.”

We are very much helped in this regard by our quarterly Project Steering Committee. It is both multi-sectoral and inter-ministerial, and brings all stakeholders to the table, the NDPC of course being one of them. It was established by government in order to ensure decision-making by consensus body and functions as a clearing house for all ideas relating to project implementation. In other words, it is responsible for COTVET’s budget and strategy approval. It is co-chaired by no less a person than the Minister of Education, along with the Minister of Environment, Science, Technology and Innovation. Members are also appointed by the Ministry of Trade and the Ministry of Finance, and there are university rectors and delegates from the Association of Polytechnics, principals of technical institutions and representatives of Ghanaian industry, such as the ITAC Industrial Training Advisory Committee – basically the whole gamut of key decision-makers for TVET. One outcome has been our Development of Skills for Industry Project (DSIP), which addresses the infrastructure needs of institutions. We’ve preselected over ten of them to upgrade their equipment, as there is a strong recognition that without the infrastructure, teaching is to no avail. How to train a hairdresser without the scissors, or an oil industry technician without pneumatic equipment? And I don’t mean just any scissors or pneumatic equipment, but the ones they will use day in day out when in jobs!



Ambatovy Nickel and Cobalt Refinery, Toamasina, Madagascar.



Upskilling for industrialisation

How an all-in training centre has changed the face of TVET in the country

Despite the lack of high-rise blocks, the city of Toamasina on Madagascar's Eastern coast is the third-largest city in the country, home to some 500,000 inhabitants. Fairly tropical in terms of climate, the city has by dint of a large off-shore reef long since been the country's the largest port. Some 8 million tonnes of goods enter the country here and as of 2014 a substantial tonnage has also been outward bound, as Madagascar took a place in the world league table for nickel exports. That was when the Ambatovy mine project went operational after two decades of careful planning, studies and construction work. Today Ambatovy is the single largest industrial enterprise in the country, by far the largest example of foreign direct investment (no less than US$7 billion) and has some 3,500 employees and another 5,500 who work for contractor companies, totalling 10,000 people working inside the facilities. Indeed, it has by many a calculation indirectly created over 15 times that many jobs – a godsend in a country that for several years received no assistance from donors. The workforce is spread across two facilities – a large open-cast mine, and the refinery 250 kilometres away.

This may sound like a mammoth project, but in a sense building the industrial plant was the easier part. Filling the jobs was a more gargantuan task, as in Madagascar TVET has long been a problem, as has education per se. One key challenge all governments have faced in this regard is the fact that about 70 percent of the population live in rural areas. While the new government invested 2.7 percent of GDP in education in 2012 (corresponding to around US$860 million), this was well below the figure that went into health, and only a smattering of that budget allocation found its way into TVET. The focus has instead been on primary education. This is understandable given that 40 percent of the population is aged 14 or younger, and it may make some sense given the fast-growing Malagasy population. It must be borne in mind, however, that the next 20 percent or more is at most 24 years of age – and completing primary education should hardly be the end of young people's time at school. For all the efforts, an estimated 40 percent of the population is still illiterate, with many primary school classes huge by any standard, and the number of those resitting a year hardly surprisingly high.



Ludovic Randriaharihaja, Ambatovy, Toamasina, Madagascar.



Christophe Rabia, Ambatovy, Toamasina, Madagascar.

The TVET system is based on the French model of a technical baccalaureate and between one and five years spent in college or university afterwards. However, the system is essentially supply-driven and divorced from labour-market needs such as those of Ambatovy. In the absence of a set of strong chambers of commerce and industry in the cities advocating TVET, and hard statistical data difficult to come by, little seemed to be working in Ambatovy's favour in the late Noughties when it started hiring. This was even before the fledgling efforts by UNESCO in the form of its Capacity Development for Education for All (CapFA) programme in Madagascar, which aims to integrate out-of-school youths in rural areas into the world of work through TVET – it is at present laudably reaching out with pilot schemes to eleven rural communities. And it did not come in time for Ambatovy, which in 2008 initially sent 29 young aspirants to Canada to train as millwrights or as instrumentation technicians – either at NAIT, the Northern Alberta Institute of Technology in Edmonton (a WorldSkills competitor), or at the long-standing vocational college in Quebec, CEGEP. The young people were astonished to find on arrival that both institutions boasted labs that were choc-a-bloc with equipment – as compared with home, such as the University of Antananarivo, which is alma mater to many of them but is sadly lacking almost any equipment.

Ambatovy wanted from the outset to hire young people who would grow with the company, and to hire locally rather than go the classical path of large industrial combines in Africa and rely on expatriate staff. While there is no indigenous content law for employment or a policy of affirmative action, Ambatovy pursues a policy of hiring young Malagasies who will grow with the company. Sending people halfway round the world each time skills were required seemed nonsensical to management, and the decision was taken in 2009 to set up a bespoke training centre. Its current Technical Training Coordinator Ludovic Randriaharihaja comments, "Operations started in 2012, and since then over 1,000 people have participated in our courses, starting from operators, welders, electricians and pipefitters upwards." In fact, the training centre is the envy of many other enterprises, such as Galana – an oil company which operates a refinery just down the road in Toamasina – or Star Breweries, which has expressed an interest in hiring training hours. Hardly surprisingly, because, as Randriaharihaja says, "We are the largest industrial outfit in Madagascar, and the first to invest heavily in training, as neither are skills available locally, nor is there the capacity to train those skills." Today, 70 percent of the fully equipped training centre is in use at any



Downtown Toamasina, Madagascar.

one time, with countless classes learning the vast array of skills the company requires, from pipefitter upwards – the in-house "Ambatovy Skills Mine" modularises all the various vocational competences required, enabling budding candidates to draw up their own individual study schedules. Erstwhile trainee Ravaka Naliharimino, now a senior lab technician, comments: "I really wish all the kids in the country could benefit from the same structured career training sets for their personal development."

The training centre is an ideal example of how TVET can be practised. However, you have to be an employee of Ambatovy to benefit. It is not sustainable for Madagascar in the long term to rely on corporations to provide technical training. If one bears in mind that half the population of the country is under the age of 23, then it does not require much imagination to see that policymakers in government must start allocating significant budget resources to TVET if the economy is to develop. Ludovic Randriaharihaja comments, and he is borne out in this opinion by many former trainees, "What's wrong in Madagascar is the lack of practical knowledge imparted at colleges and universities, be it at the technical back level or at the level of the Ecole Supérieure Technique. So what we try and do is complement the theory they have learned."

Sadly, and this contrasts sharply with efforts in many countries on mainland Africa, it is at present almost as if TVET passed Madagascar by – and it most certainly has to date if one considers the absolute dearth of laboratory and technical equipment in training facilities. Christophe Rabia, a proud father, relocated to Toamasina with his family. He has been working his way systematically up through the ranks at Ambatovy, and his career track was at first fairly symptomatic of many in the country. After completing his studies in one of the big and austere-looking lycées in the capital, with large classrooms full of desks and chairs facing a blackboard, he studied natural sciences for three years at university, but had never had the opportunity to actually work with lab equipment. What he had was in-depth theoretical schooling, but none of it specifically for mining. After graduation he was fortunate to move straight into a job, working as a lab technician in the pharmaceuticals business in Antananarivo. (This is a sector that served not just him but various of his colleagues now working in Toamasina as a launchpad for their careers.) There he benefited from some basic training, but there was no training centre, nor was there any structure such as a sandwich course. Either one had to go to other labs, or one relied on the older employees training the



Students at Ambatovy Training Centre, Toamasina, Madagascar.

younger ones – on-the-job training in the form of learning by doing only. Looking back, he is proud to have learnt to implement the standard operating procedures for the pharmaceutical industry, but wonders why the government could not provide more systematic TVET. Rabia moved on to work in various schools where he ran the labs and taught life sciences, something that has stood him in good stead at Ambatovy, as it gave him a mix of leadership and people skills.

In Toamasina he now faces a new challenge: he has been appointed lab supervisor and functions as the analytical services superintendent with budget and HR responsibility. The former superintendent is now his mentor and will soon be handing over to Christophe entirely: today, he simply checks everything Christophe does and intervenes when necessary, looking over his shoulder. Christophe expects to stay in the company. And he feels certain that economic growth in Madagascar can only really take root if TVET is provided around the country. After all, 25 percent of the government's expenditure is on payroll costs, and given the lack of solid hands-on training, here again there is a risk that the money will not be as well spent as it could.

But back to Toamasina. When Ambatovy first set up shop, which means firm residential zones for the large number of staff, this involved not just providing large canteens, but a laundry service and cleaning. The idea of a major cleaning service was completely new in Madagascar, recalls Lalaina Randrianarivelo, Communication Manager at the company. The idea was in fact a real shock to the system, albeit a beneficial one, as the notion that you need hundreds of cleaning staff, not just a few buckets and mops, was as good as unknown and sparked the emergence of a new sub-segment of the economy. It is one that rolls over favourably, of course, into other key sectors such as tourism, which, if it is to flourish, will likewise require such services. And since Ambatovy has international standards, it has indirectly set benchmarks for the nation.

The same applies to procurement and illustrates how one major industrial investment can spark all manner of minor local investments. Ambatovy set up a local business initiative in order to act as the angel investor seeding such new enterprises. Randrianarivelo says with justifiable pride, "We've helped build up local sectors, and that means agriculture in particular. When we realised we needed 7,000 eggs a day during the construction phase, we had to support the restructuring of local poultry farming to ramp up supply to our kitchens.



Toamasina Port, the largest in Madagascar and the export terminal for nickel and cobalt.



They'd never encountered the idea of such a market before. And in a sense our corporate responsibility means pursuing a sustainable long-term business model, as we are now contributing to the prosperity of many families far beyond our perimeter fence. After all, the egg story applies by analogy to most soft produce. In total, today in excess of 750 local companies act as our suppliers."

During the construction phase, Ambatovy had to help resettle smallholders, and it did so by resorting once again to training. It set up a farm academy nearby, where the smallholders were taught how to get more out of their new fields. Sadly, the academy lies idle today, and one can only hope it will be the sole instance of a TVET institution opportunity passing Toamasina by. It is, however, a rare negative in a city and region that is full of educational success stories. Take Ayto Arivelontseheno, for example. He was one of the first-wave trainees who seven years ago benefited initially from studying abroad in Canada, at NAIT, where he spent almost a year as a young electromechanical maintenance technician. He arrived at the company from the Institut Supérieur de Technologie in Antananarivo, where he had been on a sandwich course for industrial maintenance. Maintenance he sincerely believes is absolutely critical to the success of Madagascar's fledgling industry. Since returning to Madagascar he has on several occasions spent periods learning at the training centre during his time as a team leader and then as a general foreman's assistant. He is now general foreman for instrumentation and maintenance, and is one step away from becoming the manager. Looking back on what Ambatovy has achieved, Arivelontseheno is impressed at how quickly his fellow Malagasies learn and have made their mark in the company. He is evidently not alone in being firmly of the opinion that "if you persevere, you can progress."

This possibly applies to countries, too. After all, Madagascar has much economic potential, and were there to be more foreign direct investment to kick-start things in sectors in addition to mining, then the country might be able to start creating the jobs its young people need – assuming that this mass of youths also has the training to fill them. One can only hope that the politicians make wise choices in how best to allocate budgets in the coming years.

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Outskirts of Dar es Salaam.



Technical education in Africa – History and future focus

Many TVET activities have been launched around the continent. However, the system is dogged by a lack of facilities and outdated methodologies. Can a 'dual' system on the German model perhaps be the solution once economies have a sufficient SME sector?

Back in January 2007, in its "Strategy to Revitalise Technical and Vocational Education and Training in Africa", the African Union Commission in Addis Ababa stated quite unequivocally:

"After years of benign neglect, due to a complex set of reasons that included budgetary constraints and criticisms of the World Bank in the early 1990s on its direction and focus, technical and vocational education and training (TVET) is back on the human resource development agenda of many African governments."[41]

The strategy paper went on to say that TVET delivery systems were "well placed to train the skilled and entrepreneurial workforce that Africa needs to create wealth and emerge out of poverty." As a consequence, in its Plan of Action for the Second Decade of Education (2006 – 2015), the AU specifically recognised the importance of TVET as a "means of empowering individuals to take control of their lives", and recommended that TVET be integrated into the general education system.[42] Since then, many African economies have started to blossom and the need for TVET has become both more compelling and more urgent.

Over the last decade, many African governments have instituted national policies to foster TVET, have devoted much elbow grease to devising the requisite curricula, and started the tall task of capacity and institution building. In the process, they have in most cases had to base their efforts on a tough legacy. Indeed, the reality today still corresponds in part to the flaws the World Bank had identified in its policy paper back in 1991. At the time, it emphasised high training costs, poor TVET quality, a mismatch between training and labour market needs, and a high rate of unemployment among TVET graduates. It advocated moving away from school-based technical and vocational education and training to TVET conducted by dedicated institutions.

Suffice it to say that over half of African youth do not have access to secondary education, technical and vocational training opportunities are scarce and enrolment rates in formal TVET programmes at least at the secondary level are in some places 5 percent or less.

In various countries, the sector is dogged by a colonial past, which means that the training models follow those of the erstwhile colonial ruler, and as a consequence

are out of line with the country's specifics and often with the country's needs. Moreover, the TVET programmes often kick in after primary school and thus double up on secondary education, raising costs, rather than being formalised after junior or even senior secondary school. TVET courses tend to run for three years.

The two main colonial systems are the British and the French, neither of which is without its respective shortcomings, particularly if one bears in mind that these systems were put in place well before the advent of IT.

The British system of secondary technical schools is to be found in many of the anglophone countries of Sub-Saharan Africa, along with a split between polytechnics and universities. It bears saying that in Britain itself, the secondary technical schools failed to attract any significant number of young people and the system was complemented as of 1994 by publicly funded modern apprenticeships, whereby some of the higher technical engineering programmes entail four to five years as an apprentice and academic study. Apprenticeships are increasingly recognised as the key to skills acquisition, but this is a recent development. There are three levels of apprenticeship available for those aged 16 and over. Crucially, then, the system emulated in such countries in Africa is one that has failed to work in the United Kingdom and has had to be modified since.

The other main system of technical education to be encountered in Africa, again a product of its colonial past, is the French system. In France, the system is highly centralised and vocational diplomas are set at a national standard. The French system hinges on vocational secondary and post-secondary education, where a certificat d'aptitude professionnelle is obtained, through technical baccalaureates, to technical colleges, where students gain a brevet de technician, or technical universities. In France, the various diplomas cover nearly 450 subjects, which are related to different trades or fields of activity and are regularly reviewed in consultation with professional bodies. The focus is thus less on apprenticeships.

How can either system meet the need to integrate an ever younger population into the economic cycle? After all, the sheer scale of the task is enormous: three out of five unemployed in Sub-Saharan Africa are young people, who seek to eke out a living informally, and the number of under-twenty-ones is rocketing.[43] Hardly surprisingly, non-formal TVET is the prevailing system, with old craftsmen teaching younger colleagues 'on the job' when a new member of staff is required.

Little structure, much fragmentation, informal learning, and a lack of school skills and technical skills are often the result – precisely in countries where artisanal abilities are the alpha and omega of progress.

In fact, it is fair to say that very few governments in Sub-Saharan Africa are able to finance TVET at a level that can support the sort of quality training companies are now calling for to drive the emerging economies. The new middle classes tend to send their children to university, while the poor often do not have the opportunities to acquire the skills the economy requires.

Dr. George Afeti, Former Secretary-General of the Commonwealth Association of Polytechnics in Africa, writes in this context: "We need to understand that the acquisition of technical and vocational skills may take place in different learning environments: formal, school or curriculum-based learning; non-formal job-specific skills training; and informal apprenticeship training. In some parts of Africa, the informal sector accounts for more than 80 percent of all skills training (ILO, 2007). Informal sector training is more flexible than school-based TVET that imposes rigid admission criteria and age limitations on learners. … Countries like Benin and Burkina Faso now have a modernised or renovated 'dual' system of traditional apprenticeship where learners alternate between the classroom (for theoretical learning) and the workshops of the master artisans (for practical skills training). Some other countries like Ghana and Senegal have developed programmes to upgrade the pedagogical skills of the master trainers in an effort to improve the overall skills transmission effectiveness." [44]

In other words, a system akin to that practised in Germany, a country whose economy is driven by SMEs, is starting to gain sway. This has the added advantage of enabling curricula to be devised that are tailor-made to the respective country and are customised to local industries' requirements, allowing a meaningful mix of public- and private-sector engagement. Moreover, such curricula often include what the African Union advocated: entrepreneurialism. In an age when mobile phones and micro-financing have entered into a truly vibrant alliance, the prospects for young people to be able to use artisanal skills and business acumen to set up their own companies are good – and may very well prove to be the best road forward for many an African country. A road that the various councils or agencies for TVET are busy paving.



The new Botswana International University of Science and Technology main building and the Engineering Annexe, Palapye, Botswana.



Prof. James Ketande

Founding Dean, College of Engineering and Technology, Botswana International University of Science and Technology, Palapye, Botswana

How large is the Faculty of Engineering?

With the new intake we'll have 1,500 in all, with almost 1,000 of them in Engineering. It's interesting because we have more engineering students than science students, because everybody wants to be an engineer apparently. And we need this type of professional to transform the economy going forward.

How long have you been 'in the business'?

I came to Botswana in 2010 but I've been in this form of education ever since I graduated in 1978. I started out working at the University of Lagos in Nigeria, where I spent a total of 15 years. And then I moved on to the Bayero University of Kano, for about the same period of time. After that, for four years I was on the staff at a new private institution, Covenant University, which is in Ota in Nigeria, too. It is only about ten years old now, but it has surged to the top of the Nigerian rankings and beats most of the government-founded institutions hands down. I was really comfortable at Covenant I must say, and I set up Science and Technology. They have some of the best labs you can find in Nigeria today. Because the founding fathers recognised how important such equipment is, and committed vast amounts of money – rightly so – I liked it. But in actual fact I am a Ugandan.

What made you decide to come here?

What really attracted me was the opportunity to start on a completely clean slate. I experimented when I was at UNILAG and we tried one thing or the other when I was at Bayero University, where I must say I introduced a new thing or two. But the challenge has always been to structure completely how engineers should be trained locally and trained with a view to local industries. Sometimes when they go overseas the young people perform wonderfully. But when they return something does not fit somehow. So evidently we were not getting everything right. And I experienced this for myself as I did my Ph.D. at Rome University in Robotics. Back in 1983 there were no openings back in Nigeria in robotics, but I returned nevertheless, out of a basic conviction that Africa in general and Nigeria in particular had the potential to be really great. Whatever can be achieved elsewhere can be achieved in Nigeria because you have human resources, material resources and everything you need. So I stayed on. Some of my colleagues left Nigeria in the 1980s because their pay was really poor. But I still persisted because I believed that we were able to do something. The other teachers were quitting teaching to go to banks and other industries. But I wanted to be the guy who trains the guys who make a difference. It's a personal passion for training engineers.

And then I saw an advert on a job website and I realised this just might be the opportunity to play a role in deciding things from the very outset the way I think engineering should be. Because I want to make certain we turn out the technical personnel who can make a difference. I admit I was really enjoying myself at Covenant University but I put in my application anyway – the wonders of the online world in Africa today. It offered me a challenge to again make a difference. I was founding Dean of Engineering and Technology, arrived five years ago, and seized the bull by the horns. Establishing things from scratch is what makes me feel comfortable.

Then there was the benefit of Botswana's reputation as a peaceful environment that is very progressive in terms of democratic principles and so on. A lot of people are encouraged by this to come to Botswana. As long as we are setting up something new and they are willing to put down money on international universities I'd say we have to be proud of it.

How do you interact with industry?

There's a large mine and power station nearby and we seek to interact more closely with them. We've set up an industry advisory board for the college so we get the captains of industry to sit down with us and look at our curriculum and advise us on whether we are missing something or not. People from the telecoms industry because we have a telecommunications programme, from computer engineering, from the IT industry, from government. It helps us get things right in electrical and electronic engineering. And in energy engineering. We're going to be conducting some research with the Ingolstadt University of Applied Sciences in that regard.

Word has it you champion an 'African' curriculum?

The truth of the matter is that we made a mistake over the years in training our engineers as if they were going to work in Europe, America or Australia. What we need today, and this is readily apparent wherever you look, are more hands-on engineers for our industries and even for our governmental facilities. I like to be able to go to a telephone exchange, because I worked in one for some time with Germans, and be able to move the wires and put it all together. I don't want people who are happy sitting in an air-conditioned office, wearing a tie, and simply producing theoretical designs. That's where we seem to have missed it.

In our curricula we always modelled things on the European or American curricula because most of the old professors we had all had their training from Europe or America. The trend was of course to bring back what they had encountered there. Therefore we end up training people who are very sharp with curricula. They can solve equations without thinking but when it comes to going outside and getting their hands dirty, they hang their heads. So how do we change it?

So theory and practice…

One of the first things I did on arrival here was to declare: our students need to learn engineering drawing, visualisation and workshop practices. Hands up those of you who when you have drawn an object can also make it! Few hands went up. So now we teach them engineering drawing in their very first year, although the first year here is supposed to be pure science. But in my opinion as long as someone enters university to learn engineering then from year one we must train them to use their hands. Not just to push pens, but to fabricate things.

My view is that drawing is very important because an engineer may have a concept, but needs to convert that concept into something others can look at. That's visualisation for you. Moreover, every engineering student must not only be introduced to drawing but that same first year must learn to use the machines which can be used to fabricate what they are drawing.

Another problem with the system is that we adopted the credit system. And this means there's a risk students don't have the time to really concretise what they have learnt but have simply been busy trying to garner credit points. So I structured things differently: I want people who are able to walk into a workshop, go to a machine shop and without having to wait for a technician are able to turn on the machine – they get on and construct what they want to construct. Students who can walk into a joinery workshop and can fabricate things in wood.

Remember, these are things which you can even rely on to set up your own business. We should not train people who graduate and then spend three years looking for a job. We want to bid farewell to scholars who are able to say with pride, “Nobody has given me a job so I will create one for myself.”

To put this all into practice we invested a lot of money, for which I am most grateful to the university founders, and set up a machine shop, a woodwork shop, a metal working lab – all of them to industry standards. Even those students who eventually can’t get work can come and use the machines to do something, maybe give something small to the university.

Another point is that the machinery is not used for almost 80 percent of the time. So we can invite others to use them in groups and do exercises with them. Part of the plan is how to make certain we cut that 80 percent downtime, especially of machines which people can use to learn a skill. We are trying to work out how to interact with people from technical schools or NGOs who have got people they are wanting to train. So the big issue is how to use our time here to fill in more skills development for our society. I also insist that my students go out to the local technical college in their vacations and experience what the workshops there are like – that nurtures their creativity, and they soon see how important it is also to get by without all the machines we have here.

Local projects are often not executed quickly because of the low level of engineering manpower, which is hardly existent. That we are busy rectifying. And this also involves inculcating the right work ethic. I was impressed by one of our laboratory technicians; he was from Zimbabwe. His work ethic was profound, he didn’t knock off until the job was done. That’s my role model for my students, not highly scientific manuals or a clock. We need to work on the attitude and approach to work. I still don’t yet know how best to address this, but my feeling is probably when you bring people in and you give them assignments you have to insist that the assignments must be done, and you give them a tough deadline. And you identify what they are best at.

"The truth of the matter is that we made a mistake over the years in training our engineers as if they were going to work in Europe, America or Australia."

What about the maintenance of your workshops?

This is the flip side. We can produce not only the engineers but also the lower-level technicians, the guys who are very good with the air conditioning, for example. We have facilities to train people in air conditioning and engineers who will hardly ever encounter the insides of an air conditioner. Why do we have to do both? Because all these facilities have to be maintained, to be kept alive. It's also a mindset or structural thing that even runs through to budgeting. Budget items cover acquisitions, but rarely maintenance of a facility. And where budgets cover maintenance items, often the money is not used sensibly but is wasted on superfluous repairs. As much as you want things to look new when you bring them in, how do you maintain them so that they work as new? So one of the courses I am really proud of is maintenance engineering because we need to start somewhere. We need new ambassadors who go out and preach maintenance. This starts at a very fundamental level, such as taking into account workshop foundations. When we started out I first had to revise the plans to make certain my workshop floors were sturdy enough to take the vibrations from the machines into account.



Worker mounting brushes at Tanzania Brush Products Ltd., Dar es Salaam, Tanzania.



Brushing up on skills

Formal and informal TVET may still be in their relative infancy, but are already showing what a great contribution they can make to socio-economic development at all sorts of levels

When Shabbir Zavery took over at the helm of Tanzania Brush Products Ltd. it was all a matter of training staff on the job to run the machine lines in the factory located not far from Dar es Salaam's international airport. The product looks simple enough: brushes in all shapes and sizes to keep the country clean, be it its roads, its homes or its shoes. But the technology is quite complicated, and as the company has grown, so has the manufacturing plant. Zavery recalls how "originally back in 1968 we had just one mechanical system and six sets of two people working on the process, turning out about 200 brushes a day on an eight-hour shift. By contrast, today, 25 years after I took over, we are fully automated and on average roll out 4,000 brushes. Since we do not enjoy any import protection – this is the downside of free trade – for us efficiency is the key to competitiveness." And efficiency means trained staff, as personnel who are not intimately acquainted with how to operate and maintain the lines of machines will not perform as well as they could.

Certainly in the last decade, among other things Zavery has had to contend with one enduring difficulty: the severe shortfall in staff with the right skills set. He attributes this to a lack of linkage between the chambers of industry and commerce and what the Tanzanian TVET system focuses on. He puts this in a nutshell when he says, "Most of the curricula in the technical colleges used to be based on mechanical engineering, but over the last decade or two the emphasis has switched to electronics, so the number of people with hands-on skills has dropped sharply. This is a real problem for us SMAs." But Zanzibar-born Zavery would not be the award-winning entrepreneur he is if he had been prepared to accept this state of affairs. Instead, he has developed a two-pronged strategy to offset the deficit. He insists on regular visits from the machine suppliers to

ensure there is constant knowledge transfer. He therefore strongly advocates selecting the right machines from the right suppliers in the first place, as you "need to be sure they can provide servicing." And for each machine installed by the vendor, the operators and maintenance staff are then trained. In other words, key to the success of Tanzania Brush Products Ltd., which now proudly boasts a large catalogue of articles, is on the job for production.

Zavery's son, V. K. Mohandas, is already following in his father's footsteps and has adopted the same philosophy. He comments that "in-house training is very effective. Your foremen know the particular problems. The difficulty with policymakers is that they remain in the world of the theoretical." His father interrupts to bear him out: "I would suggest that funding for upskilling should be directed to travel, to sending production staff to the industrialised world to plants where they learn the western style of work." The two concur that what they are most proud of is their corporate mindset. "Everybody here is proud to be working, is proud to be an artisan." The company payroll has expanded from the three persons back in 1990, when Zavery took over, to no less than 110, and with the growth so the volume of training required has risen, too.

The Tanzanian government has in part recognised the difficulties and is trying through SIDO, its Small Industries Development Organisation, to take up the slack. However, SIDO Director General Omar Bakari is well aware of the challenges that any reality check quickly reveals. Building capacity for very many industries in Tanzania is a mammoth task, and he wants to see success rates upped significantly and the dropout rate markedly reduced. SIDO's four divisions at present cover the entire gamut, from technology transfer via financial access (through a Small Entrepreneurs Loans Facility that provides microfinancing) and marketing insights, to training, with the emphasis on both soft skills and product development. This takes place in a total of seven industrial production centres nationwide, whereby linkages to the agribusiness are being put in place to enhance value addition.

The main hurdle to development at present: Tanzania's growth is not sufficiently broad-based and poverty levels still remain high. Despite high growth averaging 7 percent over the past decade, recent household budget survey results indicate that 28.2 percent of Tanzanians are poor and poverty remains more prevalent in rural areas than in urban areas. To counteract this, the government has estab-

lished an ambitious national programme that seeks to achieve a twofold increase in the medium-skilled workforce. Translated into numbers, this means adding about three million highly skilled and seven million medium-skilled workers by 2025.

The agriculture sector, which employs about three-quarters of the workforce, contributes only about a quarter of GDP and is actually growing at less than 5 percent annually owing to low productivity. Therefore, the crux to achieving broad-based growth lies in the transformation of the rural economy largely through significant improvements in agricultural productivity. In this case, productivity is not just a matter of learning better techniques, it is a matter of mechanisation.

This is where people like George Buchafwe take centre stage. Aged 45, Buchafwe came to the Dar es Salaam SIDO incubator two years ago having after secondary school worked as a technician in a soap company. He practises exactly what DG Bakari preaches. He is passing the knowledge and practical insights he has acquired in the profession on to students, in an effort to enable women in particular to upgrade their skills. In the small classroom where he teaches, he has taken Zavery's philosophy out into the world: learn the skills you need to work. And like Zavery he is doing his bit to keep the country clean. Using a simple system he is teaching a class how to make soap from a palm-oil feedstock, and then how to dye it. The final step in the process: the soap is cast in blocks on a machine he himself makes and maintains.

The group of eager pupils, a mixture of housewives and young unemployed persons, chants its way through the list of ingredients: for the "sabuni", meaning soap, I need: 20 litres of palm oil, 10 litres of caustic soda and two litres of silicate. The colour of the dye happens to be light blue but that is for the students to later decide for themselves: the women of course know their local markets better than does Buchafwe. The students are familiarised with the fundamentals of entrepreneurship and business management, too, starting with finance and bulk purchasing through to labels for their soap bars. Buchafwe explains that the 45 bars they will be able to make with the solution will bring about 4,000 shillings in the market. And thanks to him they will know all about protecting themselves against splashes by wearing goggles, gloves, masks and overalls and how to pipette and to use the hydrometer to check the causticity level is right.



Shabbir Zavery, CEO, Tanzania Brush Products Ltd.,
Dar es Salaam, Tanzania.



Dr. Hassan Mshinda, Director General, COSTECH Tanzanian Commission for Science & Technology,
Dar es Salaam, Tanzania.

Right at the other end of the education spectrum, and yet equally important for the country, lies postgraduate agricultural research. The relevant programme is coordinated by the Tanzania Commission for Science and Technology, where Director General Dr. Hassan Mshinda explains: “Under COSTECH’s aegis in the field of agriculture, livestock and fisheries two research institutions on the industry side focus primarily on machines for rural areas as opposed to research into cultivating seeds, improving livestock or enhancing best farming practices. They concentrate on developing new mechanical equipment and materials. The issue here is to transfer the technologies from academia to industry and on to rural communities. Our role is to interface and facilitate the process and make sure the approach to technology development is more market-driven.” Here at COSTECH the linkage of industry, on the one side, and R&D, on the other, is evidently functioning, as it is critical if the mechanisation of agriculture is to proceed apace. After all, simply importing machines and thinking it is a matter of ‘plug and play’ is hardly applicable given the national and cultural specifics of agriculture.

Not far down the main road running from Zavery’s factory toward downtown Dar es Salaam and tucked away behind a major junction lies the Head Office of VETA, the Vocational Education and Training Authority of Tanzania. There are thousands of young people on the overall VETA system and the agency runs 25 vocational centres countrywide, whereby workshops tend to be staffed by people doing work, rather than by trainees… It is a great network and infrastructure, but it needs to be better aligned, and performance must be monitored. “It’s a matter of probing and asking the right questions. That way you make certain that the tasks are the right ones being taught,” comments Francis Komba, the Dual Apprenticeship Training Coordinator at Head Office. He works closely with Martin MacMahon, the project manager at the facility who anchors the Handwerkskammer Hamburg consultants’ office and interfaces with VETA on its Vocational Training Partnership. The pilot programme resulted from an enquiry made during an official Tanzanian visit to Hamburg in North Germany and involves two training streams, one for car mechanics and the other for electricians. MacMahon is a wise old hand as he has run similar projects, among other places in Asia, and is well aware of how cultural specifics and local business conditions must be factored into curriculum development.

There are 50 apprentices in total, with the number set to rise by another 70 with the next wave – out of a multi-million city. Apprenticeships didn’t exist before,



Students at VETA (Vocational Education and Training Authority), Dar es Salaam, Tanzania.



Komba explains, so “we designed the work contracts for everyone as a template.” Unlike Germany, where the dual apprenticeship is enshrined in law, in Tanzania the system is entirely voluntary. The companies sending students have thus tended to be the big corporations that can afford to second staff, the Hondas or SAB Millers of this world, and reaching out to real SMEs has not yet been successful. That said, MacMahon insists, “dual apprenticeships force people to be in contact with each other and that helps keep the VETA system firmly on track.” After all, the focus is “not on making sure that technologies coming in from the outside can be adapted locally, but on making certain that when money is spent on a motor, the maintenance and repair is perfect.”

To that end, follow-up is crucial. “We are encouraging a mentorship system in companies. The idea: to make certain what is assessed is something that has been learnt and that our students aren’t getting tested on things from a book that they won’t have learnt,” Komba confirms. And MacMahon goes one step further: “A lot of theory you might learn in Europe is not actually something you need to know. For example, an artisan does not need to know which atoms go to make up a metal door frame in order to learn to hang it correctly.”

The training Komba and MacMahon supervise is decidedly hands-on. And practicals also help overcome language barriers, given that instruction is always in English, whereas Kiswahili is the national language and there are approximately 120 languages spoken in Tanzania. Each student, Komba insists, has to be able to take a car engine apart completely and put it back together again. Which they do, working in small groups. No one on the dual apprenticeship system leaves without being able to do just this. “The students first had to remove the engine from a Toyota. Then they had to fit the new one. They had to do all the welding etc. themselves.” In the process they train with the tools they will actually use later. And the crunch was less the students, who are incredibly enthusiastic, and more finding teachers who were practically minded enough! MacMahon continues: “We’re busy installing our own solar system in all three centres. We worked together with the automation engineers section to create the rooftop system. In other words, our electrician apprentices got invaluable insights and their practical work was really important to them and us. After all, the system has cost only US$12,000,” he finishes, with a smile. The dual apprenticeship pilot project is thus institutionalising exactly what Zavery has successfully put into practice in his factory as a one-man show.

Festo Didactic and Africa

Since opening a branch office in South Africa in 1973, Festo Didactic has been introducing technologies and, in cooperation with local educational and economical experts, developing didactic concepts relevant to the African educational and industrial markets. Festo Didactic is the world leader in technical education, offering a holistic portfolio including learning systems for all fields of technology, the equipment of laboratories and classrooms, the development of curricula and training programmes, the operation of learning centres and the provision of educational and consulting services for governments, educational institutions and industrial companies. Festo Didactic is a member of Germany's Festo Group (employees: over 18,000, annual turnover: US$2.5 billion), which in the course of over half a century has become a household name among companies requiring pneumatic and electrical drive technology products for factory and process automation. The industrial client base of the Festo Group is now over 300,000 strong, with its education division responsible for services to over 40,000 individuals annually and the equipping of over 45,000 educational institutions worldwide.

Festo Didactic has from the outset been part of the Festo Group's DNA. Only a few years after Festo Automation brought pneumatics from the USA to Europe in the 1950s, Festo staff members began acquiring in-depth knowledge of how training concepts need to be structured today to meet the requirements of businesses. They were implementing training on their own as well as their customer's shop floors, introducing the new technologies and how they can be used in manufacturing. At the time, compressed air was used to clean machines and hardly anyone had an idea of how pneumatics could be used to render work more efficient. Pneumatics was rarely a topic addressed at vocational colleges, technical colleges or universities. Recognising this lack of educational options, Festo developed a technical seminar programme.

Students learn all the more, the more they are actively involved in things.

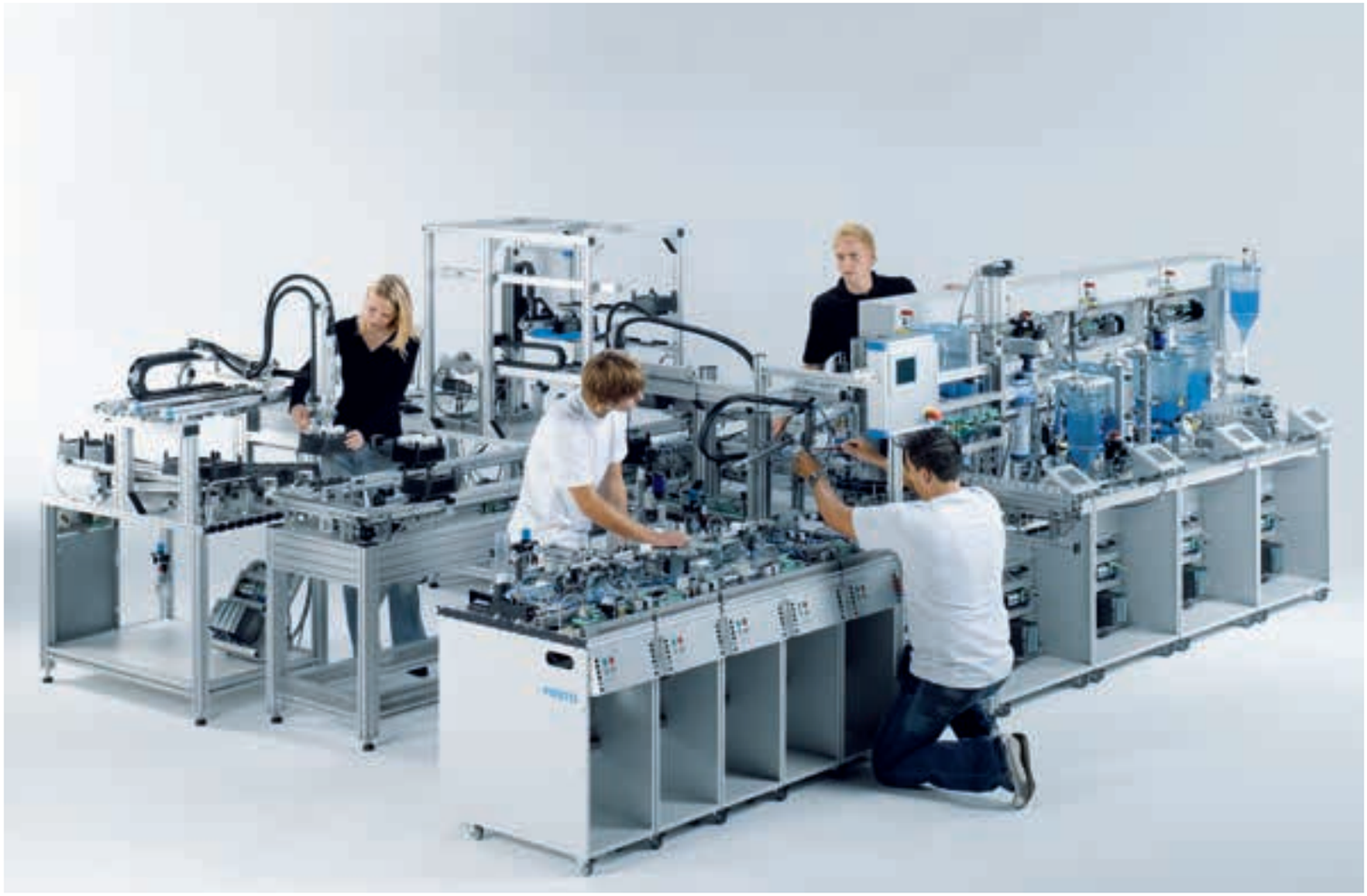
Listeners were soon no longer confined to the benches in seminar rooms, but were sitting at large tables arranged in a U-shape, offering interactivity, and they were expected to try their own hand at things – building their own pneumatic controls using components identical to those they would later be using in-company. Dozens of lecturers were soon driving up and down Germany, their car boots choc-a-bloc with appliances the students could practise on.

The learning materials and media changed with the times – the development of a so-called learning factory was a very important step, providing a hardware platform that integrated real industrial components and software, resembling a real production process and offering learners the opportunity to gain hands-on experience in manufacturing. The idea that intuitive and fast learning needs to be supported by hands-on didactic systems that are close to the reality of the shop floor and render automation technologies and processes very tangible – preferably by visualisation – is essential to all solutions provided by Festo Didactic.

In line with the strategic insight that technical education needs to be holistic in order to provide knowledge and experience that leads to more efficient production processes, Festo Didactic included hydraulics, electrical engineering, electronics, mechatronics and controls in the programme and thus integrated the various fields of automation technology into a cross-cutting and manufacturer-neutral range of laboratory equipment, training programmes, software and services.

Today, the company is by far the world´s largest provider in technical education, setting the standards in didactical methods and technologies and innovating concepts of workforce development in cooperation with governments, universities, colleges and industrial companies – active in more than 140 countries.

Its broad portfolio on offer is embedded in a network of managed and consulting services tailored towards its various kinds of customers. Education, and especially vocational education, is of enormous importance in order to maintain competitiveness for companies and entire regions on a global scale. The development of a workforce needs to be planned with a far-sighted focus and include the perspectives of economical, ecological and technological stakeholders. In the course of globalisation, in particular TVET is becoming a key factor driving socio-economic development, equal opportunities and sustainable development. Festo Didactic Member of the Board Theodor Niehaus explains: “In this context, we tend to discuss with clients not whether it should be Product X or System Y from Festo that they should buy, but more about what solutions best fit their labour market going forward and will help foster upskilling in their schools, companies and universities long-term. We feel it important to act as partners who are able to help drive such developments in the coming decades.”



Hybrid learning platform AFB covering the fields of process and factory automation.

In Sub-Saharan Africa Festo Didactic has been performing this role for many years, supporting the development of local education systems and numerous economic sectors. Only eight years after Festo Didactic was established back in 1965, the Festo branch in Johannesburg was joined in 1973 by education experts. The Festo Didactic staff today support a total of 21 countries, including all the SADC member countries. A second central hub is the Festo office in Nigeria, in existence now for over a decade, from where Festo Didactic serves a total of 16 countries, covering many of the ECOWAS countries and Cameroon. A third country cluster in the Festo Didactic responsibilities matrix: the Maghreb countries and some of the francophone countries of West and Central Africa. Libya, Egypt and the Horn of Africa are served by the company's Middle East hub, due to their proximity and geopolitical ties.

The task of the Festo Didactic staff members – highly qualified engineers, most of whom are fluent in several languages – is to advise customers on the basis of market analysis and to help define the capacity-building demands of the local industry as well as the actual educational capacities of a specific school. The design of complete curricula and certification cycles for the defined vocations that need to be established in a region is essential to the development of a workforce. Curricula for vocations are developed according to the national qualification framework. They have modular structures and integrate dual elements of theoretical knowledge and practical exercises.

The certification of students is a very important part of every qualification programme, since qualification needs to be documented in nationally and, ideally, internationally comprehensible and comparable forms. Festo establishes certifications in cooperation with national associations and additionally offers to integrate German certification in cooperation with German associations.

In the past, many of the regional qualification projects were realised with assistance from the international development finance institutes (DFIs), from Japan to Sweden, from France and Germany, not to mention the World Bank as a frequent source of funding. Yet this is giving way to projects financed either locally or from a local base, making a consistent presence all the more important. Theodor Niehaus points out that "it is wrong to think that all you need is good contacts to the DFIs' headquarters to successfully implement a project. In fact, often it's the other way round. Our local representatives are contacted by polytechnics or



Training in a FACT centre at Afe Babalola University, Ado-Ekiti, Nigeria.

universities, technical or vocational colleges, or by ministries or parastatals, who have heard of our learning solutions and want to find out for themselves how they might benefit from using them. Together we can then try and find the right package, develop it on location and, if necessary, fine-tune it later."*

* See case study on Nigeria, p. 122

The focus in qualification projects is on sustainability.

Qualification projects are getting increasingly complex, often involving a number of partners in several countries at once and requiring tenacity and continuity in the sense that often several years can elapse between project initiation and implementation or turnkey of a mechatronics teaching facility at a university, for example. Then there's the sheer size of the African continent and the diversity of its peoples, cultures, languages, education systems – and the enormous numbers of young people seeking education.

Festo Didactic is supporting its Africa-based staff with its "Global Project Solutions" unit in dealing with the complexity of qualification projects. The unit consists of 15 specialists from Germany and the US who are designing and equipping classrooms and laboratories based on the defined qualification programmes of a region. "The key," Niehaus feels, "is to provide all-in services. Today, we see ourselves as an education corporation covering the entire technical education value chain, which means we have to be able to provide all the technologies a client needs, configure everything, and also ensure that the trainers at the respective centres are themselves trained and have all the requisite materials at hand in the language they need." The product portfolio thus ranges from workbenches, hardware learning systems and teaching materials for people learning the basics of automation and mechatronics through high-tech learning platforms for digitalised production processes, to follow-up support as well as the operation of entire learning centres.

Today's companies and industrial manufacturers produce goods in many different regions, often under very different conditions. But their products must still be made to the same exacting global standards.



Festo Didactic learning environment.

To ensure the success of their products and their production facilities, it is vital for them to establish long-term qualification solutions at their production locations. One way to achieve this is by collaborating with external training partners and educational institutions.

At Festo learning centres, staff from all over the world can be trained to meet the same high standards. As a centre operator, Festo can provide complete managed services to meet individual requirements ranging from the provision of training facilities and equipping of laboratories and training centres, to the development of curricula, qualification programmes and certification schemes. Festo manages the operation of learning centres and also provides full service agreements including the design of the structural organisation, process design and description, task and job descriptions and recruiting services.

In Saudi Arabia, Festo Didactic runs a public college by way of a joint venture, and in China another training centre is soon to follow, which will be managed on behalf of an industrial estate. “I firmly believe we will see this model adopted in Africa, too,” comments Theodor Niehaus, “because it offers tangible benefits below the line and in terms of know-how transfer. It’s a win-win. We are closely familiar with the education business as it has been our core business for so long now. And this frees up the client to concentrate on running his own industrial plant or the non-technical sections of the educational institution in question.” This step has established Festo Didactic as a provider of all-embracing solutions such as those which make so much sense in the African context – as is evident from the number of FACT centres (Festo authorised and certified training centres) that have been built. FACT is a Festo seal of quality indicating compliance to global standards for learning equipment and didactic methods for technical training in industrial automation and mechatronics. Educational institutions certified as meeting these standards receive the status of a FACT centre. Regular audits of trainers and facilities ensure continued compliance, providing customers with the certainty that training courses are state-of-the-art.

Festo Didactic is resolved to committing more resources precisely in those places in Africa where the result can be “lighthouse projects” that act as beacons for either a country or an entire region and unlock the potential there.



Student working in a FACT centre at Afe Babalola University, Ado-Ekiti, Nigeria.

*See case studies on Namibia, p. 86 and Madagascar, p. 148

*See interview with Moroccan industrialist Mostafa Hamdi, p. 36

There are already countless such “lighthouse projects” in Africa that the company was involved in establishing, in particular the FACT centres in Tanzania, Egypt and Nigeria, where there are now no less than three: in Lagos, Taraba and Ekiti states respectively. In these centres, people can focus on hydraulics, fluid, control or CIM technologies, for example, and acquire the qualifications (and recognised certificates) that local industry needs. The company expects to soon be building on the experience it has in supporting mine operators,* by providing training facilities in the Democratic Republic of Congo, for example. Likewise, as the auto assembly lines pick up pace in Morocco* – and later in Nigeria – so Festo Didactic systems will again potentially come into their own.

Learning for applications in industry is becoming more mobile, more networked and occurs in more frequent cycles.

Technology trends in ever shorter cycles are leading to greater complexity in increasingly networked industrial environments in Africa and other continents. Teachers and trainers need to plan and layout their learning environments flexibly, and trainees and students want to put together their own learning programmes. They want to choose where they want to learn without being dependent on educators – using modern communication tools – and they need to prepare on their own in advance for their lessons. At the same time, they want to share their experience in an ever more valuable global network, and also want to profit from working in teams and exchanging experience.

As a concept within hands-on learning environments, “Connected Learning” creates a new dimension of learning with a seamless connection between the virtual and real worlds.

Methods such as face-to-face, hands-on and self-guided learning are all linked through Connected Learning. Additionally, Connected Learning creates a new and direct interaction between software and hardware, thereby erasing the boundary between theory and practice. An excellent example of how the Connected Learning concept can be realised within technical learning labs is the interactive multi-media learning companion Tec2Screen. It connects digital learning material from all technical fields with the hardware components of learning systems. With Tec2Screen, Festo Didactic adds a qualitative dimension to learning. Consisting of a combination of base unit and iPad, Tec2Screen makes it possible to call up



Students work on a learning system for water management.

modular learning material from the fields of mechatronics, robotics, industrial communications and plant controlling, and can be directly connected to different learning environments designed by Festo Didactic.

Practical vocational education solutions connected to digital learning and training programmes offer African students hands-on work experience and increase the employability of young adults entering the job market and skilled staff in need of further training.

The internationally standardised education solutions and curricula for a wide range of technical job profiles that are being developed by Festo Didactic include all technological fields as well as vocations focusing on new technology fields that are relevant to the African markets, such as aquatronics (water and waste-water management), renewable energies and digital communication. In addition to the core technological fields of factory and process automation, these new fields contribute to the development of sustainable economies, strengthen the know-how of companies and open up new job opportunities for skilled workers in Africa.

Green industry offers new paths for economy and education in Africa.

Through their innovation and broad-based value chains, industries are the backbone of economic growth and prosperity. As industries increasingly face raw material and energy shortages, a fundamental shift towards a more “green” industry and greater energy efficiency is inevitable to ensure sustainable growth – especially in regions rich in material resources and options for renewable energy.

On the one hand, the “greening” of existing industries will lead in the long term to an improvement in their environmental “performance” regardless of industry, size or location. On the other hand, new, “green” industries will arise in response to newly developed technologies and services. These environmentally oriented industries will give rise to and serve completely new markets in Africa.

Both trends will require well-trained employees and specialists who can design professional facilities in accordance with the guidelines of the green industry concept.


Solar Thermal Energy Traini



Solar Thermal Energy Learning System

Festo Didactic is offering solutions that prepare African students and skilled workers for the implementation and optimisation of new sustainable technologies and services:

The Solar Thermal Learning System forms a complete hybrid energy training system that demonstrates how solar radiant energy can be harnessed from the sun and converted into solar thermal energy in order to elevate air, water, and surface temperatures within a residential home or commercial business.

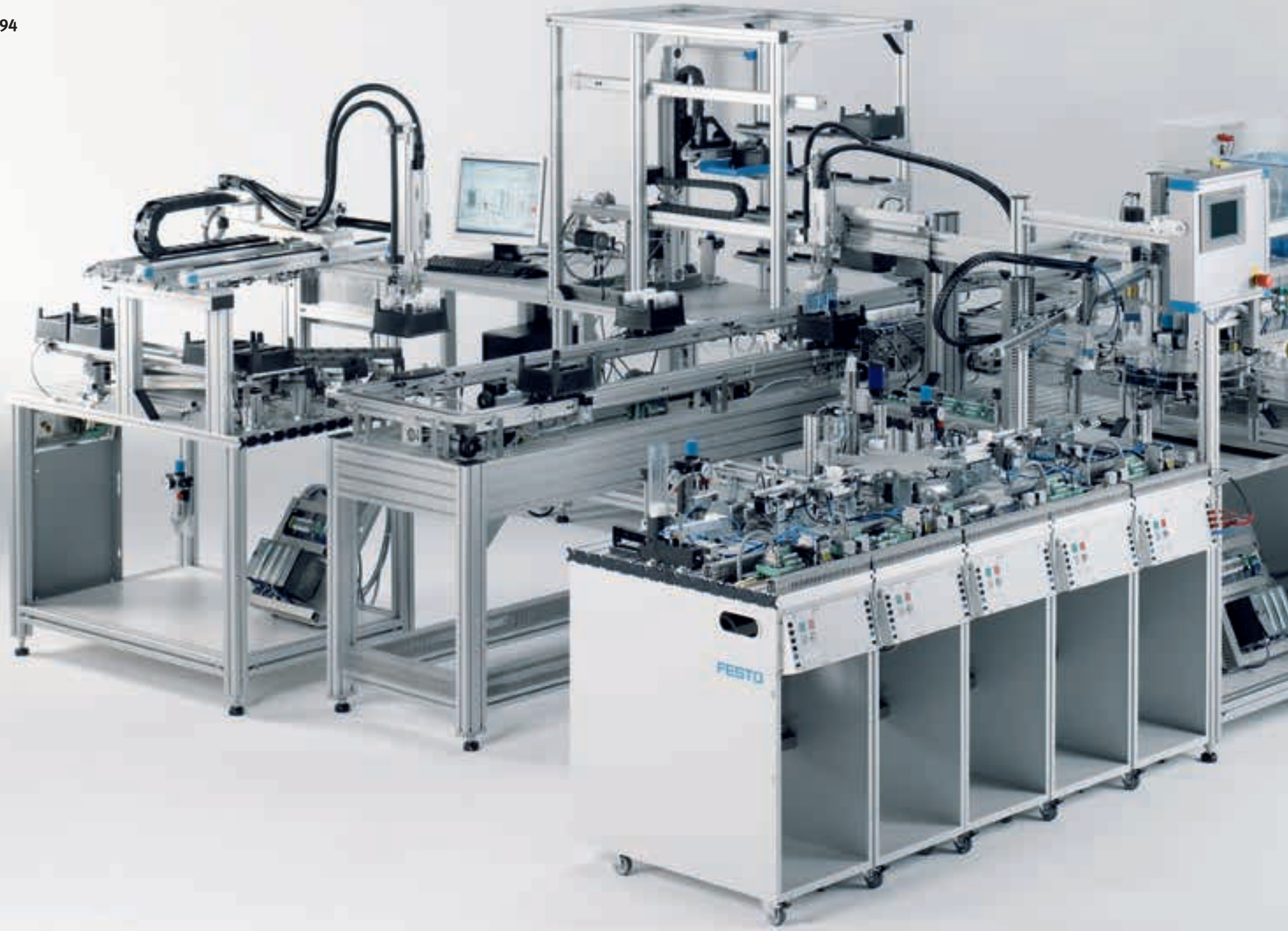




EDS Water Management – Core processes of water technology

Ensuring a constant, sustainable supply of water is a key issue around the world. Festo Didactic is committed to promoting the establishment of “aquatronics specialist” as a vocational profile and to develop holistic learning solutions for the field of water management.

The Environmental Discovery System for Water Management is a modular learning system for providing knowledge on water supply and wastewater treatment. It can be used to qualify people to plan simple and complex projects in the field of water management and to maintain and optimise water supply and treatment plants.


FESTO

EDS Green Factory – Energy-efficient industrial production



Modern sustainable factories increasingly produce their required energy themselves using environmentally friendly technologies such as wind power, solar energy or heat recovery. In addition, energy-efficient production and new energy management practices help to reduce energy consumption.

The EDS Green Factory provides a comprehensive learning environment for exploring and optimising future scenarios of energy management. It covers the complete range of energy in production systems.



CP Factory – the cyber-physical learning and research platform.

Digital production

The enormous rise in the quantity of data and in the complexity of plant networks and company divisions is changing our production processes and is requiring new qualifications solutions.

For the operation and ongoing optimisation of facilities, and to maximise adaptability, one needs to communicate both a general understanding of digital, fully automated production technologies and in-depth knowledge of the structure and programming of digital facility networks.

The qualification solutions are modular in structure:
The practical training in the use of new technologies is conducted using the cyber-physical learning and research platform “CP Factory”. The platform replicates the workstations of a real production facility and makes it possible to learn how to programme facilities, set up networks and optimise many other aspects such as energy efficiency and data management. In addition, the CP Factory can also be used to develop and test flexible software solutions prior to their implementation in practice in the production facility.

The CP Factory is part of a holistic learning factory solution – a modular learning environment that can be used to qualify personnel in the operation of a particular production process or in a particular field of work, such as production technology.

Different qualification modules can be added to the CP Factory: process-oriented training in the fields of mechatronics, logistics and process optimisation as well as organisational and skills training in aspects such as interdisciplinary collaboration, learning capacity and adaptability.

In so-called “One-Point Lessons” skilled workers and management staff are trained at frequent intervals by internal or external experts in practical aspects of current requirements.

Hands-on learning environments prepare students and staff to contribute quickly to the productivity of a company.

Upcoming technologies and rapid developments in changing economies create an urgent demand for a skilled workforce in manufacturing and services in Africa. To operate efficiently and to find opportunities and solutions in new technologies,



Staff working in highly automated production facilities.

a skilled workforce needs both – practical experience and fundamental knowledge of advanced technologies.

Practical experience in industrial environments helps students connect theoretical knowledge with the real demands of production. It prepares them to actively and responsibly solve problems, to adapt quickly to changing demands and to contribute quickly to the productivity of the company they work for.

“Like many policymakers, we believe education must not be an elite matter in Africa, but must be opened out to the broad masses who cannot go to university, and thus in the final instance remain affordable,” insists Bernd Gienger, who is responsible at Festo Didactic for Europe and Africa. “We’ve seen that the continent is crying out not just for academics, but even more so for engineers, technicians and highly skilled artisans, who are able to set up machines, run them, service them and if necessary repair them.” For this reason, he believes the focus going forward will shift increasingly to TVET, irrespective of whether this is provided in-company, in private colleges or by public-sector bodies. Why? Because vocational training translates far more swiftly into people getting jobs and into job creation. The idea cannot of course be to recommend that Germany’s dual education system simply be adopted lock, stock and barrel; what does bear emulating, however, is the German interfacing of theory and practice, firmly aligned to local industries’ needs, Gienger suggests. He goes on to comment that “given the over-emphasis on academic training, and we encounter this all over the world, with people thinking this is best for their kids, manufacturing’s strong need for qualified personnel is often not sufficiently met, and this can without doubt hinder growth if not addressed.”

Festo Didactic is set on tripling the number of its staff in Africa over the next four years and thus appreciably enhancing its visibility on the continent of the future. “We firmly believe that in-house personnel development is the right path here,” says Bernd Gienger, “as that way the experienced African staff can help the newcomers hone their skills.” After all, with the increasing focus at the Pan African and national levels on education as the key to a prosperous future it seems obvious that the whole sector is about to take off. As the case studies in this book reveal, many countries are at present ramping up to tackle the challenges, and creating a broad awareness of the benefits.



South Africa Mechatronics team members competing at WorldSkills in London, 2011.



"There is a growing recognition that investments in education are by far the best way to combat youth unemployment. And with the demographics in most African countries, that may well be the single greatest challenge going forward," Niehaus interjects.

In order to better serve the East African Community (EAC), with its member states of Kenya, Uganda, Tanzania, Rwanda and Burundi, Festo Didactic will be establishing a local presence, with an executive officer supporting project work and acting as the intermediary for government agencies, associations and education facilities. This intention is already manifest in the FACT centre at the Dar es Salaam Institute of technology (see the interview with Prof. Kondoro on p. 202). The clear expectation is that as the pace of socio-economic development in the region picks up, so will the investments in education, a trend already witnessed in South Africa and Nigeria. Festo Didactic managerial staff have long since been fine-tuning a stand-alone "Africa Strategy" in the firm belief that if there is a continent of opportunities, then it is Africa. Theodor Niehaus puts it in a nutshell when he comments with a smile: "Given that at the AU and national levels there is a clear recognition that the next decade will have to be dedicated to broad-based education, something we will no doubt see discussed intensively at the UN level in the context of the Sustainable Development Goals, we are prioritising work on the continent and investing heavily above all in human capital, as befits an education corporation."

The activities in workforce development in Africa also include WorldSkills, the leading platform for international benchmarking in education. Festo is a Global Partner for this skills competition and a Member of the WorldSkills Foundation project in Africa – supporting the competition as an employer, as a training company, as an equipment and solution provider in the field of technical education, and as a promoter of the dual system for vocational training. In WorldSkills, Festo aims to excel and help to communicate the competencies that are required by industry and enterprise – and the skills that African students need to secure their own growth and training and to enable them to contribute to the economic progress of their country.



Prof. John Kondoro

Principal, Dar es Salaam Institute of Technology, Dar es Salaam, Tanzania

What have been the key milestones since DIT's foundation in 1997?

We have achieved a lot. Firstly, we are now autonomous from government. The second thing I'd say is because of our autonomy there has been a lot of development, since we now have more than ten programmes. And we'll have three masters programmes by next year. And the number of students we have has more than trebled because at that time we were I think about a thousand. We now have about 3,500 students. And we recently started master programmes, and have about 60 students in the master schools. That said, there is a two-level structure in place here. At the first level the intake is students who come from secondary school and they progress for three years. Those who acquire a diploma can go on to become technicians, for example, or can continue here for a degree programme. In fact, we are now seeing about 50 percent going on to study for a Bachelor of Engineering to get off to a better start in their careers.

Previously it was very difficult to review or start programmes because all these were also based on decisions of the government. The change came at a time when the country was also undergoing difficult economic challenges. That was the time of change. The country knew that we could not continue with the existing socio-economic system. The country knew that because of globalisation it had to open up. Therefore the institutions would not compete if they were all under ministries. Back then there were instruments like the Institute of Education, which was responsible for curriculum development, and the Examinations Council, which was also responsible for examinations for the programmes of Full Technician Certificate (FTC) and Advanced Diploma in Engineering (ADE) offered at that time. All that has gone. And we've developed our own human resources, too: we now have more than 40 Ph.D. graduates on the staff!

How would you distinguish yourself from the university?

The distinction is in terms of skills. I feel that we focus more on skills and I think the university is a university. I mean they stress theoretical knowledge and we stress the applied skills. As a consequence most of those who come to our undergraduate training are those students who come from the diploma. They already have real skills. The major students who enter their programme are students who come from high school. The second distinction is that our programmes are also geared that way. We focus on the needs of industry and society, and then develop our students in terms of the skills required by industry and society. We also bring them back and revalue what we intend to do, which again is, I believe, signally different from the typical university.

In what way does the feedback loop function with industry?

It works in two ways. First we ask for information from the industry. We poll their views in terms of skills and their requirements. Once we have finished the curriculum informational report we invite them to a joint board, where we inform them about what we found out during the review and how we treated that information to develop our curricula, so they can give their feedback. For instance they can say, “Maybe you’re putting in too much theory there” or “You have inserted something that probably you don’t need.” So they give feedback during the curriculum development. We normally bring them in. The second feedback is that we send our students on what we call industrial practical training. Students have to attend industrial practical training twice within three years, in their first and second years. It is nine weeks for the undergraduates and ten for the diploma students. Then we send our staff out, so they are familiar with the equipment the students have been using. And industry informs us in terms of what they see our students doing and in terms of their skills. We get feedback on our curriculum every year when students go for industrial practical training. However, after every five years the curricula have to be reviewed afresh as part of the accreditation conditions. We can do this every year but after five years it is imperative.

There is a lot of organisation involved in practical training like that...

We have an “industrial liaison officer” who is responsible for this and who works in close cooperation with departments. Each department has a coordinator and these go out looking for placements. Then we also sometimes send out informational requesting. For instance our students will be going for industrial practical training sometime in June, but we will have already sent information to industry nationwide requesting for placements by that time. Industrial practical training (IPT) placements involving computer-related programmes can sometimes be difficult because banks say they have their own separate space that they don’t want people to access. With civil and electrical engineering it’s not too difficult.

What attracts the students to come here?

Over time our graduates have clearly been preferred by the market, they get jobs, and there could be no better advertisement. There was a company that was recruiting for mining, for example. They came and said they were looking for students. We wondered why they had come to us, and they answered, “When we were recruiting, your students all came top of the class. That is why we are interested.” I think the prospect of employability is compelling, and it stems from the fact that they have appropriate skills. The students read about how companies come to visit us, and then they get interested. Probably even industry is telling them that if they come from here they can employ them.

There are other African countries where it has been the other way round, where government has had to impose laws in order to force companies that were only on the ground to start creating graduates themselves.

The way we have been doing it from the beginning is that we go to those companies we believe are going to be employers and try to ask them what they need. We also even ask them how they view our programmes. Because if the latter are not relevant to them it means our students will be irrelevant. It would be beneficial were we to track our alumni more closely in this regard and it is useful for curricula development. Because if you know that most of your students go to the private sector or to government it gives you an impression of what you should really have in mind. It is very important. Employment in government is an option but so is self-employment. We are giving our students the knowledge and capacity to create their own business.

Where would you want your graduates to go afterwards? Agriculture, which is very under-industrialised, or industry, which is very productive but is actually a very small employer?

This is a difficult matter. Where do you start? Because agriculture is also very wide. You can talk about industry which processes the products of agriculture or you can talk of industry which provides input into agriculture, meaning fertilisers and so on. It is very wide. I think that sometimes agriculture does not need to be stimulated. The question is, should we start with value addition so that we can extract more from the fields? Or should we put more technology in place so that we have more products? And obviously if you are thinking of exporting, you need to invest. Take the investments in mining, by contrast. The miners need to eat. So that can also be an incentive for people to say sell into that large market.

A thought experiment. You have two graduates and one of them is going to be an electrical engineer and the other is going to be a civil engineer. Who would you send out to solve traffic light problems in the city?

For traffic lights in the city I would say that an electrical engineer would be best, but when it comes to maintenance I think there is much more involved. We are looking at people at senior management level. What do I mean? Well, say you are managing an institution and there are many maintenance challenges. Possibly you have only one person to do repairs. So you have to manage the resources, you have to manage human capacity and the infrastructure. Some of these may be outsourced; some of them can definitely be done in-house. You need a coordinating mechanism, especially if you have a lot of machines and they consume a lot of power. This requires a management strategy. Basically we are talking about somebody who is in the position where he is making policy and not really a technician. It is someone who sometimes has to make a decision. It is much more than going there and fixing a problem. It is apparent to many of us Africans that we need capacity to develop a culture of maintenance. In Tanzania, it is DIT that is the centre of excellence for maintenance in the sense that I have always said we must try and impart the holistic skills of maintenance management.



National examinations day: students taking the exams in the auditorium of the Namibian Institute of Mining and Technology (NIMT) in Arandis, Namibia.



An oasis of learning in the middle of the desert

Having completed their dual apprenticeship at the Namibian Institute of Mining and Technology (NIMT), thousands of young people are ready to embark on a hands-on career

Every morning at 5:50 a.m. Eckhart Mueller sets off from his home in the Namibian coastal town of Swakopmund and drives into the desert. Having travelled through darkness and fog on a dead straight road for 45 minutes, he takes the left turn for Arandis, and enters the small mining town just before sunrise. Mueller swings into the palm-tree-lined avenue that forms the entrance to the Namibian Institute of Mining and Technology (NIMT) – he has been its director for the last 25 years now. Located in the heart of the Namibian desert, the sweeping complex composed of individual pavilions, dotted with palm trees, and with peacocks wandering around, is destined to captivate the gaze; for the people in Africa's Southwest the institute is simply an oasis of learning and education par excellence.

Rachel Josaphat likewise makes her way to Arandis every day. At 5:30 a.m. she boards one of the desert-bound buses that depart from the port town of Walvis Bay and picks up dozens of young men and women along the route. At NIMT, Rachel, who is 24, is training as an artisan in instrumentation, a profession that is in high demand in a whole host of different sectors. In the first two years of her apprenticeship she completed an in-depth internship at a calibration services provider, and in her third year she gained hands-on experience during her time with Namibia Breweries in the capital of Windhoek; now she is in her fourth and final year and hoping to get a job at the brewery after completing her national trade certificate – her entry card to the world of skilled work. "I'm really looking forward to earning my own money," the young woman reveals, "but I also want to do a correspondence course and qualify as a mechatronics engineer."

Several thousand young people have completed their training at NIMT in the last 25 years – be it as mechatronics specialists such as Rachel Josaphat, as fitters and



“We are swamped with applications and sadly have to turn down so many of them,” comments **Eckhart Mueller**, Executive Director of the Namibian Institute of Mining and Technology (NIMT), Arandis, Namibia.

turners, including machine-tool technicians, as electricians and refrigeration engineers, as welders, diesel and petrol mechanics or installation technicians, or as joiners, bricklayers and carpenters. “There is a huge demand for skilled craftspeople in Nigeria,” explains NIMT CEO Eckhart Mueller.

Topping the list of prospective employers is the mining industry, which on its own contributes some 10 percent of the country’s GDP and about half of Namibia’s exports. Just 40 kilometres from the vocational training centre in Arandis, construction work for Husab, destined to become one of the world’s largest uranium mines, commenced in 2013; expectations are that it will have reached full extraction capacity by 2017. The mine is believed to have created some 1,200 permanent jobs, with treble that amount of people needed for several years to get the facility up and fully running; and additional ‘indirect jobs’ arising in connection with the service providers are expected to spring up around the mining complex. The Rössing mine, which belongs to Anglo-Australian mining corporation Rio Tinto and has been producing uranium oxide since 1976, is located even closer to the vocational training centre; indeed it was the Rössing uranium mine that sparked the development of the town of Arandis and the NIMT training centre – the workers live in Arandis, and NIMT trains them.

That said, Namibia’s demand for skilled professionals extends well beyond the manpower required by the uranium mines. After all, the country has made a name for itself as a source of high-quality gem diamonds, the majority of which are mined in the South of the country at the mouth of the Orange River, on the Atlantic beaches, and even offshore. Indeed, cutting-edge technology is being used on specialised vessels and drilling rigs as well as for the processing and refinement of the diamonds. Shortly before Christmas 2014, employees of the newly established Otjikoto gold mine in the North proudly presented the first-ever bullion minted in the country; Otjikoto is only the second gold mine to have been set up in Namibia, and hopes are that it will catapult the state to a level where it becomes the seventh- or eighth-largest gold producer on the continent. Hundreds of people were involved in the construction of the gold mine: concrete workers, welders, electricians, bricklayers, carpenters, joiners, pipefitters. And all of those professions are included in the range of training courses provided at NIMT. Long-term, the gold mine has created some 550 permanent jobs – which might sound like not very many but is actually quite a large number considering Namibia has a population of just 2.3 million. At the end of 2013 and a mere 30 kilometres



A female student in the Namibian Institute of Mining and Technology (NIMT) carpentry workshop.

from the gold mine, the ground-breaking ceremony was held for the Tschudi copper mine, which is destined to create just as many jobs and innumerable 'indirect employment opportunities' into the bargain.

According to figures presented by the Chamber of Mines of Namibia the mining sector, which among other things also extracts zinc, lead and fluorspar from the ground, spent around 13 billion Namibian dollars (equivalent to US$1 billion) on fixed investments in 2013 alone. Most notably in the construction phase, the Mining Chamber revealed, there was "massive job creation" as a result of the procurement of goods from Namibian suppliers and contractors. However, even when one of the mines is up and running, the need for experts with the theoretical basics and hands-on experience is set to continue – just as it did at the Husab uranium mine. There will be vacancies for people to operate, service and maintain gigantic cable excavators, dump trucks the size of a single-family house, kilometres of conveyor belts or aggregate crushing plant. Additional expertise will be required for the Husab project, where acid sulphur is produced in the mine's own facilities and then used for the process of leaching uranium oxide. And there's an additional win: the steam generated as a by-product will be fed into a small power plant for the production of electricity.

That the company is setting up its own on-site training centre in the mining complex, giving employees the opportunity to learn on simulators how to drive gigantic dump trucks, leaves NIMT boss Eckhart Mueller quite unfazed. He does not believe this is in any way competition. In fact, Mueller is convinced that businesses have the duty of ensuring their employees have all the requisite and highly specialist entrepreneurial skills: he considers it his mission to impart to his students hands-on, comprehensive vocational training based on the German dual apprenticeship system. "Our country needs practically-minded professionals" – or so his unwavering creed. Job offers for engineers with a university degree are not exactly in abundance, he explains and adds to say that university graduates run the risk of joining the labour market "without ever having held a tool in their hands. What Namibia's businesses need above all else are well trained artisanal workers and technicians." Mueller, who understands his task as setting young people out on the first few rungs of the educational ladder, says quite emphatically: "Many of our kids," which is how Mueller likes to call his pupils, "come from the most remote backwaters in Namibia, where some schools have not yet been connected to the power grid. A lot of those kids have never



The Namibian Institute of Mining and Technology is located in the desert and is widely considered an oasis of learning and education.



even had a reason to insert a light bulb, their mothers don't have a washing machine, and their fathers don't have a car. Which means we need to start with the very basics and allow a lot of patience for them to find their feet."

Eckhart Mueller wants to help companies recruit the staff they need in a developing economy – this is why NIMT went to where the companies are and, in addition to its headquarters in Arandis, opened two subsidiaries, one in them in the mining town of Tsumeb and the other in Keetmanshoop, which is where they produce diamonds. Seven new professions will be added to the ten that the NIMT has on its training curriculum in a move to optimally cater to the needs of the companies and their heavy earth-moving equipment. That said, the idea is also to "serve young people," as Eckhart Mueller puts it: "We need to introduce them to technology's complexity while making sure we bolster their self-confidence, which was taken away from them during Apartheid. We want to prepare them for lifelong learning and in that way enable them to keep abreast with the advancements made in technology and IT. Because it means they will have the requisite know-how and having completed their apprenticeship enables them to qualify further as engineers or build up their own small company." It is these statements that reveal that Mueller is a teacher at heart; in his previous life he was a school principal and responsible for designing the curriculum in Namibia's Ministry of Education before he became Head of the NIMT, which today has a payroll of 230.

One day in spring 2015 Eckhart Mueller is standing on the stage of NIMT's large auditorium in Arandis. Seated in front of him at their desks are 140 young women and men, divided into nine seemingly endless rows; it is national examination day for all the different engineering courses. Candidates are studying for all kinds of professions and training levels from 1 to 6; many of them are students at NIMT, while others come from in-company training centres or are correspondence students. "We are completely full – we are being swamped with applications and sadly forced to turn down so many of them," Eckhart Mueller says broodingly as he lets his gaze wander across the rows of exam candidates. "We would love to be able to train twice as many students at NIMT. Because what you have in front of you here," he points to the candidates in the hall, "is Namibia's future." Then Eckhart Mueller steps aside to make room for the Head of Exams, who is ready to give the final instructions for the examination proceedings. Precisely at 12 noon things get underway: "You may start – the very best of luck to all of you."

Training for the economic sectors driving Africa's future

Experience shows that there is a strong need to align methodologies and systems to the sectors that policymakers and the labour market prioritise. The investment shortfall is a huge challenge

However, the crux is where exactly such training opportunities are most needed. The logical conclusion would be mainly in those sectors that will in future drive the African economy and sustain its growth trajectory. One of the segments of the continental economy in question is a sector that already accounts for a large proportion of GDP and/or foreign reserves in the respective countries (extractive industries). Two others are on the brink of major breakthroughs (automotive industry, renewable energy). Another is perhaps the single largest economic sector in Africa, but one that was long neglected and left to traditional techniques – all of which is changing: the agro-industry. A fifth is key to the health of the prodigious number of young Africans that will soon form the majority of the continent's population, namely water and wastewater management. And the final sector chosen is one that has already emphatically changed the face of the continent, and is poised to continue to do so going forward: telecommunications and e-business.

With the exception of the last sector, all the others have first and foremost to overcome a single challenge: the urgent need for massive investment, be it foreign direct investment or local investment. What is equally critical is for companies active in them to be able to draw on the requisite skilled manpower – without having to rely on foreign staff to do so. Whereas in the 1980s the "indigenisation debate" was all about countries insisting certain economic sectors be owned nationally in order to drive local industrialisation, and taken out of foreign hands, the emphasis today is firmly on local content. Given the competition for African resources, often governments have been able to set the terms under which foreign companies can engage, and one key condition has been the proviso that they train local staff and support local supply and value-added chains. This trend has been most pronounced in the petroleum industry, where it is to be encountered in countries such as Angola, Kenya, Nigeria, South Africa, Uganda and Zambia, with Ghana and Tanzania in the process of joining the group. Legislation has helped promote the establishment of training schemes and training facilities, but some would say not nearly enough progress has been made here. However, it is certainly a step toward counteracting resource exploitation (grab and go) instead of resource extraction.

The extractive industries: Oil & gas, mining

The extractive industries have already embarked on systematic TVET, but there is still much ground to be covered

Nowhere has this trend been more pronounced than in the extractive industries in Africa. This is reflected in Principle 1 of the Extractive Industries Transparency Initiative. The principle reads: "We share a belief that the prudent use of natural resource wealth should be an important engine for sustainable economic growth that contributes to sustainable development and poverty reduction, but if not managed properly, can create negative economic and social impacts."[45] Almost all the countries of West, Central and East African countries are registered as 'compliant' with the EITI principles, with Senegal, Ethiopia and Madagascar candidate countries (as is the USA), while the Central African Republic has been suspended.

* See case study on Nigeria, p. 122

** See case study on Ghana, p. 238

The oil and gas industry is booming in Africa, despite the recent falls in the price of oil. And with the boom comes an increased training requirement. The heavyweight oil exporters at present are Angola and Nigeria, which already have dedicated training institutes in place, but are nevertheless hard put to train enough local skilled staff.* At the same time, there are frontier states opening up, such as Ghana, Côte d'Ivoire and South Sudan. Developments in Ghana show just how fast the industry is moving as the Jubilee deepwater field progressed from development to production in less than two years, but without the expertise being present in Ghana. Indeed, recent finds have lured policymakers and industry into expecting great future dividends.**

* See case study on Tanzania, p. 170

Then there are the new East African boys in town, specifically Mozambique and Tanzania. By acquiring British Gas in 2015, Shell has been investing heavily in Tanzania, which is in a race with Mozambique to see who can get the first cargo of liquefied natural gas on ship. Forecasts suggest, with bidding rounds for exploration forthcoming in Tanzania, there will be no let-up and as exploration progresses, so in due course it is possible that Mozambique could surpass Nigeria and Algeria as the African country with the largest gas reserves. There is a commercial logic to the scramble for Mozambique, which is predicted to step up liquefied natural gas (LNG) from 10 million tonnes per annum (Mtpa) in 2017 to as much as 50 Mtpa by 2025, as it is ideally positioned to serve the lucrative Asian LNG market. That said, Nigeria has yet to undertake exploration for gas: it is currently ranked ninth in the world, one ahead of Algeria, in terms of the gas found in existing oil fields. Tanzania, for one, does not yet have sufficient TVET courses in place to serve the imminent future needs.* In addition to the training requirement for the industry itself, there are the countless positions for regulators

and monitoring bodies that need to be filled, as countries ramp up to the tasks of ensuring adherence to environmental standards and new regulatory regimes in an effort to avoid the pitfalls of the past.

* See case study on Namibia – Mining Technology, p. 210

The same boom scenario is to be discerned in the field of mining. Africa has been renowned for over a century as home to almost 50 percent of the world's diamond resources, and that sector is well developed. Likewise the continent has a long tradition in gold mining, with Ghana and South Africa two of the world's top ten producers. Yet there are less glittering minerals in abundance. Take the Democratic Republic of Congo (DRC). It is estimated to have US$24 trillion (or the annual GDP of Europe and the United States) worth of untapped deposits of minerals, including the world's largest reserves of coltan and significant quantities of the world's cobalt (used to make alloys and batteries). "The true extent of Africa's vast wealth of resources is hard to guess. Geologists have picked over most of the rest of the globe in search of minerals, yet huge swathes of Africa remain largely unprobed. But the immense ore deposits so far discovered and soaring commodity prices on the back of rip-roaring Chinese demand have convinced the world's miners that the continent is the next big frontier," wrote The Economist in February 2012.[46] If that becomes a reality, then Africa will require countless trained miners.*

* See case study on Morocco, p. 40

** See case study on Madagascar, p. 148

All that has changed since then is that more deposits have been found. Africa is ranked as having the largest or second-largest reserves worldwide of bauxite, with the key countries including Guinea, Ghana and Mozambique.[47] There are massive copper reserves in the DRC, Uganda and Zambia, just as there are plentiful manganese reserves (the key anticorrosive element in steel). Then there are numerous sources of metals in the platinum group metals (a primary component in automotive catalytic convertors, for example), soda ash (an element in glass production), vermiculite (a component in fireproof materials) and zirconium (used to manufacture heat-resistant ceramic materials), titanium and uranium (three African countries are in the Top Five worldwide, namely Niger, Namibia and South Africa).[48] And last but certainly not least there is phosphate rock – with Morocco accounting for over 50 percent of the world's reserves. This is a key ingredient in the fertilisers Africa itself so urgently needs to boost agricultural output.* Both South Africa and Madagascar have large nickel reserves, with the latter home to one of the single largest mining facilities for nickel in the world.**

The automotive industry

Wide-scale mechatronics training is necessary to accelerate the spread of local car assembly plants and improve repair and maintenance cultures

* See case study on South Africa – Automotive industry, p. 218

The automotive sector in Africa is one that is training-intensive and where a lot of the training takes place in the informal sector. But that is changing. Traditionally, for every 100 new car sales in Africa, around 60 roll out of the dealerships in South Africa. And the country has historically been by far the largest auto market on the continent.* In the past, the next 35 have been bought in North Africa and the remainder somewhere in between. Indeed, the total number of new cars sold has been very modest on a world comparison, with the figure at only 1.2 million units in 2013, a little more than the Netherlands and Belgium combined. However, the picture since 2013 has gradually been changing.[49] In Nigeria, 50,000 new cars were sold in 2013, and in Morocco over double that at 122,081 units. The first five months of 2015 saw new car sales in Egypt hit 76,500. Kenya has started to figure since 2014, with sales up 18 percent at 17,000. This growth trend has been noted by manufacturers, with Ford, for example, about to start building an assembly plant in Nigeria that will roll out 5,000 vehicles a year – but it is having to send skilled staff to the country to make this possible.

However, this market is not the source of the massive informal training requirement. The lion's share of car sales in Africa is accounted for by used cars, as there are massive imports of used cars into the continent (these are banned in Southern and Northern Africa). Those cars require servicing and repairs, inevitably more often than would new cars. The figures are quite staggering. Nigeria's "The Guardian" newspaper reports[50] the 2014 figure for imported vehicles as having been in the order of 400,000. Since then, tariffs have been greatly increased as the country seeks to implement a New Automotive Industry Development Plan destined to promote assembly in-country and thus drive industrialisation. Historically, as the Nigerian middle class has expanded (see p. 31), so has traffic congesting in its conurbations, indicating that there is a clear correlation between the former factor and light passenger vehicle sales. The volume of used cars imported to Ghana is likewise stupendous. In 2013, total used light passenger vehicle imports were worth US$270 million, the single largest item on its import list! As urbanisation progresses and the middle classes particularly in the countries with strong extractive industries grow, so the African car market will surge, and with it the need for skills, from basic mechanics to staff handling computer diagnostics. The trend is definitely a one-way street, as a glance across the continent to East Africa shows. There, Nairobi's "Business Daily" reported in a recent story as follows: "Authorities in Nairobi, Kampala, and Kigali are caught in a race to expand key road infrastructure following an upsurge in vehicle traffic."[51]



Training workshop at the VW Technical Learning Academy in Uitenhage, near Port Elizabeth, South Africa.



Practice makes perfect

South Africa's automotive industry is a mainstay of the country's manufacturing sector. The current lack of trained staff is undermining the sector's potential. The Volkswagen branch in Uitenhage helps close the gap

In early 2015 in Cape Town's conference centre, Deon Borchjes took part in a panel discussion held as a satellite event to WorldSkills – South Africa's Professional Skills Competition. Borchjes is the Head of the VW Technical Learning Academy in Uitenhage and the issues aired during the debate were not really news to him: educational policymakers and other experts took the opportunity to voice their concern over the sluggish momentum exhibited by South Africa's manufacturing industry. In the last 15 years, the sector's share in GDP is reported to have dropped from 19 to below 18 percent, prompting government, industry and the educational institutions to join forces to develop a national strategy destined to boost manufacturing. "South Africa's greatest asset is not its gold, diamonds or platinum. Its richest asset is its people," one of the speakers remarked. Unanimously they called on the nation's technical colleges and universities to place practical training for students at the heart of their curricula. The consensus: there is an urgent need to improve educational programmes for artisans – at present the country is turning out an average of 13,000 qualified artisans each year. An extremely low output if one considers that this is less than half the 30,000 artisans the country requires per year up until 2030. South Korea was a good example of how to invest smartly in people, one speaker remarked. After all, South Korea won the most gold medals in the last five international WorldSkills competitions.

Several months later we meet Deon Borchjes at the VW Technical Learning Academy in Uitenhage near Port Elizabeth. In his presentation he again draws attention to those 30,000 technicians and trade workers that South Africa is expected to train each year in fulfilling the country's National Skills Development Strategy



“Young people need to be given opportunities to prove themselves”:
Deon Borchjes, Head of the VW Technical Learning Academy in Uitenhage, South Africa.

(NSDS). He links this back to the steps the Technical Learning Academy is taking to bridge the seemingly insurmountable gap between demand and supply. One example is completing a classical apprenticeship: every three years, the VW Academy offers 19 semi-skilled workers from its own automobile factory plus an additional 19 apprentices from outside the company the opportunity to qualify as motor mechanics or electricians. In addition, more than 90 previously unemployed men and women get to take part in a so-called Learnership Programme that trains people in seven different professions, from mechatronics engineering to toolmaking. Next there is the state-funded Accelerated Artisan Training Programme (AATP), which enables unemployed people with a technical background and good grades to obtain fast-track qualifications. In addition, Deon Borchjes and his 25 employees assist people with disabilities (PWD) and help them gain technical qualifications at apprenticeship level. And then there is the Adult Development Programme (ADP), which provides ten training places at VW for senior assembly staff who lack in qualifications proper but bring plenty of hands-on experience to the job. 2013 then saw the launch of the Dual-System Apprenticeship Project (DSAP), a joint undertaking with the technical colleges. To date, the programme has given 48 budding engineers specialising in electrical, mechanical, civil or industrial engineering the chance to complete internships (P1/P2) at VW. Last but not least, VW's Technical Learning Academy has teamed up with Eastern Cape Province ministries and authorities to provide additional programmes of varying formats, plus there are several dozen companies from entirely different sectors who send their employees to VW for training, meaning that on average 250 people are learning new skills at the Academy each month. "In conclusion, we are tackling the problem from all angles," says Borchjes.

There is plenty of activity in the training workshops behind Borchjes' office, evidenced by the sounds of files rasping on metal and hissing robots, roaring engines, and people talking to one another. Learners in blue overalls are standing next to drilling or milling machines; together with their trainers they are hunched over the engine blocks of more recent Polos, or indeed older Audi or Jetta models; building engineers are standing around control cabinets, deeply engaged in discussion; car electricians are reading out engine data via Bluetooth. "Many educational facilities give students only the most rudimentary practical knowledge," Deon Borchjes explains as we take a tour of the training workshops. "But this basic knowledge is not anywhere near what the companies actually require. And in particular in the automotive industry, which is the most advanced sector when



Car electricians in the training workshop reading engine data outputted via Bluetooth.

it comes to automation, the education system does not move fast enough to keep up with the industry and the advancement of technology, and so the gap is widening." However, getting closely involved with a company was equally as important to grasp the bigger picture, he says. "There is so much more to getting an education than mastering technical skills alone," Borchjes comments. "The learners need to develop an understanding of their role in a team, of why it's important to get to work on time and look after their health and of what it means to the company and its customers if they make a mistake. Even though we are a training centre we have a holistic approach."

The Volkswagen Group South Africa has lived up to its claim ever since the first Volkswagen Beetle rolled off the line here in Uitenhage on 31 August 1951. In 1981 the first black motor mechanic and, one month later, the first black toolmaker qualified at Volkswagen in South Africa. In 2003, VW launched the state's first Autotronic Learnership pilot scheme; only 12 months later, the company was the first automotive manufacturer to start training multi-skilled artisans. In 2006, Volkswagen announced its 'People for the Future' initiative – and subsequently invested more than 400 million rand in training and skills development between 2006 and 2010. The following years saw Volkswagen establishing five Learning Academies to provide advanced training not only to its employees, but also to local suppliers and businesses in general. The five Academies specialise in Production, Leadership, Commercial & Sales, Marketing and Technical. Borchjes is responsible for the latter.

Practice makes perfect – that is the credo at the heart of the VW Academies' philosophy. "Though many companies want experienced staff, they are prepared to give only few young people the chance to gain this experience with them," Deon Borchjes says with regret. "But young people need to be given opportunities to prove themselves." Finding a permanent job for every freshly qualified apprentice certainly was no easy task, he admits, but some advanced training programmes succeeded in placing up to 80 percent of graduates in permanent employment. Indeed, South Africa's auto industry counts among the nation's biggest employers, with three-quarters of all vehicles produced on the continent originating in the South. According to a report by the United Nations Economic Commission for Africa (UNECA) published in 2014 companies such as VW, BMW, Toyota, Renault and General Motors, including their suppliers, represent some 30 percent of the value added in the manufacturing, or at least 6 percent of South



Since the first Volkswagen Beetle rolled off the line in Uitenhage in 1951, the Volkswagen Group South Africa has established five Learning Academies for its staff and also for local suppliers and businesses. One of the five is the Technical Learning Academy in Uitenhage, South Africa.



Africa's GDP. Well above 30,000 people work for the car manufacturers, and an additional 60,000 to 70,000 are employed by automotive suppliers.

One of them is Mzukisi Dow, who is currently training as a toolmaker at Deon Borchjes' Technology Academy. The profession has suffered decades of neglect, which is one of the factors contributing to the difficulties South Africa's manufacturing industry is experiencing today. Having started out with Levels 2 und 3, which teaches learners everything they need to know about Filing, Turning and Drilling in addition to Hydraulics and Pneumatics, Mzukisi is now on Level 4, which has its chief focus on Milling. "Training also includes Maths, Finance, Communications, and Technical Drawing of course. The latter is essential if you want to make precision tools," he explains. Mzukisi has been at Volkswagen since 1999. He started out in the Production department as an unskilled worker with just a single school leaving certificate (grade 12), but went on to take several advanced training courses and gradually worked his way up to become a Group Leader. Coming into contact with turners, electricians and toolmakers then whetted his appetite to do an apprenticeship, he says, but hastens to add that money wasn't his primary incentive: "I simply want to be able to do the same as my colleagues." While completing his training he continues to be paid his salary as a line worker, and once he has passed his exams and VW has a vacancy for a toolmaker he will apply for the job. "I'm 41 now, a ripe old age for a learner," Mzukisi says with a smile. "I would still have started the apprenticeship at 60, but age doesn't matter. What does matter is that I get closer to my goal, which is working as a toolmaker at Volkswagen some day."



Traffic gridlock in downtown Cairo, Egypt.

Renewable energy

Africa has huge renewable energy potential as it is blessed to be one of the world's largest concentrations of alternative energy resources in the form of solar, wind, hydro and biomass energy. Overall, 17 countries in Sub-Saharan Africa are in the top 33 countries worldwide with combined reserves of solar, wind, hydro and geothermal energy far exceeding annual consumption now or as forecast for the future.[52] Most of the Sub-Saharan countries receive solar radiation in a range not dissimilar to that in southern Spain, the preeminent location for solar energy generation in Europe. That said, in many countries north and south of the Equator, the irradiance levels are even higher. Yet to date, not only has Africa not invested much in thermal power plants, it has tapped only a minute amount of these renewable energy sources. Yet they may hold the key to overcoming the electricity shortfall, as renewables are more suitable for smaller systems than their big thermal sisters. While the latter at present require a lower upfront investment per megawatt, the days when gas-fired thermal power stations produce electricity more cheaply than solar PV are numbered, as among others the International Energy Agency (IEA) in Paris declares.

* See case study on South Africa – Renewable Energy, p. 229

Morocco is one of the trailblazers in rolling out solar and wind power, a wise policy given the absence in the country of major sources of fossil fuels and the ever greater electricity requirement as the country industrialises. The country has set up a dedicated Moroccan Agency for Solar Energy (MASEN) to coordinate policy and implementation, and one of the agency's major achievements to date was paving the way for a 300 MW concentrated solar power plant in Ouarzazate, which when built will be the third-largest of its kind in the world. It will be followed by the 155 MW solar PV Nzema plant in Ghana as well as a raft of similarly sized projects in Nigeria and South Africa.* And for each of these plants, technicians, maintenance staff and operators will need to be trained. However, it is not just these utility-scale plants that will act alongside the massive new hydropower plants such as the Grand Ethiopian Renaissance Dam (6,000 MW), the Inga III Dam (DRC) or the Mambilla Dam (Nigeria). The IEA suggests in its 'New Policies Scenario' that the future in Sub-Saharan Africa also lies in the mini-grids sector, where it predicts an energy source split for electricity as follows in 2040 (for 26 TWh): oil 32 percent; solar PV 37 percent; hydro 20 percent; wind 8 percent; and bioenergy 3 percent. Of the total of 12 TWh it anticipates being generated completely off-grid, 65 percent will be generated from renewable sources.[53] The number of mini and off-grid facilities required will be immense, each one of them again bringing a training requirement with it.



Wind power on the horizon: South Africa is on the cusp of a massive boom in renewable energies.



Wind and sun abound

Renewable energies are set to change the game in South Africa. Skilled professionals are in high demand. The South African Renewable Energy Technology Centre (SARETEC) in Cape Town is busy training them

Just down the road from the Bellville Campus at Cape Town's Cape Peninsula University of Technology (CPUT) a peculiar steel structure towers into the clear blue sky for 21 metres, arresting our gaze. Inside it we glimpse young men swiftly climbing up and down the ladders and using electric aids with amazing adroitness, while others are busy practising fastening their safety belts. At the foot of the tower stands Sven Pietrangeli, Operations Manager at SARETEC NPO, his head tilted back in an attempt to watch the climbers doing their safety training. After the young men have completed their tasks, he starts talking about the recent surge in enquiries to SARETEC. "If this is anything to go by, we could easily set up a second training tower," says Pietrangeli as he walks inside the building. One of the halls houses the massive turbine of a wind power plant that Germany's wind power specialist Nordex SE donated for training purposes. "The turbine is fully functional, allowing our students to train on it as if they were working atop a wind turbine tower somewhere in South Africa – the only thing missing is the view," says Pietrangeli jestingly.

South Africa is at the dawn of a massive boom in renewable energies – the country no doubt has what it takes: sun and wind abound, a coast spanning almost 3,000 kilometres, not to forget plenty of inland space for wind and solar parks. The primary goal is to make the country less dependent on coal (around 90 percent of the power is generated in the few major coal-fired power plants or imported*), and to curb carbon emissions as a result. Moreover, as a result of decentralisation, renewables are expected to relieve bottlenecks in the power supplies for a growing population and create some 300,000 jobs by 2030.



Combatting the shortfall in qualified staff: **Sven Pietrangeli**, Operations Manager at the South African Renewable Energy Technology Centre (SARETEC) in Cape Town, South Africa.



All over South Africa, wind energy projects are attracting local and international investors.

* See Case study on Nigeria, p. 122

Today the trend has started, albeit modestly. The biggest wind system built in Africa is the Cookhouse wind farm in the Eastern Cape, where 66 turbines already churn out 138 MW and have been feeding electricity into the grid since the end of 2014. The government's plan is to bring on board 3,725 MW of generation capacity driven by renewable sources and to up that figure by a substantial multiple in the period through 2030, bringing on board concentrated solar power plants, too. According to a study by researchers at Bloomberg New Energy Finance, 2014 saw more gigawatts from renewable power plants being hooked up to the Sub-Sahara network than the entire period between 2000 and 2013, with South Africa, Ethiopia (mostly geothermal energy) and Kenya (likewise mostly geothermal energy) at the vanguard of this trend. By international standards the total capacity installed is still very modest, and yet the data reveal the enormous dynamism powering this development. Wind and sun are feedstock that come for free and are abundantly available; they have long since attracted local and international investors. Another incentive are the long-term prices homes and businesses will pay for electricity, which are agreed with the power plant operators individually. The industry as a whole is pumping billions into South Africa's Green Economy. Renewables no doubt have what it takes to be a "game-changer" – whether in connection with climate goals, as regards energy costs for businesses and private households or in the case of energy security and economic development.

There is only one flaw to these fantastic economic prospects: the major shortage in qualified staff. In South Africa's wind power sector alone, forecasts predict some 5,000 skilled workers will be required over the next 15 years – for installation, monitoring, maintenance and repair work on the wind turbines. The South African Renewable Energy Technology Centre in Cape Town, SARETEC, was founded to alleviate the problem. The project received start-up financing from the South African Department of Higher Education and Training, while the neighbouring Cape Peninsula University of Technology (CPUT) provided the land and acts as an umbrella organisation; further financial and organisational support come from, among others, Germany's Federal Ministry for Economic Cooperation and Development and the Sector Development Agency of the Provincial Government of the Western Cape and Cape Town, GreenCape.

SARETEC also functions as a conference centre, bringing together companies and scientists, politicians and investors in a move to exploit the potential of the Green Economy. That said, SARETEC sees itself first and foremost as a training



Busy: construction workers finishing the SARETEC building in Cape Town in spring 2015.

centre that in collaboration with universities, technical universities and vocational colleges develops and implements tailor-made basic and advanced training programmes for wind energy, photovoltaics, solar and geothermal energy as well as related fields, and monitors their quality. “The original idea was that we would not be able to expand renewables in Africa if we did not have the skilled manpower to do so,” says SARETEC Operations Manager Sven Pietrangeli. And Manfred Dutschke, Skills Development Consultant at GreenCape Agency, adds: “Another part of the business model was that we did not wish to leave the technical services market in the hands of international providers alone, but wanted to make certain they were on-shored: we want to get African and South African services providers fit to square up to any competition.”

The SARETEC educational programme is geared towards trained artisans and technicians who hold a national diploma. They have professional experience and an educational background in the electrical and mechanical fields, plus they are physically fit and not afraid of heights. All this is essential if you want to work atop the giant wheels 100 metres above the ground, or on sloping roofs installing PV panels. The soon-to-be wind turbine, solar and biogas plant service technicians learn the theoretical background in designated classrooms; for their practical training in Hydraulics, Electro-Solar or Composite Materials, which are used in the construction of rotor blades, they go to specialist workshops. There are four training supervisors from the technical colleges and TVET colleges. An additional eight trainers have gained further qualifications in Germany. If required, SARETEC also offers a whole host of tailored short courses for students, specialised professionals, academics and even for unskilled workers, ranging from courses in modernising buildings for energy efficiency to combined heat and power all the way to vibration analyses for wind turbines. “We regard our role as that of a service provider who fine-tunes its range of offerings to the demands of the company. We take the experts from our own network,” Operations Manager Sven Pietrangeli explains. It is not least its affiliation with CPUT Advanced Technical College that has ensured SARETEC has swiftly gained such a sterling reputation. Sven Pietrangeli says that the Technology and Training Centre fulfilled its mandate not only for South Africa, but indeed for the entire African continent. And the programme is a great success. Every day people from many different states ring him in Cape Town to enquire about the range of courses.



View of the Bellville Campus at Cape Peninsula University of Technology (CPUT) in Cape Town, South Africa.



Given the dynamism in the renewable energies sector, SARETEC graduates have very bright prospects on the labour market – and will no doubt scoop up jobs that are considered exceptionally secure thanks to the long-term nature of the service agreements with the operators of wind and solar parks. They will "most definitely be in jobs that are more secure than say in the mining industry, which largely depends on the world market prices of the respective commodities," GreenCape consultant Manfred Dutschke explains. Moreover, these service technicians should easily find employment also outside of the wind power, solar power or biogas sector, Sven Pietrangeli says with conviction. "They will be equally in demand in the mines and ports, in the food industry and any other sector."

This major job creator is fast gaining in momentum. In Atlantis, a city north of Cape Town, at the end of 2014 the Spanish Gestamp Group opened what is to date Africa's largest factory for the production of wind towers, creating several hundred jobs; before that South Africa's DCD Group, which specialises among other things in the construction of traditional power plants and rail tracks, began in South Africa's Eastern Cape Province to erect a factory in which up to 200 towers will be built each year. This way South Africa is getting closer to its target of making certain there is sufficient 'indigenous content', in other words attracting local manufacturers who will offer sophisticated and exciting places to work.

As early as 2012 Western Cape's Premier Helen Zille stated that thanks to the marriage of the private and academic sectors the region could indeed develop into South Africa's green economic hub. Perhaps even more. "Today the country is still in its infancy in this regard," says GreenCape consultant Manfred Dutschke, "but there is every reason to believe that South Africa with its central position between India and Brazil, the boom countries for wind power, and its ports will evolve into one of the world's key production locations."

There is still a long way to go but the first steps have been taken. One of them was that in 2013 and 2014 in a kind of test run SARETEC sent 21 South Africans to Germany for training. And there are two young women among South Africa's first officially certified wind turbine service technicians. "In Africa they are as rare as diamonds," says SARETEC's Operations Manager Sven Pietrangeli. Mind you, by further investing in the green economy many more such 'gems' will no doubt be unearthed in the immediate future.

The agro-industry

Agribusiness can play a critical role in jump-starting economic transformation through the development of agro-based industries that bring much-needed jobs and incomes: this can only happen if the right training facilities are in place locally

In 2014, the total cost of food imports for Africa came to a staggering figure of almost US$45 billion.[54] The Africa Progress Report 2014 comments in sobering terms: "Agriculture remains the Achilles' heel of Africa's development success story. Low levels of productivity trap millions of farmers in poverty, act as a brake on growth, and weaken links between the farm and non-farm economy – links that were crucial to development breakthroughs in Bangladesh, India and Vietnam. Low productivity has another consequence that has received far too little attention. Africa's farmers could feed rapidly growing urban populations and generate exports to meet demand in global markets. However, the region is increasingly and, in our view, dangerously dependent on imports. African countries spent US$35 billion on food imports (excluding fish) in 2011. The share accounted for by intra-African trade: less than five percent. If Africa's farmers increased their productivity and substituted these imports with their own produce, this would provide a powerful impetus to reducing poverty, enhancing food and nutrition security, and supporting a more inclusive pattern of growth."[55]

At the same time, agriculture and the agro-industry are projected to constitute a US$1 trillion industry in Sub-Saharan Africa (SSA) by 2030 as the population explodes and urbanisation advances (up by a factor of three on the 2010 figure).[56] What is important here is that many African countries have a comparative advantage in agriculture, given that the continent has more than half of the world's agriculturally suitable yet unused land and major water resources – and a population that has strong rural roots. Small wonder that African governments have been prioritising agriculture in their transformation agendas.

In this context, the World Bank comments that "agribusiness can play a critical role in jump-starting economic transformation through the development of agro-based industries that bring much-needed jobs and incomes. Successful agribusiness investments in turn stimulate agricultural growth through the provision of new markets and the development of a vibrant input supply sector."[57] While some markets will remain reliant on imports, these may be intra-African, and the potential for the sector is immense. Such investments spell great job creation in the SMEs that need then to evolve, or in multinationals investing in the continent. The jobs will cover the entire value chain, with an emphasis of processing and the gradual expansion of the supply chain. This requires not just financing in all forms from microcredits upwards, but a mass of well-trained labour, with skills in all manner of different areas. Only with such training will the agricultural sector

be able to boost productivity and the continent feed itself, something that has often been the aspiration of past rulers.

* See interview with Donald Kaberuka, p. 138

One example of where government is trying to steer a nation into industrialised agriculture is Nigeria, with its plan for staple crop processing zones. The idea is to establish clusters into which infrastructure investments are funnelled, establishing better value chains, and promoting industrialisation. This has gone hand in hand with liberalisation of the fertiliser procurement laws. In this way, under the then Agricultural Minister Dr. Akinwume Adesina, who has succeeded Dr. Donald Kaberuka as President of the African Development Bank,* the hope is that the staple crop processing zones "will attract private sector investors to set up processing plants in high food production areas … to create sustainable employment in agro-production, processing and related activities, and drive rapid rural development." While it remains to be seen how successful the bid for foreign investment will be, the policymakers are evidently on the right track.



Teaching mushroom cultivation, Adidome Farm Institue, Adidome, Ghana.



Farming for the future

How training farmers may help the country get back on track harvesting pineapples big time

Ghana depends on its farmers. And not just the cocoa farmers, who make the country the world's second-largest exporter of the commodity. For vegetable exports have almost quadrupled in the last five years, and agriculture contributes 20 percent of GDP. Unlike many other African countries, in Ghana 'only' a good 45 percent of the population lives in rural communities, because here the pace of urbanisation particularly around Accra and Kumasi has been extremely fast. Not only do those in the country communities depend largely on the agricultural sector for their livelihoods, but the city-dwellers depend on their rural compatriots to maintain a functioning food chain.

Potentially, those farmers are growing ever younger, for a good 35 percent of Ghanaians are 14 or under, which happens to also be the age when compulsory education ends. There is immense pressure among young people to find work, meaning that as of that age many are possibly leaving education, a trend suggested by the fact that for secondary education the net enrolment rate was below 55 percent in 2013. Although this is about 15 percent up on the 2004 figure and thus a vast improvement, much still remains to be done to educate, and in particular to train people in the sort of skills the country's economy urgently requires. Needless to say, the range notably includes basic and advanced farming skills.

Joseph Kwesi Sarpong (M.Sc.), a committed agro-educationalist, has been head of Adidome Farm Institute, one of the three providers of ATVET ('A' for agricultural) of its kind in the country, for a good two years now. Trained at an agriculture college, he himself then became a technical advisor, before embarking on further education. The institute has a long track record; it was established in 1964 and is now under the Ministry of Food & Agriculture, as are the five agricultural colleges, but unlike the latter the focus is on hands-on competence-based training or CBT for short, with instruction provided in both animal husbandry and crops!



Director Sarpong and Deputy Director Pommeroy in the greenhouse for cucumber husbandry,
Adidome Farm Institute, Adidome, Ghana.

Adidome is located about halfway between Accra and the border with Togo, not far from the banks of the Volta River, from which the region takes its name. Students come to the Adidome Farm Institute from the entire Volta Region, and spend a year there. Headmaster Sarpong says the average February intake is 140, whereby of late the proportion of women among them has risen to as much as 30 percent. The students stay on campus in the single-storey halls of residence. Each weekday starts early, with the young people out in the field from 6 to 8 a.m. every morning, before returning for classroom instruction. Lunch is followed by a second stint in the fields through till 5 p.m. Fridays are special, in that they are characterised by practical work all day long.

The idea developed by Sarpong and his colleagues nationwide is to impart skills to the prospective farmers along the entire value chain, with each segment broken down into its constituent parts. For example, students are trained in one module in pest control and, in another, in fertilising or in defining the soil's properties and then preparing it correctly. "The students do the TVET certification at the end of December. We are trying to make certain they train to meet industrial needs wherever possible, even if the students have only junior secondary school under their belts. We even facilitate learning for illiterate applicants, and customise short courses to specific needs," the headmaster comments. This means, if necessary, taking the budding agriculturalists out of their comfort zone and teaching them how to grow crops they might not be familiar with locally, such as cucumbers. Sarpong's deputy, Mr. Pommeroy, explains that "we have a key role to play training people because we have so much technology, but farmers don't have these technologies. It is therefore important we train them in good practices." In the case of cucumbers, this involves showing what fungi can affect crops and what sort of conditions they best grow under.

* See Interview with COTVET Director Sebastian Deh, p. 144

The Ghanaian state admirably dedicated 23 percent of its expenditure to education in 2010, an absolute first in Africa. More than 90 percent of this budget is spent by the Ministry of Education and its agencies: primary education attracted 31 percent of the expenditure, followed by tertiary education (21.6 percent). Indeed, education spending has held steady at over 9 percent of GDP, meaning Ghana is in this regard the leading African Lion! However, there has been a downside: TVET has long simply been the ugly duckling.* Mr. Pommeroy comments that "it is the basic skills that are often lacking. It's what is keeping agriculture back. We have the climate, we have the water, we have the soil, but we don't have enough



Joseph Kwesi Sarpong, Director, Adidome Farm Institue, Adidome, Ghana.

basic skills. Or the right ideas, often. You must understand your crop. Know-how to look for a market. Know the steps in the value chain. I met a rice farmer recently. He was still taking the rice and scattering it. That was something you did, and rightly so, 50 years ago. Now you have a nursery, plant the seedlings out etc." One of the basic skills that is lacking is a command of one and the same language. Pommeroy as a local expert often finds himself acting as interpreter for his superior, who comes from the Ashanti region. Not everyone here in Adidome speaks Twi, which is after all only spoken in two-thirds of Ghana.

Sarpong and Pommeroy are strong advocates of a return to pineapple production, once a prime crop in Ghana. Disaster struck when American supermarket chains decided they preferred the MD-2 pineapples as these were sweeter, more uniform in size, had a flatter base and thus 'stood' better on shelves – and had a longer shelf life. The EU soon followed suit and this pulled the rug out from under the feet of the Ghanaian pineapple sector, because there traditionally the pineapple which has been grown is the 'Smooth Cayenne', a fruit that is more cylindrical in shape and larger. It is ideally suited for canning, but that did not prevent its sad fate. In other words, a crop switch was necessary if Ghanaian pineapple growers were to remain competitive. And most farmers felt overwhelmed with the idea. After all, the South American cultivar did not grow as well in West Africa given the climatic and soil conditions in Ghana, making it more costly for smallholders or the larger farms to produce. The MD-2 tends to be grown in Costa Rica, and despite the greater distance to market, the Costa Rican farmers were able to supply EU supermarkets more cheaply than could their Ghanaian counterparts.

Even assuming they do manage to persuade farmers to return to pineapple cultivation, if only for the local market (the fruit is a great source of nutrition, after all), there are other obstacles to success. Sarpong says, with a sad shake of his head, "We face 30 to 40 percent harvest losses, especially with vegetables. There is simply a lack of linkages between the farms and the markets, be it buyers or processors. That link is missing." In many places in the Volta Region, for one, the logistics chain difficulties are severely impairing farmers' revenues, and a brief look at the number of roadside watermelons abandoned by smallholders who have been unable to sell them to cars passing by is a terrible testimony to this.

Thanks to the Comprehensive Africa Agriculture Development Programme (CAADP) launched by the African Union and managed by NEPAD there is a strong drive



Fruit being sold at the roadside in Ghana – in the absence of a wholesaling infrastructure.

to improve the status and quality of ATVET – the programme encompasses Kenya, Nigeria and Ghana and is supported vigorously by Germany's GIZ. One crucial aspect of the effort: regular workshops to harmonise and standardise curricula. The managers from Adidome Farm Institute travel well over 100 kilometres to attend them, but this is actually not much, as fellow headmasters have as much as an eight-hour car drive behind them to reach the workshops.

The session on harmonising the pineapple curriculum (Level III) takes place in 2015 at the Hephzibah Christian Centre Peduase; the location is appropriate as it is just below the Aburi Presidential Lodge, which then President Nkrumah had built in the late 1950s and which has served as the venue of many an important meeting, such as the Aburi Accords conference where the two sides involved tried to prevent the Nigerian Civil War unfolding. If Ghana's agriculture is to pick up, then this workshop is possibly as important. The conference room, nestling on the side of the high hills, offers a stupendous view, but the participants' eyes are glued to the curriculum outline projected onto the whiteboard. Under discussion is "Unit 1 – Introduction to Pineapple Production". It is one of the ATVET learning facilitating materials and has to be completed by farming students seeking to gain the "Pineapple Production Certificate I". The next unit in the series then focuses on "Site Selection & Land Acquisition", as the students work their way through the modules en route to acquiring a full set of pineapple production skills.

Among those present are pineapple advocates Joseph Kwesi Sarpong and Deputy Headmaster Mr. Pommeroy. There is a lively discussion on comments made by an outside consultant on the phrasing of the items on the curriculum and on when students' progress should be evaluated. Headmaster Sarpong interjects: "We can assess them at the end of the entire training course on carrying out the plan, but not after only a few weeks." One of his colleagues, a representative of a private agricultural college in Kumasi, supports him and continues the thread, saying, "Surely the key is to ensure that changes to the Pilot Curriculum always square up to practical work and practical life on the farms." Everyone present, including team leader Ernest Mallet, agrees. And the relevant wording in one of the 'LO's' or learning objectives in the training master booklet is changed accordingly.

After an intensive morning session, the workshop breaks for lunch. Essentially what they have accomplished is to act as the spearhead driving the rigorous framework



Worker in a pineapple field at Adidome Farm Institute, Adidome, Ghana.



for what Sebastian Deh, Director of COTVET, is busy establishing, namely a policy to enable “competitive, employable and entrepreneurial skills nationally and globally within the formal and informal sectors”. COTVET’s mission is to set up a TVET system that “improves the productivity and competitiveness of the skilled workforce and raises the income-generating capacities of people, especially women and low income groups, through provision of quality-oriented, industry-focused and competence-based training programmes and complementary services.” The basics for this start with a standardised pineapple curriculum!

Water & waste management

Water is undoubtedly going to be even more of a key issue in Africa's socio-economic development in the future than it is now – as the population mushrooms. Africa has only 9 percent of global renewable water resources and yet that volume has to suffice to support what is now already 15 percent of the global population. Whereas annual renewable water resources per capita are around 35,000 m^3 in Latin America, the figure is less than a quarter of that in Africa. Added to which are the increasing effects of climate change, with desertification in the Sahel and Sub-Sahel zones leading to changes in rainfall patterns. Sub-Saharan Africa is the part of the world that today faces the greatest variability in rainfall – something that will grow with the effects of climate change.

With the rampant rush of urbanisation and the deficit in urban master planning ahead, waste and water management cannot keep pace with the population influx. Take the case of Kibera, a district that accounts for 20 percent of Nairobi's population. As it is an informal settlement it is not included in the standard infrastructure of the city. As a result, it is not connected to the municipal sewage system or to the wastewater treatment plants. It is living evidence of the fact that in Africa there are more mobile phones than latrines.[58] The lack of water is making itself felt especially in such informal housing settlements in the many conurbations, and it is being compounded by the fact that even where pipes exist, water and wastewater treatment facilities are insufficient or simply lacking. Access to safe drinking water and sanitation may have been one of the key UN Millennium Development Goals, but it is one where much still needs to be achieved in Africa.

At the same time, there is great potential for improvement. Estimates suggest that at present "only 5 percent of the Africa's potential water resources are developed and average per capita storage is 200 m^3 (compared to 6,000 m^3 in North America)."[59] Indeed, calculations show that if the irrigated area in the Zambezi basin were increased by a factor of three, agricultural productivity would rise by a factor of five, and the dollar value of these benefits would be twice the investment needed.[60] The opportunities are immense, given the water sources, but Africa for a variety of reasons is the least irrigated continent in the world. There is likewise great potential for better water treatment to augment the provision of potable water and the quality of it. The treatment of wastewater and effluents is also a must, as much such waste gets inputted into existing freshwater sources causing pollution and lowering available resources still further, so the better and more extensive the treatment, the larger the resources available.

Aquatronics: a key training sector to guarantee health and prosperity

Things are little different in South Africa. There, fouled domestic and industrial wastewater and the run-off from fertilisers together with the fertilisers themselves make pollution of open water sources a real problem. The South African government has realised the need for immediate remediation and has budgeted no less than US$3 billion through 2018 to advance the water infrastructure. Yet for all its efforts, “the country still faces major challenges in terms of the operation and maintenance of water and wastewater treatment plants. Although these tasks usually fall under district or municipal jurisdiction, many municipalities lack the respective management and engineering know-how. The drinking water therefore often fails to comply with quality regulations, and municipalities cannot ensure adequate long-term maintenance of their water infrastructure assets.”[61] The key here will be to train the requisite staff, and in this regard South Africa can be taken as typical of Africa as a whole: without sufficient engineers and technicians who have undergone practical training methodologies and been familiarised with systematic processes there will be no way forward. Such training must break the overall water supply and treatment cycle down into the respective components and provide hands-on instruction in such fields as operating pump stations, automating processes and monitoring plants. South Africa has already taken the bull by the horns, and the University of Pretoria and The Water Academy in Knysna have adapted existing training modules for the different target groups of university students, trainees in water and wastewater treatment and staff of water and wastewater plants to train 450 engineers over a period of two years. That number is, however, only the tip of the iceberg.

E-business

Back in 2013, a UN/NEPAD report stated that "In the current economic environment of on-going global financial and economic instability, microfinance lies at the heart of Africa's efforts at delivering inclusive socio-economic development. Microfinance offers significant opportunities for African countries to fully unleash the private sector's potential and contribute to addressing emerging and long lasting development challenges. It is estimated, however, that as of 2007 only around 12.7 per cent of the poorest families in Africa had access to microfinance services compared to 78.5 per cent in Asia."[62] At that time, there were a total of 230 microfinance institutions operating in Africa, whereby only in ten countries did potential customers have a double-digit choice. The far greater difficulty was ensuring access to microfinance where indeed such facilities were available.

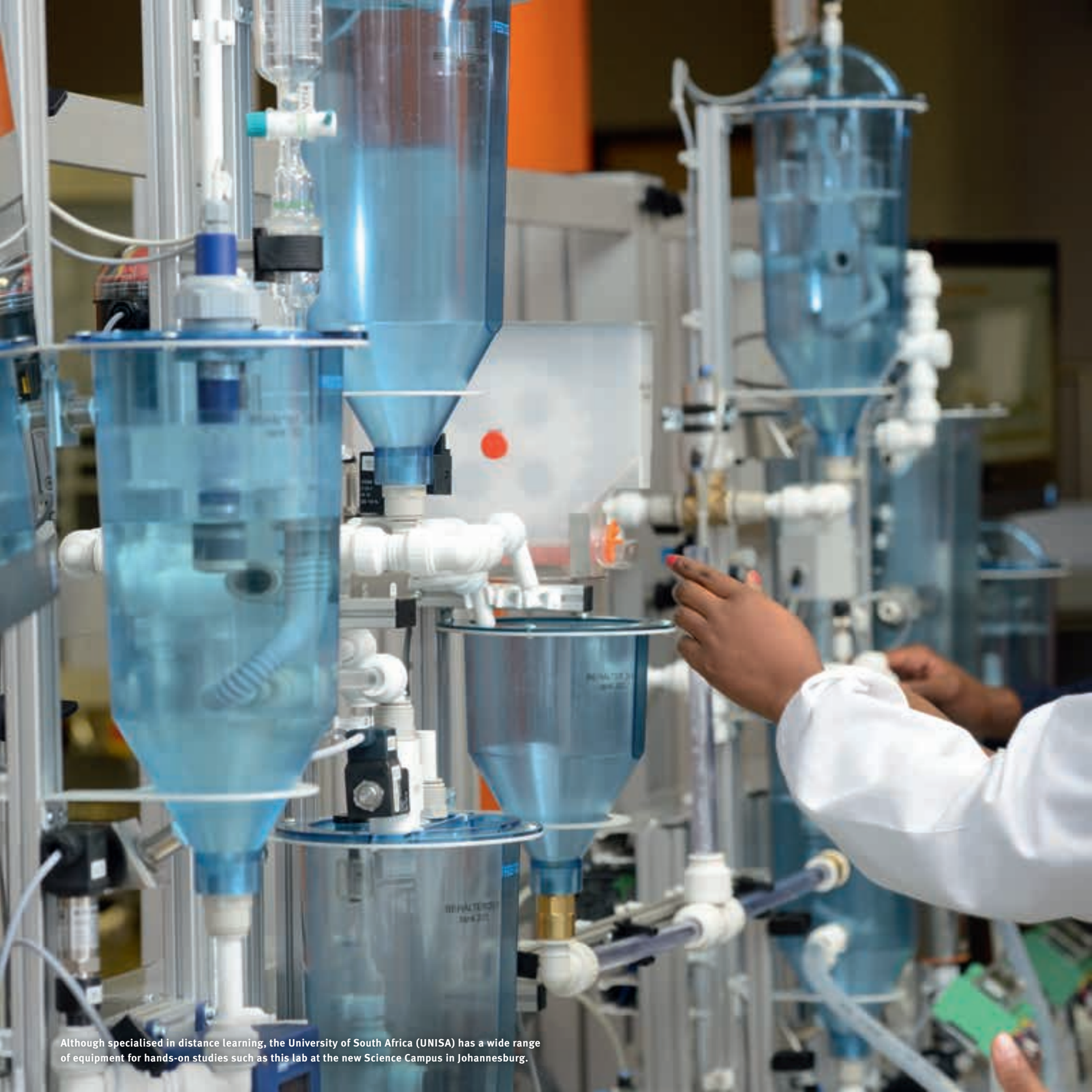
One African solution to this has been e-based money transactions. The major success story here has been Kenya's M-Pesa system (M as in mobile and Pesa as in Swahili for money), driven by Vodacom and Safaricom. The system runs from a mobile phone and allows the phone user to deposit, withdraw, transfer money and pay for goods and services from the handheld – affordably, while sidestepping the risks of retailing and trade based on cash transactions. Given the incredible spread of the mobile phone, hardly surprisingly in nine African countries (Cameroon, DRC, Gabon, Kenya, Madagascar, Tanzania, Uganda, Zambia and Zimbabwe) such mobile-phone-run accounts now outnumber physical bank accounts.[63] The range of possible applications for such services is endless.[64] In Rwanda, Uganda and Ghana mobiles can be used to withdraw cash from ATMs – run by MTN, the mobile phone service provider. In other words, like telephony, banking in Africa has leapfrogged many traditional solutions and has gone digital – producing many jobs from SIM and scratch-card vendors through to the technicians running the services or repairing the handhelds.

E-business overcomes distances – but requires clear skills sets that are often still lacking in the requisite numbers

In a recent article Credit Suisse noted that M-Pesa has led to a culture of saving: "In cooperation with Safaricom, the Commercial Bank of Africa offers savings accounts, paying 2 percent interest for amounts up to the equivalent of 100 Swiss francs. Accounts equivalent to more than 500 Swiss francs even earn 5 percent. Many people are earning interest for the first time in their lives." The renowned Swiss bank goes on to write: "It is no exaggeration to say that Kenya's economy depends on M-Pesa. According to the Central Bank of Kenya, the value of all transactions between June 2013 and June 2014 represented 39 percent of the country's GDP."[65]

* See case study on Ethiopia, p. 20

However, what of those who need Internet connectivity where there are no mobile phone masts near at hand, a frequent occurrence once one is deeper into the rural areas of Africa? Not to forget that many areas are dogged by epileptic power supplies? Africans have themselves come up with one solution to this already: a sturdy black brick that goes by the name of BRCK. It was developed in Nairobi, Kenya and is destined to overcome connectivity problems. "BRCK," the designers proudly say, "makes accessing the Internet simple and reliable wherever you are. It's a rugged, cloud managed, full-featured modem/router. If there's a way for you to connect, BRCK will help you get up and stay up no matter where you are."[66] In other words, portable Wi-Fi for Africa. Sized a mere 13 x 7 x 4.5 cm, the unit survives drops, dust and the extremes of African weather, to give you connectivity for multiple devices and a strong external antenna. Moreover, it provides enough backup power to survive a blackout, power surges and reverse voltage, and can if necessary be charged from a solar panel, and used to charge other devices. As the need for Internet connectivity rises in remoter areas, for example for remote medical diagnostics or schooling, so the potential of devices such as the BRCK will come into play. And as the possibilities for e-business expand and Internet and smartphone usage merges, the demand will increase for the skilled engineers and technicians needed to keep the systems up and running. People with the right skills set will hopefully be graduating soon from technical colleges or universities such as those in Addis Ababa and Debre Markos.*



Although specialised in distance learning, the University of South Africa (UNISA) has a wide range of equipment for hands-on studies such as this lab at the new Science Campus in Johannesburg.



University with an “instinct to innovate”

A dedicated open distance learning institution with more than 400,000 students, the University of South Africa (UNISA) is the largest higher learning institution on the continent

Professor Touhami Mokrani walks through the corridors of his university. As he unlocks one lab door after another and briefly steps into each room, glimpsing the extensive range of equipment stored inside brings a smile of appreciation to his bearded face. The apparatus includes a device for the biotechnical manufacturing of ethanol, an experimental setup for heating service water using flat-plate solar collectors, gas cyclones for the separation of solids, learning stations for water purification, sand and diaphragm filtration, devices for identifying materials, along with equipment for his own personal area of specialisation, namely research into fuel cells. Add to this a small biodigester, appliances for anaerobic water treatment, flue gas filters etc.

The equipment has been shipped here from the United States, Germany, Italy and Malaysia. A great deal of it is still covered in bubble wrap or stored in timber boxes with the delivery slips still stuck on the outside; only few of the items have been hooked up yet to test how well they function. “It’s all new,” Professor Mokrani says, beaming, as he walks from one appliance to the next. “Visitors often cannot believe their eyes when they see this, but it’s true: we have everything a university professor could possibly dream of; in fact, we now have one of the best-equipped labs in the world.”

The University of South Africa, or UNISA in short, is very special indeed. Originally founded in 1873, it has dedicated itself to distance learning since 1946, making it one of the world’s longest-standing institutions of its kind. And with more than 400,000 students UNISA is the largest university in Africa; nearly one-third of all students in South Africa are enrolled here. Enjoying an excellent reputation for some decades now for its Colleges of Economics and Management Sciences,

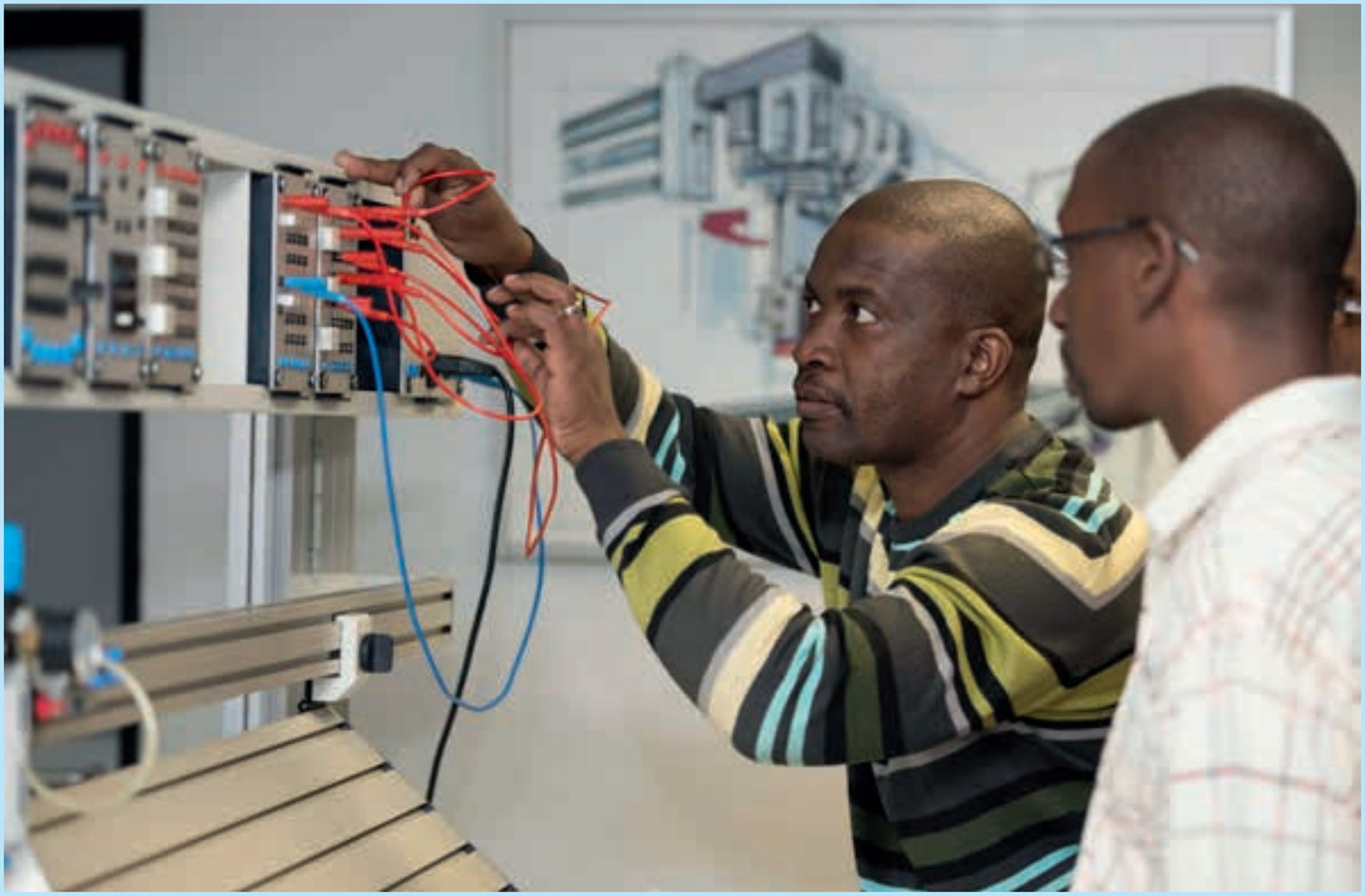


“We have everything we could possibly need for the next 20 years”: **Touhami Mokrani**, Associate Professor of Chemical Engineering at the University of South Africa (UNISA) in Johannesburg.

Education, Human Sciences and Law, UNISA, which has its main campus in Pretoria, is now busy expanding its offerings in its College of Science, Engineering & Technology: in mid-2013 in the West of Johannesburg UNISA opened its Florida Campus, which was built for just under 1 billion rand and today offers state-of-the-art labs for some 30,000 students working on their degrees and doing research. "The skilled teaching and training of mathematics, chemistry, physics and all their related subjects is a vital ingredient of our county's advancement in scientific areas," commented Science & Technology Minister Derek Hanekom at the inauguration of the new campus, and reported, "Our colleagues at the Department of Basic Education and our various private and public partners are pouring tremendous human and financial resources into putting the infrastructure and facilities in place to enable such teaching."

Touhami Mokrani is among those who have embarked on the project with peerless zeal and enthusiasm. Originally from Algeria, Mokrani completed his studies in South Africa and is today Associate Professor of Chemical Engineering. "It's not like those new devices and appliances in our labs have simply replaced some old equipment. What we have here is a genuine new beginning," Mokrani says with evident pride. In the past his distance students used to complete their practical modules in other universities and training centres that were closer to them, but sadly only offered below-par equipment. The practical curriculum is now centralised on the Florida Campus – "for the next 20 years we have everything we could possibly need," Professor Mokrani remarks, still unable to believe his luck.

Quite recently he read a newspaper article that claimed that South Africa was experiencing a job shortage for engineers, Touhami Mokrani recalls, but swiftly dismisses any need for concern. After all, he says, it is perfectly normal to have ups and downs on the labour market, and there is no questioning industry's long-term needs: "In developing South Africa and indeed the entire continent we need technicians and engineers who know how to operate pumps, valves and all that other equipment." In particular his area of expertise, chemical engineering, offers a wide choice for well-trained specialists, ranging from the petrochemical, metalworking and pharmaceutical industries all the way to the food sector and the paper industry. "Not to forget environmental protection; think water and wastewater treatment, air pollution control and solid waste management – all of them core focal points on our 'green campus'," Mokrani explains. Indeed, the field of aquatronics, which covers all aspects of water treatment, is becoming



Students participating in the Festo Didactic electro-pneumatics course.

increasingly important and looks set to become a discipline that will soon be on curricula throughout Sub-Saharan Africa.

It was the campus's green image that acted as an invaluable incentive for young people to opt for UNISA to study Engineering, or so he is convinced. After all, the institution covers a wide spectrum of courses and degrees – from the National Diploma in Technology, which is what the majority of students enrol for, to Bachelors in Engineering and even Ph.Ds. "You need a solid foundation to do good research, it's the 'pipeline' that enables top performances in this field," opines Mokrani, who enthuses about the fact that in his lab technicians, engineers and Ph.D. graduates now get the chance to work next door to one another. Incidentally, this is how he thinks universities should engage with one another on the whole: "Working as a team is my philosophy, not competition."

Nonetheless, being Africa's longest-standing distance learning institution, UNISA still gets to enjoy a very special role on the continent. An "innovation instinct" had always been part of UNISA's DNA, Derek Hanekom, South Africa's Minister of Science and Technology until 2014, commented in the keynote commemorating the ground-breaking. This included the resolution to form a dedicated distance learning institution that would serve both educational and social development needs. In recent decades the university has developed a unique logistics system for shipping physical educational materials. However, today UNISA aims to harness the new and emerging potential in information and communication technology to catapult the university "into a truly digital future", using e-learning to make studying, most often restricted to brick-and-mortar laboratories and lecture theatres, available to students whose circumstances would otherwise preclude a career in science and technology. Which is why at UNISA, all students can now purchase quality laptops and tablets at affordable prices. Students may also apply for discounted 3G data packages.

"We have come pretty close to becoming a paperless university; thanks to my UNISA our students are in a position to do almost everything they have to do online," explains Touhami Mokrani. "While on the teaching side, we can make nearly all teaching materials available as downloads and even mark exams online." Standing in front of a flow control trainer destined to introduce students to the fundamentals of control engineering, Mokrani talks about his plan to set up a website for his department: "You can use it to read the latest published articles,



The Eureka building on the new Science Campus of the University of South Africa (UNISA) in Johannesburg houses laboratories for the College of Agriculture and Environmental Sciences as well as for the College of Science, Engineering and Technology.



and we will make e-books available along with video footage of experiments." Mokrani picks up one of the thick cables from the experimental setup: "Our new devices are suitable for use at the Web-Lab interface, meaning our students will be able to conduct virtual experiments online, independently of whether they are based in Cape Town, Kenya or Zambia – they are always only one click away."

Nonetheless Professor Mokrani is fully aware that nothing compares to gaining hands-on experience on the new UNISA Science Campus. "Practical experience is essential," he says, "for it's the practical experience that makes the course really attractive and ensures that even greater numbers of our enrolled students keep going till the end." Take, for example, that group of budding technicians and engineers which in spring 2015 is busy building a biodigester for research purposes on the 'green' UNISA Campus, which will subsequently be put to proper use in rural areas. The group is part of "Engineers Without Borders South Africa", which believes that change and development in South Africa will essentially be driven by engineers. The outreach digesters will allow reliable estimates of how much gas can be produced a day – from which countless families could benefit up and down the country, just as countless students benefit from UNISA. Judging by UNISA's track record, it is a success story that needs to be broadcast throughout the continent. Given how strongly Africa has embarked on the path into the new e-age, the idea of distance learning is a growth model waiting to happen, as it allows universities to reach out to far greater numbers of students. Not that this dispenses with the obvious need for hands-on practicals along the way!



Cairo, Egypt.



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Index of abbreviations

AfDB
African Development Bank

AU
African Union

COTVET
Council for Technical & Vocational Education & Training

ECOWAS
Economic Community of West African States

EU
European Union

GDP
Gross domestic product

GUC
German University in Cairo

ICT
Information and communications technology

ITU
International Telecommunication Union

NEPAD
New Partnership for Africa's Development

NIMT
Namibian Institute of Mining and Technology

PAU
The Pan African University

PPP
Public-private partnership

PV
Photovoltaic

REC
Regional Economic Communities

SME
Small and medium-sized enterprises

SSA
Sub-Saharan Africa

TVET
Technical and Vocational Education and Training

UNDP
United Nations Development Programme

UNECA
United Nations Economic Commission for Africa

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NB: OECD average: 13.0% in 2014

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