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THE AFRICAN TECHNOPOLITAN

A MAGAZINE OF THE AFRICAN CENTRE FOR TECHNOLOGY STUDIES (ACTS)

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BIG DATA BIG SCIENCE AND BIG DEVELOPMENT

Time for Africa to Think Big Again

ICTs AND STRUCTURAL TRANSFORMATION IN AFRICA POST 2015?

By Günter Nooke, German
Chancellor's Personal Representative
for Africa in the Federal Ministry
for Economic Cooperation and
Development

DEVELOPING INNOVATION ECOSYSTEMS IN AFRICA

Prof. Dr. Stefan Schepers, Formerly,
Secretary General of an Independent,
Tripartite High Level Group on
Innovation Policy Management in
the EU

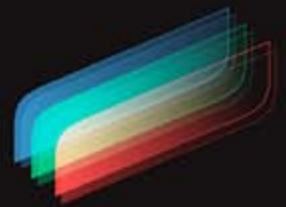
CLOUD COMPUTING IN AFRICA

Dr. Shiyghan Navti

**SOCIAL IMPACT
INVESTMENT IN AFRICA**

**ONLY THE BEST
IS GOOD ENOUGH
FOR AFRICA**

**PROMOTING APPLIED
SCIENCES, ENGINEERING
AND TECHNOLOGY IN
AFRICA**



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TIME FOR AFRICA TO THINK BIG AGAIN

*It is time for africa
to think big again.*

Economic Diversification and Structural Transformation. Big Science. Advanced Technologies and Knowledge Economies. Big, Inclusive Politics. Information Rich Democracy. Big Data. Eradication of Poverty, Disease and Ignorance. Technological Revolution. Industrial Policy. Big Development. Pax Africana.

The Pyramids, the Panama Canal, the Aswan High Dam, the Volta River Project, the Kariba Dam, the 'Moon Landing' are examples of large scale, 'big science', 'big development' innovations that fundamentally transformed economies, sectors and societies. Like many advanced and emerging economies, once upon a time, Africa used to think big and to act boldly in pursuit of its economic development. Africa has the expertise, technology and resources to solve many, if not most, of its fundamental development challenges. The continent must think big again, and act big again if the Africa rising narrative is to become a permanent reality: 'The African Development Miracle.'

Technology comes in small and big packages. Development comes in incrementalist and transformative packages. Over the last 50 years, Africa has tended to focus on small technological and incrementalist development packages, often at the expense of big technological and transformative development packages. There is no compelling reason why Africa cannot harness 'advanced technologies' for transformative development outcomes.

Recent impressive development indicators aside, the continent still faces a stark reality. It has yet to structure and transform itself out of its vicious

cycle of poverty, ignorance and disease.

Africa has the best possible opportunity in more than a generation to achieve economic diversification and structural transformation. It must now take the boldest, biggest, most development measures to achieve this goal. Economically, this will require a structural shift from low technology intensive sectors to high technology intensive sectors including but not limited to:

- Information and Communication Technologies (ICTs)
- Biotechnologies
- Materials Technologies
- Space Technologies
- Nanotechnologies
- Nuclear Technologies

Politically, this will require collective leadership and mutual social responsibility: Big, inclusive politics and information rich democracy. Africa, despite the multiplicity of peoples, physical features and viewpoints that characterize it, is a single politico-geographical-ideological entity. Its peoples share a formative history, a common geography and a common destiny. It would serve them well to embrace a common mission and to uphold the timeless African principle of mutual social responsibility or 'Ubuntu' (southern Africa), 'Amana' (Hausa speaking West Africa), 'Ujamaa' (Swahili speaking eastern Africa).

Welcome to the second Issue of the African Technopolitan! In the first Issue of African Technopolitan, we promised to bring you fresh, critical and independent analyses and insights from a multidisciplinary team of scholars, policy makers, technologists, innovators, captains of industry and other thinkers on international and African development, science, technology and innovation policy. We have kept our promise.

In this Issue of the African Technopolitan, we challenge African countries to think big again and to act boldly to harness applications of science, technology and innovation for economic and social development.

In the lead article of the Magazine - '**Big Data, Big Science and Big Development: Time for Africa to Think Big Again**' – Dr. Cosmas Milton Obote Ochieng provides a critique of Africa's development strategy in historical perspective and suggests alternative development and technology policies post 2015.

Günter Nooke, the German Chancellor's Personal Representative for Africa in the Federal Ministry for Economic Cooperation and Development, explores the potential contribution of ICTs to Africa's economic development post 2015.

Prof. Dr. Stefan Schepers makes the case for a new approach to economic growth, sustainability and social inclusion in Africa, one anchored in 'Innovation Ecosystems'.

Prof. Goolam Mohamedbhai highlights the opportunities and challenges presented by the World Bank's Programme on Applied Sciences, Engineering and Technology (PASET) in Africa.

Dr. Shiyghan Navti argues that Cloud Computing is the Next IT Innovation in Africa.

In two separate articles, Yentyl Williams reflects on Africa's trade relations with the EU and the US.

In 'Only the Best is Good Enough for Africa: The Portrait of an African Scientist', we profile three African scientists/scientists of African origin who are blazing the trail in three different fields:


- Prof. Babatunde Ogunnaike, the William L. Friend Professor of Chemical and Biomolecular Engineering at the University of Delaware and an expert in control and systems theory
- Dr. Tilaye Tadesse Asfaw, Ethiopian born NASA Astrophysicist
- Moses Gichanga, a drones for development technology innovator

Dr. Janice Golding examines the social investment landscape in Africa.

We also share highlights of our research, policy engagement and capacity building activities in the second half of 2014. Finally, we share our assessment of strategic technology and development trends in Africa in 2015 as well as our top 12 technology and development books for 2015.

The African Technopolitan remains open to policy and research insights, analysis, commentary, opinions and other forms of relevant submission by scholars, policymakers, technocrats, bureaucrats and members of the public. The African Technopolitan welcomes contributions that offer constructive, provocative and original ideas, analysis and commentary on how applications of science, technology and innovation can be harnessed to address Africa's fundamental development challenges: enhancing agricultural productivity and food security; sustainable energy access for all; universal clean water access; sustainable biodiversity conservation and use; climate change adaptation and mitigation; industrial development; infrastructure and human resource development. We invite submissions of not more than 2500 words from across academic disciplines and policy spheres. We are particularly interested in submissions that are multi or interdisciplinary, based on empirical work, advance original or alternative theories; and challenge conventional schools of thought on contemporary issues in science, technology and innovation policy research and practice in Africa.

Dr. Cosmas Milton Obote Ochieng
Executive Director,
African Centre for Technology Studies



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BIG DATA, BIG SCIENCE AND BIG DEVELOPMENT

Time for Africa to think Big Again

Dr. Cosmas Milton Obote Ochieng

Executive Director, African Centre for Technology Studies

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'In this epoch of the Great Awakening, it would be pathetic if the young economists in the underdeveloped countries got caught in the predilections of the economic thinking in the advanced countries, which are hampering the scholars there in their efforts to be rational but would be almost deadening to the intellectual strivings of those in the underdeveloped countries. I would, instead, wish them to have the courage to throw away large structures of meaningless, irrelevant, and sometimes blatantly inadequate doctrines and theoretical approaches and to start their thinking afresh from a study of their own needs and problems'.

Gunnar Myrdal,
Nobel Prize winning economist, 1957.

”

Economic development is not an exportable or importable commodity. Its constituent parts (ideas, policy, technology, capital and arguably institutions), can be imported or exported but the thing as a whole must be put together or ‘assembled’ locally. The ‘right mix’ of institutions of state, market, laws and civil society necessary for the functioning of a stable, predictable, free and talent unleashing nation-state cannot be imported. The local or indigenous capacity to absorb or adapt new technologies and innovations must be homegrown through investments in physical, human and social capital and organizational infrastructure.

Turning this ‘recipe’ into national economic development requires an overarching grand development strategy responsive to the history, geography and institutions of a given society (i.e. co-evolution of mutually supportive technological, policy, organizational/managerial and institutional innovations).

No country ever successfully imported or exported its development (model). Despite a number of similarities in the development (or more accurately, industrialization) pathways of the now developed countries, each country, while mindful of the paths taken before, essentially pioneered its own path, consistent with its historical, geographical, institutional, technological and natural resource endowments. While Britain led the way with the ‘First Industrial Revolution’ nearly two hundred and fifty years ago, and was followed within a few decades by Western Europe and the United States, neither Western Europe nor the US adopted the British industrialization or ‘developmental model’.

At the time of their pursuit of industrial or economic development, virtually all the now developed countries rejected the premise that economics (of development) is generalizable over space and time. Economic and industrial policies of all the now developed countries once challenged the universal validity of economic theories, especially the marginalist analysis of neoclassical economics with its ‘static’ framework and pre-occupation with the narrower problems of resource allocation and theory of exchange. Many of the now developed countries proceeded from the assumption that economic development is context dependent, with culture, history and geography being critically important

factors in any successful development strategy.

This is the critical insight from the study of economic development in historical perspective. This insight was central to arguments between the US and the UK over trade policy (i.e. tariffs) when the US was ‘industrializing’. It also central to arguments between the East Asian Tigers (Japan, South Korea, Singapore and Taiwan) and the US and Western Europe over trade and industrial policies (infant industry protection, export subsidies) during the industrialization of the East Asian economies. In the history of economic thought, this insight was powerfully propounded by the German Historical School (Friedrich List, Bruno Hildebrand, Gustav von Schmoller, Etienne Laspeyres, Karl Bücher, Adolph Wagner, Georg Friedrich Knapp, Werner Sombart and Max Weber) which held sway in much of continental Europe, and in the US until at least 1900 – well after the US had surpassed Britain economically in the 1870s. The argument continues in the 20th and 21st centuries in the works of Alexander Gerschenkron, Barrington Moore, Theda Skocpol, Alice Amsden, Lance Taylor, Dani Rodrik, Ha-Joon Chang, Joseph Stiglitz, Howard Stein and Thandika Mkandawire, among others.

While the pioneers of modern development economics were mostly from developed countries, to their enduring credit, many of them questioned the relevance of neoclassical and Keynesian economic theories for the analysis of the problems of underdevelopment. Nobel Prize winner Gunnar Myrdal, quoted above, went further and challenged developing countries to produce a new generation of economists who might create a body of thought more realis-

tic and relevant to the problems of their own countries. Raul Prebisch, one of the few pioneering development economists from the developing world, used the Regional Office of the UN for Latin America (ECLA/CEPAL) to do just that in the 1950s and 1960s – nurturing the ‘structuralist school’ of development economics, a strand of which later evolved into dependency theory.

Early Development Innovation in Africa: Strengths and Weaknesses

At the advent of African independence (1960s through the 1970s), many African countries attempted to follow the tried and tested pathway of ‘development innovation’. From Ghana, Guinea, Kenya, Senegal, Uganda, Tanzania to Zambia, many African countries preoccupied themselves with the ‘big questions’ of development (‘structuralism’; how to eradicate poverty, disease, ignorance – and yes, dependency). The focus on ‘Big Questions’ led to ‘big push’ or a grand development strategies: unifying ideological, theoretical and philosophical frameworks for development; bold visions of political democratization, economic emancipation and social progress; massive calls to popular participation that would tax the physical and intellectual energies of African countries to the limits.

This was not only the promise of African independence but its very definition. The concept of African independence had always been three legged: political liberation, economic independence and social progress. Here is Kwame Nkrumah, the first President of Ghana, in 1957, the year Ghana gained its independence from Great Britain: ‘We shall measure our progress by the improvement in the health of our people.

The welfare of our people is our chief pride, and it is by this that we ask to be judged’.

Immediate post independent African development strategies focused on eradication of poverty, ignorance disease, colonization, apartheid, and ‘dependency’ (i.e. structural bottlenecks to economic development). This was to be achieved through a combination of large scale industrialization (including but not limited to import substitution industrialization) and public provision of (free) education, health and social services. This development strategy was also rooted in a foreign and trade policy oriented towards decolonization and abolition of ‘unequal exchange’ in trade between Africa and advanced economies. Many African countries, whether they leaned ‘East’ or ‘West’ (in the context of the Cold War divide), deployed some version of this grand development strategy. In most cases, willingly or unwillingly, this strategy came to be known as ‘African Socialism’.

There were different definitions, interpretations and variants of African socialism (e.g. Nyerere’s Ujamaaism in Tanzania; Uganda’s Common Man’s Charter; Kaunda’s Humanism, Leopold Sedar Senghor’s version in Senegal and Kenya’s African Socialism). In the context of the Cold War, many critics were quick to see the various forms of ‘African socialism’ either as a disguise for, imitation of, or reaction to Soviet or classical socialism or as clever by half attempts to achieve some kind of non-alignment. Few recognized their potential for what their proponents claimed they were – and what they might as well could have become, if either the superpowers had not been determined to manipulate them one way or another, or if their own proponents had the competence, commitment and fidelity to diligently implement them: an African version of a social market economy or social democracy (i.e. an African version of Scandinavian capitalism or welfare state: ‘Ubuntu’, ‘Amana’, ‘Ujamaa’, ‘Harambeeism’).

Just sample excerpts from two of the founding documents of African socialism:

“There are two African traditions which form an essential basis for African Socialism – political democracy and mutual social responsibility. Political democracy implies that each member of society is equal in his political rights and that no individual or group will be permitted to exert undue influence on the policies of the

State. The State, therefore, can never become the tool of special interests, catering to the desires of a minority at the expense of the needs of the majority. The State will represent all of the people and will do so impartially and without prejudice...Mutual social responsibility is an extension of the African family spirit to the nation as a whole, with the hope that ultimately the same spirit can be extended to ever larger areas. It implies a mutual responsibility by society and its members to do with very best for each other with the full knowledge and understanding that if society prospers its members will share in that prosperity and that society cannot prosper without the full co-operation of its members. The State has an obligation to ensure equal opportunities to all its citizens, eliminate exploitation and discrimination, and provide needed social services such as education, medical care and social security...African Socialism

“Mutual social responsibility is an extension of the African family spirit to the nation as a whole, with the hope that ultimately the same spirit can be extended to ever larger areas.”

must be politically democratic, socially responsible, adaptable and independent” (Republic of Kenya, African Socialism and its Application to Planning in Kenya, 1965).

“We hereby commit ourselves to create in Uganda conditions of full security, justice, equality, liberty and welfare for all sons and daughters of the Republic of Uganda and for the realization of those goals we have adopted the Move to the Left Strategy...We subscribe fully to Uganda always being a Republic and have adopted this Charter so that the implementation of this Strategy prevents effectively any one person or group of persons from being masters of all or a section of the people of Uganda, and ensure that all citizens of Uganda become truly masters of their own destiny...We reject, both in theory and in practice, that Uganda as a whole or any part of it should be the domain

of any person, of feudalism, of Capitalism, of vested interests of one kind or another, of foreign influence or of foreigners. We further reject exploitation of material and human resources for the benefit of a few...we hereby re-affirm our acceptance of the aims and objective...To fight relentlessly against Poverty, Ignorance, Disease, Colonialism, Neo-Colonialism, Imperialism and Apartheid...To plan Uganda’s Economic Development in such a way that the Government, through Parastatal Bodies, the Co-operative Movements, Private Companies, Individuals in Industry, Commerce and Agriculture, will effectively contribute to increased production to raise the standard of living in the Country...To protect without discrimination based on race, colour, sect or religion every person lawfully living in Uganda and enable him to enjoy the fundamental rights and freedom of the individual, that is to say: Life, Liberty, Security of the person and Protection of the Law; Freedom of Conscience, of expression and association; Protection of Privacy of his home, property and from deprivation of property without compensation... To ensure that no citizen of Uganda will enjoy any special privilege, status or title by virtue of birth, descent or heredity”: (Uganda People’s Congress, The Common Man’s Charter, 1969.)

Of course, the proponents of African Socialism did not succeed in advancing the high minded political, economic and social ideals embodied in these documents. In the widespread betrayal and mockery of the promise of African independence, and of the principles and ideals of African Socialism by the first (and for that matter, subsequent) generation(s) of African leaders that followed, the entire immediate post independent development innovation was thrown out with the bath water of its discredited political leadership. The practice (more than the policy) of African socialism and development innovation in the immediate post-independence period deserves severe criticism. Africans would do well to partake in self-flagellation on account of their collective failures to fulfill the promise of African independence and the development innovation it spawned. Half a century of lost opportunities later, the continent is virtually back to square one: talking about structural transformation; eradication of poverty, ignorance and disease; unfair trade agreements; the limits of foreign aid and a new promise of ‘Africa rising’.

Once a tragedy, twice a farce. The failures of early development innovation in Africa should not have led to the wholesale dismissal of the entire enterprise. Sadly, this is what happened with

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the structural adjustment programmes (SAPs) of the 1980s and 1990s. The wholesale dismissal of early African development experimentation is tragic because a lot of crucial lessons from that experiment gets lost and the entire development policy making in Africa risks being turned into a farce. The critical lessons that get lost include the following: (a) Africa can be ahead of the curve in identifying the causes of its underdevelopment and in devising solutions for them; (b) the African development challenge consists of 'Big Questions (i.e. eradication of poverty, ignorance and disease) which requires a big response or structural transformation or 'Big Development' – a massive, large scale undertaking that taxes the physical and intellectual resources of the African population to its limits; (c) 'Big Development' works - in Africa as elsewhere.

In identifying poverty, disease and ignorance as the fundamental challenges of Africa's development, the immediate post independent development strategy was not only absolutely spot on but was also well ahead of the curve in development theory, policy and practice.

It predated the UN Millennium Development Goals (MDGs) by at least four decades. We now know, from the experience with the MDGs that with sufficient attention and resources, extreme poverty (defined as severe deprivation of basic human needs, such as food, safe drinking water, sanitation facilities, health, shelter, education and information) can be reduced significantly within 2 or 3 decades, depending on initial country conditions, economic growth and income distribution. In 20 years (between 1990 and 2010) the global poverty rate was cut in half from 43 percent to 21 percent. This has led Bill Gates, who has taken on the task of eradicating poverty and any number of diseases in the world - with more seriousness than exhibited by any African government - to predict that by 2035, there will be almost no poor countries left in the world. This is the rare case in which Gates is being less ambitious. Jeffrey Sachs, a Columbia University economist, thinks that extreme poverty can be eliminated globally by 2025. If all this appears too ambitious, now consider that African countries were committed to eradicating poverty, ignorance and disease from the continent straight out of the gate from the time of their independence.

This is what I call 'Big Development'. The immediate post independent African development strategy had it right. Current development strategies on the continent do not. Economic growth and income distribution are the keys to poverty reduction. By one estimate, a 1% increase in incomes cuts poverty by 0.6% in the most unequal countries. However, a 1% increase in incomes cuts poverty by 4.3% in the most equal countries. African socialism had income distribution covered. Its economic growth record in some countries (not all) was hampered by its tendency to distort prices through excessive price controls and regulations but this was a problem that could have been solved without shelving many of the high minded political,



Besides having the world's highest rate of extreme poverty, Africa is in fact the world's second most inequitable region after Latin America.



social and economic ideals. At any rate, if Africa had enjoyed the kind of economic growth it has witnessed over the last two decades since the 1960s (with the same income distribution trajectory of the African socialism era), chances

are the continent would have witnessed reductions in poverty very similar to China's – which accounts for the bulk of the global poverty reduction over the last two decades.

Africa may be enjoying some of its highest economic growth rates in a generation, but in many countries, this has been accompanied by sharp rises in income inequality. Besides having the world's highest rate of extreme poverty, Africa is in fact the world's second most inequitable region after Latin America. In 2010, six out of the 10 most unequal countries in the world were in Sub-Saharan Africa. This is exacerbated by the politics and economics of exclusion: by ethnicity, region, faction, gender, class, disability, etc. Barring a fundamental shift in development strategy, this is going to make the task of poverty reduction on the continent much harder, in spite of all the present economic optimism. Consider that even with these terrible income inequality figures, economic growth over the last two decades has contributed to significant poverty reduction in sub-Saharan Africa.

In 2010, for the first time since 1981, less than half the population of Sub Saharan Africa lives in extreme poverty. According to the World Bank, in 2010, 414 million people (or 48.5 percent of the African population) were living in extreme poverty across sub-Saharan Africa (i.e. living on \$1.25-a-day). In just one decade (1999-2010), even with its income inequality levels, Sub Saharan Africa witnessed a 17 percent decline in extreme poverty rate. This decline would almost certainly be deeper if some of the larger African economies such as Nigeria Ghana, Kenya and Senegal as well as relatively smaller economies such as Zambia and Malawi would have been more 'equal' in terms of their national income distributions.

Secondly and more importantly, the focus on poverty, disease and ignorance and their 'origins' anticipated a vast body of theoretical and empirical economic work that would later either investments in health and education to increased economic growth and identify geography (location, disease incidence), history (i.e. slavery, colonialism) and institutions (culture, customs, slavery, colonialism) as the ultimate causes of underdevelopment in Africa. A recent study published in the Lancet (Global Health 2035: A World Converging Within a Generation) found that 'reductions in mortality account for about

11% of recent economic growth in low-income and middle-income countries as measured in their national income accounts’.

The returns to investment in health are even higher when a different, more useful indicator – value of additional life-years or (VLYs) is used. The study found that between 2000 and 2011, ‘about 24% of the growth in full income in low-income and middle-income countries resulted from VLYs gained’.

A vast body of literature confirms the social profitability of investments in education – whether at primary, secondary or tertiary levels. Returns to investments in education appear to be more sensitive to a country’s level of economic development. Investments in primary education appear to be most socially profitable in low-income countries while investments secondary and tertiary education appear to be most socially profitable in middle income and high income countries respectively.

This suggests that as African countries develop, they need to shift their emphasis from new or expansion of investments in primary and secondary education to higher education. This is not unlike the model most African countries adopted between 1960s and 1970s. Structural adjustment severely disrupted this model in the 1980s and 1990s with severe cuts to investments in health and education at virtually all levels. While a focus on the MDGs has refocused attention on these two sectors, the focus has been more incrementalist and ‘small bore’ rather than of a ‘big development’ variety (large scale, universal access, big budgets, large commitment of physical and intellectual resources).

The foregoing is not an argument for a return to the African development strategy of the 1960s and 1970s. For all its ‘local ownership’, idealism and foresight, that strategy had a number of inherent weaknesses and it ultimately failed. The fundamental development challenges facing Africa may have remained the same but the continent’s development landscape and circumstances have changed. The rise of the internet, mobile telephony, the digital and revolutions, coupled with changing demographics and discovery of natural resources present African countries with unique opportunities for economic development. The foregoing is an argument for identifying what worked from

the old development model with a view to determining how best to bring that insight ‘back in’ to present economic and development policy making in Africa.

So what did work in the early development innovation and what is missing now?

- ‘Africanus economicus’ or ‘African economics’: the ability of African economists, policy makers and intelligentsia to identify Africa’s development problems and to propose solutions to them. Early African development thinkers and practitioners were right on the money with their development diagnosis and – for the most part - proposed policy solutions. They failed in the execution of the strategies but they deserve credit for their intellectual independence, especially their rejection of the premise that economics is generalizable over space and time. One reason why this appears to have worked in the immediate post independent period seems to be that for all their flaws, of which there are many, the first generation of African political leaders were not just accomplished thinkers and scholars, they were beacons of Africa’s cultural achievements. They had spent considerable time thinking about the questions of independence, underdevelopment, the African identity, personality and dignity. Many were in fact philosopher-presidents or poet-presidents: Nnamdi Azikiwe, Julius Nyerere, Leopold S. Senghor, Agostinho Neto, Henri Lopes, Kwame Nkrumah, Jomo Kenyatta, Hastings Kamuzu Banda, Milton Obote and Kenneth Kaunda. Furthermore, they were ably supported and challenged (in equal measure) by an entire movement of African intellectuals who had spearheaded the efforts to purge modern literature, history, philosophy and social sciences of racial prejudices and Euro-American ethno centrism: (a) the rejection of ‘darkness’ as the defining experience and image of Africa through the intertextual debate or dialogue (to borrow Julia Kristeva’s theory of intertextuality or the dialogism of Mikhail Bakhtin) between European ‘colonial’ works (most notably, Joseph Conrad’s *Heart of Darkness*, Joyce Cary’s *Mister Johnson* and H. Rider Haggard’s *King Solomon’s Mines*) and those of pioneering writ-

ers of the African Writers Series (Chinua Achebe, Ngugi wa Thiongo, Sembene Ousmane, Camara Laye) and the ‘lexicographicide’ (or deliberate ‘murder’ or ‘Africanization’ of the English language) of Taban Lo Liyong, Okot, P’ Bitek, Okello Oculi and Joseph Buruga; and (b) the heroic efforts of African and Africanist historians to reclaim the African space in the historiography of human civilization (e.g. Cheick Anta Diop, Bethwell, A. Ogot, Ali Mazrui, John D. Fage, Jan Vansina, Roland Oliver and Robert July).

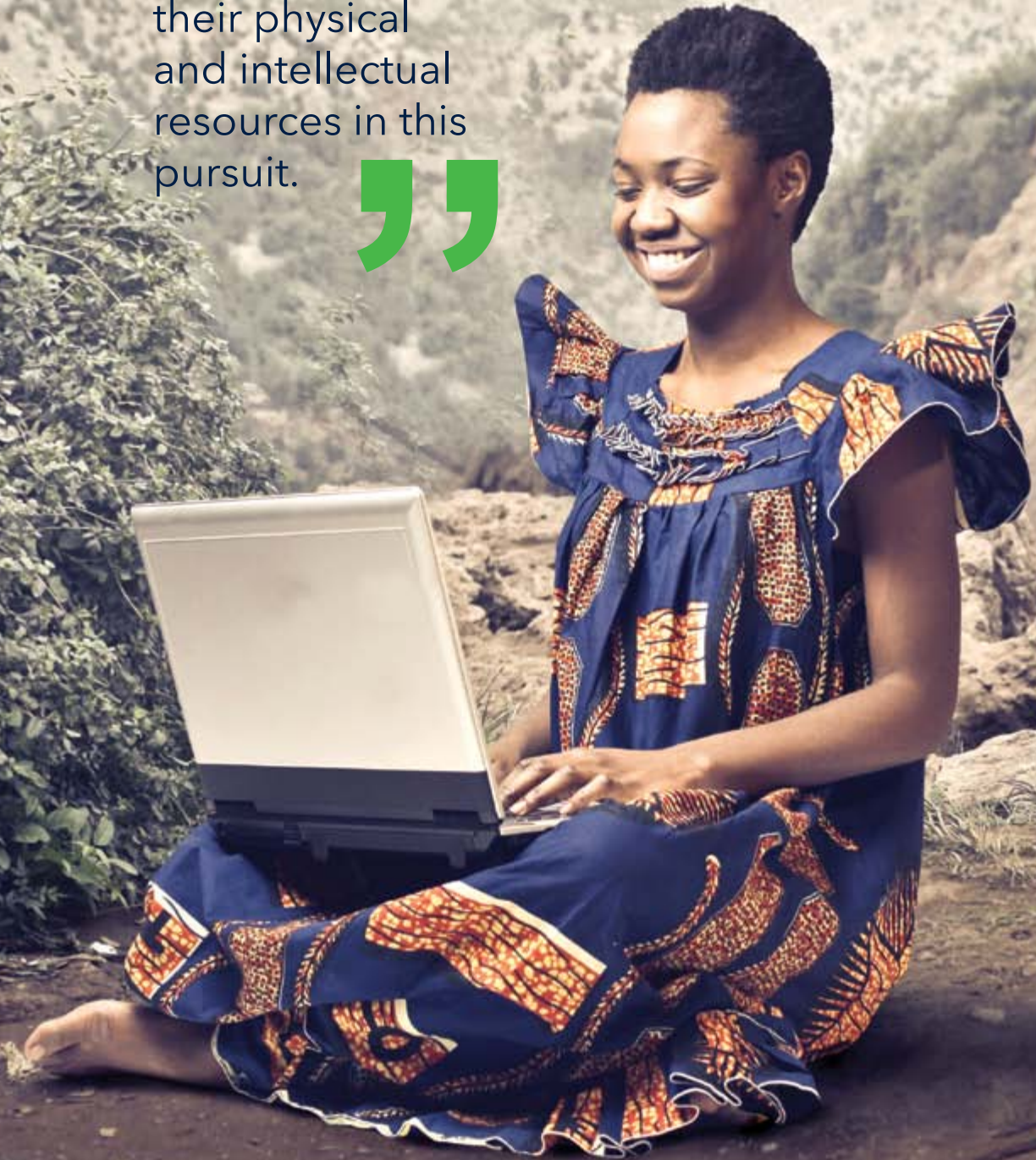
For a time, albeit very briefly, the first generation of African leaders were not so much leaders as followers. In contradistinction, today, Wole Soyinka laments that Africa’s future is determined by politicians rather than artists. Many of these politicians, having not spent much time grappling with the questions of underdevelopment and independence, and having excluded much of the intellectual, scientific and artistic community from the African nation building project, find it easy to cede the task of thinking through solutions to Africa’s problems to outsiders. To put Soyinka’s lament in context, there was a time when African presidents would go to African campuses and engage scholars in heated exchanges over questions of Africa’s independence, sovereignty and identity – or write well-reasoned opinion pieces in national newspapers making the case for their policy choices, however unpalatable. Emperor Haile Selassie of Ethiopia attached so much importance to the role of education in development that for 20 years, he doubled up as the country’s Emperor and cabinet minister for education. Today, there is no effort on the part of the African political class to engage the African intelligentsia on the important questions of economic development and political democratization of the continent. The only cabinet position many of them hold dear and often assume personal charge of is the ministry of defense.

- ‘Big Development’: A comprehensive focus on ‘big questions’ and ‘ideals’ of development – a unified and coherent political, economic and social system anchored in democracy, liberty, equality social justice, economic transformation, social

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Correcting the negative imagery of Africa is primarily a development task. They should enlist in this task in ways that would fully exhaust their physical and intellectual resources in this pursuit.

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prosperity and mutual social responsibility (an institutionalized form of social safety net or security). The early African development strategy started out from a focus on real problems and went out looking for solutions. For the most part, this entailed policy experimentation rather than ideologically predetermined 'solutions'. Today, there is no shortage of predetermined policy solutions in search of development problems in Africa. The early development innovation in Africa sought solutions for economic structural transformation, eradication of poverty, disease and ignorance, 'equal exchange' in international division of labour, decolonization and an end to the apartheid regime in South Africa. That development strategy failed in many of its objectives but it did succeed in two key ones: decolonization and abolition of apartheid.

It is taken for granted now but a key task of newly independent African states was to fight for the complete liberation of the continent from colonial rule. Political independence looks self-evident now, but it wasn't as recently as 20 years ago. The point had to be made – intellectually, morally and in blood, tears and broken bones. Political decolonization of the continent is a job that Africa did well. By 1980, virtually all of Africa was free from colonial rule although Namibia and South Africa remained under minority and apartheid rule. By 1994, the entire continent was free of colonialism and apartheid. The political, humanitarian and economic costs of decolonizing the continent were not insignificant. The so called frontline states, especially Tanzania and Zambia, bore a particularly high burden in the liberation of Zimbabwe, Angola, Mozambique, Namibia and South Africa.

In spite of these costs, decolonization and the anti-apartheid struggles were popular movements in which ordinary African citizens exercised collective leadership and responsibility. Masses of people rose up in arms (e.g. the Maji, Chimurenga, PAIGC and Mau wars), civil disobedience, economic and cultural boycotts and all manner of protests to demand African independence and to reassert the concept of African dignity, personality and identity. This was not simply limited to the political or intellectual sphere, it was also a cul-

tural independence movement.

Today, a new(ish) generation of African scholars and (social) media activists are obsessed with providing universal basic education in political geography of Africa under the rallying cry, 'Africa is Not a Country'. Numerous scholarly articles, websites, Facebook and Twitter posts have been generated on this meme. A personal favourite is Binyavanga Wainana's treatise: "How Not to Write about Africa in 2012"! For all its noble intentions, the 'Africa is not a Country' crowd is missing the point. For Africa is indeed a Country! Let's get on with it! Contemporary viewers of Africa as a country, and perhaps some of their harshest African critics may not know that the ideology that asserts that the history and destiny of all African peoples and countries are inextricably intertwined has a long, distinguished and revered tradition in Pan African ideological, philosophical, political, intellectual and development thought. The ideological construction of Africa as a 'country' dates back to the Sons of Africa Abolitionist Movement in 18th Century England (e.g. Ottobah Cugano and Olaudah Equiano) and continues in the 19th (e.g. Henry Sylvester-Williams) and 20th centuries - Kwame Nkrumah, Julius Nyerere, Sekou Toure, W.E. B. Dubois, George Padmore, Marcus Garvey, Haile Selassie, Gamal Abdel Nasser and Ben Bella. What those who see Africa as a country get, which their supposedly geographically erudite critics do not is that Africa is a 'social construction' whose meaning is contested. Africa is not just a physical geographical or political geographical entity. It is also a historical and ideological construct.

Yes, Africa is a political construct (as in nation-states) as the proponents of 'Africa is Not a Country' point out. But Africa is also an 'ideological construction' – a short hand for poverty, ignorance and disease for those who see it as a 'country' or for those who see it in Pan African terms – a land mass of a people with a shared geography, culture, formative history and political and economic destiny. Africans may prefer to see Africa as a geographic or political entity of 54 nation states but that is no reason why others must see it that way too. If for some Africa is a shorthand for poverty, ignorance and disease,

challenging their views or persuading them to see Africa differently requires not a tutorial in political geography, but changes in the material conditions that provide some support for such an ideological construction of the continent. The fundamental task facing the 'Africa is not a Country' crowd is a bit more complex than a satirical tutorial. Correcting the negative imagery of Africa is primarily a development task. They should enlist in this task in ways that would fully exhaust their physical and intellectual resources in this pursuit.

To be sure, there are material or 'real life' consequences to the conception and portrayal of Africa in negative terms. As the recent global panic over the Ebola virus disease has shown, the perception of Africa as a 'country' can have real economic, cultural and political consequences on individual citizens and countries of Africa. Afro-pessimism, partly generated by negative and misleading portrayal of Africa has been attributed, at least in part, to low levels of foreign direct investment, capital flight and brain drain in Africa. Given the material consequences of the geographical (and other) misunderstanding (s) of the continent, the effort to set the record straight is worthwhile. Individual and collective well-being of the African people depends on it. My point is not to belittle the effort. Rather, it is to try to direct it to the 'bigger question' at stake.

After all, it is easy to dispatch of the arguments of the 'Africa is a Country' population. The facts are that:

- In terms of nation-states, Africa is not a country but 54 different countries (note that Africans generally reject the balkanization of the continent into North Africa, Sub Saharan Africa, and South Africa. Instead they use, in their definition of the continent, the literal physical geography of the continent, and the political entities constituting the African Union);
- Of the 20 largest famines of the 20th century, only one (i.e. the Ethiopian famine of the 1980s) was in Africa. It should however be noted that the last famine in Europe occurred in the Soviet Union in 1946-47; the last famine in China occurred in 1958-62; the last major famine in India occurred in Bengal in 1943 (i.e. no major famine has occurred in India since the country's independence in

1947) and the last major famine in the whole of South Asia occurred in Bangladesh in 1974. In effect, since at least 1975, vulnerability to famines has been eradicated in the rest of the world outside sub Saharan Africa.

- Until very recently, a majority of the people living in extreme poverty lived in China and South Asia (India, Bangladesh, Indonesia and Pakistan). In any case, poverty itself, defined in one sense or another, has been a common and persistent occurrence in all countries throughout human history. To date, it remains, in various pockets and manifestations, even in the richest countries on earth. Why it should be the defining characteristic of Africa is arguably puzzling.

The list could be longer, the supporting arguments more watertight, but in the end, what is to be gained by winning this argument? That Africa is 54 different countries? That famines may occur regularly in Africa but they have been much worse elsewhere? That the condition of poverty in Africa might be bad but it has been worse elsewhere? The fundamental question of African development in the 21st century must be bigger than this.

How can the lessons of the early development innovation be brought to bear on the current development situation in Africa? By formulating an African development strategy that integrates Big Questions and Big Development with Big Data and Big Science to take advantage of once in a generation opportunity and to finally transform Africa into an advanced economic and scientific region.

Big Data

Big Data is an umbrella term for the explosion in the quantity and diversity of high frequency digital data. It refers to data sets that are so large that typical software tools are unable to capture, store, manage, and analyze them. Often times, big data requires a supercomputer or smart machines to analyze. It is estimated that the worldwide volume of data will double every two years, reaching a global total of 40 zettabytes by 2020. To put this into context, the world's total data storage capacity in 2012 was only 2.7 zettabytes. According to the World Economic Forum, big data is high volume, high velocity, and high value and includes a high variety

of sources of information. The World Economic Forum compares the data boom of today to the Texas oil boom of the 20th century or the California gold rush of the 19th century.

Data is collected everyday by a variety of sources on almost all of our activities. Almost every activity we undertake can be transformed into a data point. Data is collected every time we make a phone call, send an SMS, purchase a good or service, drive in a car with a GPS system or visit a hospital, bank or a foreign country. This data collection is being done not only by private corporations, but by governments, financial institutions, health service providers, international development organizations (e.g. UN, World Bank, IMF), NGOs, et cetera.

In order to know what we need to know, be it in business or development policy making, we need to have a way of gathering the necessary data and analyzing it. Big Data analytics entails finding out what we need to know to figure out new, timely, and nuanced analysis of drivers of human behaviour, economic technological, environmental and climate change. By understanding what drives these changes, Big Data has the capacity to allow us to design smarter, more effective or impactful sustainable development policies.

Big data is not just a developed country phenomenon. Big Data is collected on a large scale in countries like Kenya where 77 percent of the population has a mobile phone, 50 percent have access to the internet, and where the revolutionary mobile money application, MPESA is widely used. The high penetration rates of mobile phones in rural, hard to reach, and even war torn areas provides the potential to gather large scale data sets in places where data has never been collected on such a scale before. The data being collected can shed new light on demographic changes, epidemiology tracking, urban planning and infrastructure, weather patterns, food security early warning systems, habitat loss, environmental degradation and climate change.

Examples of applications of big data for development purposes in Africa abound, albeit on relatively pilot and isolated cases:

- By tracking population movements through cell phone data and by running analytics on social media, opt-in services such as the Kenyan based

Ushahidi have made it possible for humanitarian organizations to better understand and respond more quickly and effectively to crises. Ushahidi allows people to text in and report cases of human rights violations or political violence.

- By looking at population flows and conducting real time CCTV analytics to better understand traffic issues, cities can better plan for and accommodate their increasing urban populations by building smart cities that have adequate health, water, electricity, education, public transportation infrastructure (e.g. Abidjan).
- Engineering Social Systems (ESS) in Kenya is overlapping mobile phone data with census data to model the growth of slums in Nairobi, enabling city planners to better plan for and build public services such as water pumps and public toilets.
- Opt-in surveys: With mobile phones, short surveys can be sent to anyone anywhere in the world to collect data on any subject or sector. For example, Geo Poll, recently ran an SMS survey of 10 questions in the eastern Democratic Republic of Congo (DRC) on violence and rape and received 1.2 million text responses.

These examples are indicative of the potential applications of big data for economic development in Africa. However, the present reality is that big data is vastly under-utilized in Africa. Few if any Africa countries have developed policies aimed at big data for economic development. Large scale harnessing of big data for development in Africa is hampered by severe obstacles: lack of big data infrastructure and software (supercomputers, smart machines and analytics software); human capital (i.e. human analysts); regulatory frameworks (protective of privacy, intellectual property rights and 'inclusivity'); and finance (supercomputers and smart machines don't come cheap; training software engineers, data analysts, statisticians and economists costs money).

In spite of the costs involved in building the hardware, software and human capital infrastructure for harnessing big data for development, the potential social returns to these investments are so large that this consideration needs to feature in Africa's public finance and economic planning. Unless African governments make the strategic choice to invest



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‘big’ in Big Data infrastructure, they will continue to sit on large quantities of data that have potential to transform and quicken the pace of the continent’s economic transformation.

To harness the applications of big data for Africa’s economic development, African countries will need to do the following as a matter of urgency:

- Big Data Policy for Development: Formulate a policy that seeks to harness big data for development, especially eradication of poverty, ignorance and disease.
- Investments in Big Data Infrastructure, Software and Human Capital
- Big Data Privacy and Ethical Policy to protect the fundamental freedoms and civil liberties of citizens to ensure that big data is utilized to enhance human rights and freedoms in Africa rather than to limit them or to strengthen the police state in Africa
- Fostering Public-Private Partnerships in the development of big data infrastructure, software, expertise, collection, storage, analysis, access and use.
- Develop an open data policy
- Big Science (see below)

Big Science

Big science can be defined as large scale, monumental scientific enterprises, which whether necessary to the

survival of given societies or not, tax them to their physical and intellectual limits. Big science involves large-scale scientific projects that are usually funded by national governments or groups of governments (e.g. the Manhattan or US Atomic Project, Space Exploration, the CERN Large Hadron Collider, the Human Genome Project, National Laboratories (e.g. the 17 US National Laboratories run by the Department of Energy in conjunction with leading US universities: Los Alamos, Lincoln, Lawrence Livermore, Lawrence Berkeley, Argonne, Radiation, Ernest O. Lawrence, Brookhaven, Oak Ridge, etc).

Big science exploded in industrial nations during and after the Second World War, initially for military purposes (i.e. the atomic project) but later for more peaceful or economic purposes (e.g. space exploration and the Human Genome Project). Big science is characterized by at least four features:

- Big budgets: the scientific project is funded by large grants from government, groups of governments, industry or a combination of all three.
- Big staffs: Hundreds if not thousands of multidisciplinary, multinational teams of scientists, engineers, social scientists and other experts.
- Big machines: e.g. supercomputers. The cost of installing and running supercomputers can run into millions or hundreds of millions of dollars (from the lower end of about \$ 5 million to well over \$ 100 million).

- Big laboratories: Centralization of scientific research in large laboratories to enhance cost effectiveness of basic research.

Big science was forcefully championed, during and after WW11, by some of America’s leading scientists, university administrators, technocrats and captains of the defense industry in what would later become the US military-industrial-academic complex: the triangular model of government, industry and academic collaboration in funding research and innovation. The person most credited with pioneering this model was America’s ‘General of Physics’, star scientist and public administrator,

Vannevar Bush.

Vannevar Bush had a string of record breaking accomplishments. Among others: he built an early analog computer known as the Differential Analyzer in 1931; he founded the electronics and defense company Raytheon; was Dean of the MIT School of Engineering; helped found and lead the US National Defense Research Committee and the Office of Scientific Research and Development; helped found the US National Science Foundation; oversaw the programmes to build the US’ first atomic bomb, radar and air-defense systems. More importantly for our purposes, Bush wrote the famous Report to President Truman, ‘Science, the Endless Frontier’, which makes one of the strongest cases for Big Science or why government funding of basic research,

jointly with universities and industry, can be in a country's national economic and security interests.

In 'Science, the Endless Frontier', Bush made the case for the role of science and engineering in society that should be mandatory reading for all African leaders, bureaucrats, university administrators, scientists, private sector, civil society and development partners: "Basic research leads to new knowledge. It provides scientific capital. It creates the fund from which the practical applications of knowledge must be drawn... New products and new processes do not appear fully grown. They are founded on new principles and new concept, which in turn are painstakingly developed by research in the purest realms of science. A nation which depends upon others for its new basic scientific knowledge will be slow in its industrial progress and weak in its competitive position in world trade...Advances in science when put to practical use mean more jobs, higher wages, shorter hours, more abundant crops, more leisure for recreation, for study, for learning how to live without the deadening drudgery which has been the burden of the common man for past ages".

Bush was writing several decades before advances in economic growth theory would reinforce his argument by confirming the increasing role of science,

technology and innovation as the main driver of economic growth in the advanced economies. Today, 'Big Science' is nearly ubiquitous in advanced and emerging economies, be it physical or life sciences. Scientific research is increasingly conducted in the form of large, expensive and collaborative 'Big Science' projects often involving multi-disciplinary and multinational teams of natural and social scientists, engineers and other experts.

Therein lies the case for 'Big Science' for 'Big Development' in Africa. Besides the contributions of science, technology and innovation to economic growth and development – highlighted above and confirmed by economic growth accounting – 'Big Science' is particularly suited to Africa's development conditions and challenges. Science, whether big, medium or small is expensive: in terms of equipment, human capital (training of scientists); time and money. For this reason, among others, Africa has been lagging behind in 'Small Science' let alone 'Big Science'. Were Africa to make a breakthrough in the field of Small Science, this would still not be sufficient for its economic development. While the theoretical results of individual or small groups of individual researchers (i.e. small science) may be significant, often their empirical verification would require experiments using large expensive laboratories, equipment

or effort, without which few if any economic benefits would flow from that research.

Africa has very scientists per capita (although the few it has includes world class scientists as argued elsewhere in this magazine). It also has limited financial resources per country. However, the bulk of the countries in Africa, especially sub Saharan Africa shares common or similar development challenges. In this situation, it makes economic and scientific sense to pull together expertise, infrastructure and financial resources to initiate a few large, if expensive Big Science collaborative projects directed towards finding lasting solutions to the three common and fundamental development challenges in Africa: eradication of poverty, ignorance and disease. This might include Biomedical Research; Space Research; Nuclear Science and Technology for Socio-economic Development; Biotechnologies for Development, Nanotechnologies for Development, Information and Communication Technologies (ICTs) and Materials Sciences and Technologies for Socio-economic Development.

Many African countries already have nascent initiatives in all of these areas:

- The African space programme; the African Leadership Conference on space science and technology for sustainable Development (ALC);



The Kariba Dam

national space programmes in South Africa, Nigeria, Ethiopia, Kenya; the Square Kilometre Array (SKA) astronomy project currently involving South Africa and 10 developed and emerging economies; etc.

- The nascent national nuclear science and technology for socio-economic development initiatives (South Africa, Kenya, Ghana, Namibia, etc) and the African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA)
- The Botswana Innovation Hub and other nascent national science and technology parks across the continent
- The Ghana-India Kofi Annan Centre of Excellence in ICT in Ghana and other nascent Super Computer or High Performance Computing projects on the continent.
- The National and regional Nanotechnology for Development initiatives
- National biotechnology research and development initiatives

All of these are excellent candidates for an integrated Big Data, Big Science, Big Development Strategy in Africa post 2015. Apart from for the Square Kilometre Array and the South Africa and Nigerian space programmes which are truly 'Big Science' projects, many of the above initiatives are still being treated as 'Small' or 'Meso' Science projects. This won't work for Africa's development purposes. Neither space, nuclear nor nanotechnology programmes can be had on the cheap. Given the scale of financial, physical and human resources needed for space, nuclear, nanotechnology, high performance computing and biomedical research (e.g. laboratory biology, genomics) Africa must get this right the first time. That means Big Science and Big Development. This has budgetary, educational, social and economic implications worthy of a substantive debate that many of the countries embarking on these initiatives are yet to have.

As Melvin Kranzberg argued decades ago, technology is not inherently good, bad or neutral. The degree to which it becomes one or the other depends on among others, the purposes of its invention and the functions for which it is deployed. This applies to small or big technologies. Africa has spent a considerable amount of time and resources on 'small technologies'. These are necessary but

not sufficient for its development purposes. It must now consider investing time, intellectual and financial resources into big Big Science or big technologies, in addition to, rather than at the expense of small science and technologies. To paraphrase Gunnar Myrdal: In this era of Africa rising, it would be pathetic if African countries got caught in the predilections of investigator led Small Science project funding instead of strategic Big Science for development funding. Africa should gather the courage, foresight, ambition and reason to embark on Big Science projects geared towards solving Africa's fundamental development challenges: eradication of poverty, ignorance and disease.

To be sure, ever since its evolution in the 1940s and 1950s, and in spite of its large scale spread through the decades, Big Science has received sustained criticism – much of it from leading scientists. While many of these criticisms hold for advanced economies, in the African context, some of the criticisms can easily be turned around as justification for Big Science. One of the earliest and most famous critics of Big Science was the British Astronomer, Sir Fred Hoyle who opposed Britain's adventure into large scale space research. Hoyle argued that the intrinsic scientific interest of space research was not worth the money and manpower that went into it and that there was little justification for spending more financial and human resources on space research than on any other branch of science. He also considered the huge financial and human resource investments in Big Science as capable of 'destroying' science through industrialization, bureaucratization and politicization of research or what Alvin Weinberg called "administratitits, moneyitis, and journalitis": the dominance of science by administrators rather than practitioners, the over emphasis on funding as a panacea for solving scientific problems; the effort to attract public support for large scientific budgets and projects through journalistic reporting, which might blur the lines between scientific and journalistic writing.

Variations of these arguments abound so one has an obligation to respond to this criticism if one is making the case for Big Science in Africa. On the specific case of the cost-benefit analysis of large scale space research, we know from studies of the economic impacts of the US Space Programme and space economy studies of the Soviet, European, UK, Japanese and other space

programmes that the economic and technological spillover effects of space research have been considerable – in the fields of medicine, communications, navigation, meteorology, earth resources exploitation and climate modelling. Chase Econometric Associates found for example that from 1960 to 1974, the rate of return on NASA R&D expenditures to the American society was 43 percent. Feasibly, investments in other fields of sciences could yield higher rates of return.

There is certainly no guarantee that investments in space research in African countries would yield such high returns. Nevertheless, the preponderance of economic evidence suggests that the R&D investments needed in Big Science projects such as space research tend to enhance a country's technological capacity, a key driver in long term economic growth. The psychological 'feel good' effect of such research and accomplishments can also not be underestimated, especially in a region like Africa, still struggling to discard its image as a land of poverty, ignorance and disease. As to whether investments in alternative fields of science would lead to higher rates of social returns, this is essentially an argument about strategic priority setting rather than an argument against Big Science per se. That one Big Science project can generate higher social returns than another Big Science project isn't an argument against Big Science. Rather, it is an argument about prioritizing between two Big Science projects – an argument African countries should take very seriously as they venture, timidly or full scale, into Big Science.

The criticism that Big Science comes with high risks of "administratitits, moneyitis, and journalitis" or bureaucratization, politicization and industrialization of science holds for advanced and African economies. In the African context however, this criticism can also be double edged. Yes, Big Science does transfer the control of research aims, goals and topics to bureaucrats (i.e. strategic funding of research priorities rather than investigator led funding of research priorities), when in an 'ideal' scientific enterprise, these questions and decisions should be determined primarily by scientists. Advanced economies facing no existential threats from poverty, ignorance and disease can afford this ideal. It is a luxury African countries and scientists cannot afford. After all, after everyone is killed by poverty, disease

and ignorance, there will be no science to be undertaken, whether small or big.

This is a sensational statement but poverty, ignorance and disease can place real constraints to the scientific enterprise, small, meso or big. The research topics for African scientists should have some connection to the continent's development challenges. In any case, when was the last time an African scientist operated in an 'ideal' scientific environment? If the research topic or goal is not set by the government, it is most likely set by the funding agency, often an overseas funding agency with its own interests which may or may not be consistent with Africa's development challenges? How can this scientific goal setting be better than strategic African development led scientific goal setting? Bureaucratization and politicization of research is risky business. The entire history of the African development experience suggests that African bureaucracies and bureaucrats can be dysfunctional, inept, and incompetent and corrupt – the worst possible combination for any scientific enterprise – so this would be a real risk in Big Science projects in Africa. But we also know that it is possible to build a clean, lean, competent and efficient bureaucracy for Big Science projects (or for general public administration for that matter). This is what Vannevar Bush and the US pioneered through the triangular military-industry-academic model of Big Science (all the criticism about wastage in parts of the system notwithstanding). Closer home, more recent evidence suggests that some African countries can build fairly competent and clean bureaucracies (e.g. Botswana, Mauritius, Rwanda, and Ethiopia).

Industrialization of research is not necessarily a bad thing. In the African context, it might in fact be the 'the magic bullet' for the continent's industrial and scientific advancement. Industrialization of research might be the vehicle for the continent to both industrialize and to develop a serious scientific and technological capacity, thereby creating a virtuous cycle. By learning to assemble the infrastructure, technical expertise, finances and administrative or bureaucratic capacity to oversee a few successful Big Science projects, within and between countries, the continent might develop the technical, managerial, infrastructural and financial wherewithal to launch and sustain a large scale industrialization programme, which would in turn necessitate and finance

further Big Science projects.

The risk of 'journalitis' often associated with Big Science might be also be a productive development in Africa. The need to secure public support for Big Science would ensure that the African public is both engaged and informed of Africa's scientific initiatives. This might mitigate the negative impacts of deadening "administritis" and corrupting "moneyitis" while fostering African and non-African appreciation of the continent's scientific and development achievements (i.e. eradication of ignorance and the purging of the continent's image as a place of poverty, ignorance and disease).



I have never understood why Africa as a whole has never had an explicit and aggressive pro development immigration policy, that is, one aimed at attracting highly skilled immigrants.



Big Science can potentially solve some of the problems often associated with scientific and development management in Africa. It can pull resources and expertise (including from other countries and the diaspora, hence having the potential to reverse the problem of brain drain). It can provide innovative organizational and managerial models for executing large scale and complex problems. It can also foster tacit knowledge or learning by doing while also enhancing the quality and capacity of national education systems by creating demand for high caliber candidates.

I have never understood why Africa as a whole has never had an explicit and aggressive pro development immigration policy, that is, one aimed at attracting highly skilled immigrants. After all, most Africans see the continent as a

political rather than an 'ethnic' or 'racial' construct, hence their opposition to the balkanization of the continent into North Africa, Sub Saharan Africa and South Africa. African countries with the largest multi-racial populations during colonial rule like Kenya and South Africa made this clear at the outset of their freedom movements. In fact Kenyans of Asian descent played a leading role in the country's struggle for freedom – as did South Africans of Asian and white descent. Amin's expulsion of Ugandan Asians was a stain on the continent – as is the penchant for Africa's political leaders to run factionalized, patron-client governments premised on an ideology of ethnic competition and exclusion. A majority of the African people take a very 'cosmopolitan' view to nationality and citizenship.

African countries are presently engaged in a race to the bottom trying to attract tourists and direct foreign investment. Spurred by the US\$22 billion annual remittances that the African diaspora sent to the continent prior to the Great Recession, the African Union, the World Bank and 25 African countries have launched diaspora programmes and policies to enhance the contribution of diaspora to Africa's development. While these are all important, collectively, they are all part of an unnecessarily narrow strategy. A strategic effort to attract highly skilled immigrants might provide real impetus to the efforts to attract tourists, FDI and diaspora into the continent. More importantly, Big Science Projects would be excellent vehicles for achieving all four. The Great recession provides an excellent opportunity for Africa to attract some highly skilled immigrants – as well as the African diaspora, not to mention foreign direct investment into the continent. (However, it doesn't bode well for the African tourism sector, but the contribution of tourism to Africa's development is often overrated). With the possible exception of the East Asian or the Asian economies in general, many of today's advanced economies have benefited immensely from immigration. A staggering 40 percent of the largest US companies were founded by immigrants or their children. This includes: Ford, Boeing, Walt Disney, AT&T, Kraft, Proctor & Gamble, U.S. Steel, UPS, Estée Lauder, DuPont, Goldman Sachs, Bank of America, Citigroup, General Dynamics, General Electric, Kohl's, Honeywell, Nordstrom, Pfizer, Merck, Budweiser, Heinz, Colgate, General Electric, Northrop Grum-

man, Lockheed Martin, McDonald's, Verizon, United Technologies, Comcast, News Corporation, IBM, Apple, Intel, eBay, Oracle, Amazon, Google, Brightstar, Yahoo, Sun, Qualcomm. A 'Big Development' strategy for Africa, to the extent that it is predicated on Big Science and Big Data would do well to consider a Highly Skilled Immigrant Worker Programme.

Having made the case for Big Science for Big Development in Africa, it is worth pointing out that Big Science does have one potentially serious risk. It can funnel research into particular directions and therefore preclude other potential lines of research or approaches. While rare, this can lead entire scientific societies (or countries) into false leads as was the case with post WW11 Soviet agriculture. In general, diversity in research (topics, aims, goals, approaches) is always superior to lack of diversity. For this reason, I am not arguing that Africa should avoid small or 'meso' research in favour of big science. My point is that for the purposes of its 'Big Development', Africa must begin to think beyond vague promises of promoting STEM (Science, Technology, Engineering and Mathematics) education or investing 1% or 2% of national GDP to R&D or to science, technology and innovation. The continent needs a coherent Big Development strategy, a strand of which will be Big Science for Development, which will in turn, have a coherent strategy for developing African economies as scientific nations or knowledge economies: inclusive of STEM education and research, Small Science, Meso Science and Big Science. This has implications far beyond economic, financial, education and industrial policies and strategies. Among other things it would require African governments to separate and 'ring fence' science budgets (separate say from the education budget); divide that science budget into a capital or development budget (i.e. for creating national laboratories or world class laboratories in physical, life or biomedical sciences; installing and running high performance computers; purchasing equipment); a resource budget (for funding strategically or development led and investigator led research through grants and other mechanisms) and an operational budget (for meeting the salaries of scientists, researchers and university professors).

Given the financial, infrastructural and human resource requirements of Big Science, any African country that

ventures into this field should expect its expenditure on science, technology and innovation to rise above the lame AU target of 1 or 2 percent of GDP per year. However, since Big Science in Africa should be inextricably intertwined with industrialization (of science) and development, the cost benefit analysis of such expenditure should be viewed in terms of its economy wide technological spill-over effects, including human capital formation and national absorptive capacity – besides the direct products and services of the effort. Instead of seeking foreign aid for conventional purposes from Western Europe, the US, Japan and China, African countries might want to re-orient their foreign aid towards financing Big Science projects.

No Policy Making by Ideological Hegemony, International Consensus or Groupthink

The opportunities presented by the internet, mobile technologies, the data revolution, changing demographics and geopolitical circumstances, present Africa with a rare opportunity to formulate a grand development strategy that takes advantage of Big Questions, Big Data and Big Science to accelerate Big Development in Africa. In 2015, China overtakes the US as the world's largest economy. It has done so through a development model full of innovation and experimentation. Africa should aim to follow China's lead within a few decades. It has the know-how, resources and access to technologies necessary for the task. The AU's Agenda 2063 sets a much longer timeline than is necessary for this task given the vast explosion of knowledge, technologies, resources and geopolitical opportunities at the disposal of the continent.

Development theory, policy and practice in general but especially in Africa, has been stripped of any creativity, innovation, ambition and independent thinking over the last three and a half decades through a combination of the ideological hegemony of neoliberalism and the imposition of well-intentioned but ultimately artificial and untested international consensus on 'best practice in development' This has led entire African countries into 'false leads', failed states, antiquated economies, ruined livelihoods and lost opportunities.

Africa's inability to take ownership and control of its development strategy has turned the continent into a tragicomedy, current Afro-optimism notwithstanding. In this great moment of 'Africa rising',

the continent should resist attempts at development policy making by international consensus, ideological supremacy or groupthink. The continent would do well to look critically at its development challenges and opportunities; follow impartial evidence; have the courage, spine and pride to set its own strategic priorities as well as the honour, faithfulness and grace to seriously, rigorously and diligently implement or execute its on development strategies. That might include Big Questions, Big Data, Big Science and Big Development or it might include something else. Whatever it is, it should be based on a sound reading of the theory and practice of economic development in historical perspective; current state of economic development in Africa; opportunities and challenges facing the continent – as individual countries or as a whole.

This does not mean that Africa need not subscribe to international development efforts such as the post 2015 Sustainable Development Goals (SDGs); information rich democracy (e.g. Sen's capabilities and entitlements or development as freedom); efforts to combat global climate change and ecosystem degradation; etc. It must indeed. But with the realization that these are 'basic minimum' conditions for economic development which cannot substitute for a national, regional or a continental grand development strategy for structural economic transformation.

ICTs AND STRUCTURAL TRANSFORMATION IN AFRICA POST 2015?



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for Economic Cooperation
and Development



Back in 2000, the international community demonstrated its commitment to tackling the most crucial challenge in the history of humankind – the fight against poverty, underdevelopment and hunger – by signing up to the Millennium Development Goals (MDGs). As 2015 approaches, the MDGs are now due for evaluation and the Sustainable Development Goals (SDGs), which are to succeed them, have to be discussed and concluded. However, the track record so far has been ordinary at best.

As we enter the post-2015 debate, we have to take an honest look at our efforts and think outside the box. Is our response still appropriate in our ever faster changing world? Are traditional forms of development cooperation still suited to today's rapidly changing environments and challenges?

The Horn of Africa has vividly illustrated these various challenges. Somalia, to many minds still the epitome of a failed state, may well find its way out of the power struggle it is caught up in. Then there are the aspiring countries of the EAC, which have committed themselves to building a stronger political and economic union, and the still fledgling state of South Sudan. All these countries face different challenges and have different capabilities and viewpoints.

So we have to take a broader view. There is no “one size fits all”. I have, for a long time, been preoccupied with questions about how to incorporate sustainability and good governance. And how concrete should a global program be? How complex can it be to have a global impact at UN level and still be adapted to each individual challenge? The bottom line is that it all comes down to outreach. Instead of talking about people, we should talk with them and use the development drivers they provide. It is essential to listen to their needs, to applaud their successes and to empower them to shape their future – even without us.

Development policy in the 21st century – even though alarmingly regularly associated with food aid, drilling wells and deploying school teachers –

is not about help, it is about collaboration. Instead of resolving the past, we need to shape the upcoming decade, a decade that is often referred to as the “decade of information”.

In fact, having the right information in the right place at the right time is what changes lives by paving the way for proper infrastructure, electricity or health care. To my mind, information and communications technology (ICT) – still the most underrated driver of change – has to play a major role in the post-2015 agenda.

The reason is pretty simple. Technical innovation influences the course of history – sometimes more than money and sometimes even more than political ideas. Would the Arab Spring have been possible without text messaging? How would the world know about the atrocities taking place today without video footage? Let’s take the example of the late Martin Luther and the invention of the printing press by Johannes Gutenberg in the fifteenth century. Without this technical innovation, Martin Luther’s translation of the bible would not have spread so quickly and so far afield. And indeed, it changed the course of history.

A couple of years ago, the expression “media consumption” meant barely more than listening to the radio and watching TV. Education, on the other hand, meant sitting in a classroom. Today, this has been replaced by people communicating in real time through social media. An unimaginable amount of data is floating in virtual space. ICT has a fundamental influence on education, the acquisition of knowledge, on how knowledge is used and on how it is spread. Take the online platforms of established universities, which are easily able to reach hundreds of times more students than their offline, attendance-based counterparts. ICT thus influences the very concept of education itself.

Recent decades have shown the growing influence of knowledge-driven media on most parts of our lives. ICT provides the infrastructure for a knowledge-based world economy. It is also a key technology for sustainable development. Using ICT, things do not only get faster. We can now achieve and do things that were impossible before. We can see this especially well in the interaction between media and education. It is not over-audacious to say that the

chances of changing people’s lives for the better have never been greater. SMS-based weather forecasts and up-to-the-minute market prices for farmers, remote diagnosis for rural hospitals or distance learning programs for students and pupils are the future of development outreach. We do not need to sink wells if we can provide people with expertise on ground layers and manuals. Why should we build roads if we can provide local companies with remote sensing? I call this empowerment by knowledge, and media as its means of transmission. Tailor-made applications such as M-Pesa can really make a difference. In combination with other appropriate technologies like small-scale solar systems, ICT can also be used also in villages to provide life-saving – or at least life-enhancing – information.

There is no doubt that all these technologies can – and will – develop a dynamic all of their own in aspiring countries. Their results, and their limitations, are far beyond the foreseeable. With the post-2015 agenda effectively setting the scene for the world we want to live in by 2030, we need to adapt ICT now. The SDGs have to reflect ICT with all its merits and downsides, not only on a technical level. Information technology is fast becoming an everyday component of our lives, whether in Africa, Asia or Europe. People – obviously not only in LDCs – have to be educated on the uses, benefits, shortcomings and perils of ICT. Powerful information might end up unleashing harm if it falls into the wrong hands. As much as information provides freedom, it might easily also facilitate surveillance.

This is the point where think tanks and thought leaders are required to act. Despite the obvious technical issues of ICT implementation – not every field hospital can afford teleradiology systems, not to mention the enormous challenge posed by rural electrification – the legal aspects also have to be considered. With Africa entering the decade of information, it is now time to put in place prudent regulatory frameworks at a national level, providing an adequate guarantee of privacy.

So far, four out of 16 SDGs proposed by the Open Working Group refer to ICT by name. So, although they are mentioned as a means of implementation rather than as a front-line target, ICTs have indeed gained recognition in the post-2015 process. While Goal 5 calls

for “[...] the use of enabling technology, in particular information and communications technology, to promote the empowerment of women”, Goal 9 demands that we “significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020”.

While African governments have already begun focusing on the latter and recognized the need for a strong digital infrastructure by placing it high on the NEPAD agenda, the discussion on ICT has remained primarily on the technical level. The SDG debate should avoid the mistake of merely focusing on numbers. What we need is a holistic approach, comprising social and legal aspects as well. We have to emphasize the right use and right regulation of ICT.

So we have to think ahead. Academics, citizens and politicians alike need to make their case now. Only by promoting the benefits of ICT as a major driver and lever in achieving our superordinate sustainable development goals, while also setting regulative boundaries for their proper use, can we allow their dynamic to unfold and pave the way for a development beyond paternalism and autocracy.

New means of communication provide vast possibilities for transparent administration and good governance. They enable people to review government actions and forge opinions regardless of their geographical, social or economic status. Democracy and political participation thrive on this public outreach. It is estimated that by 2017, mobile phone penetration in Africa will reach 97%. Every one of those mobile phone users will have at their fingertips the means to have their say. Let’s listen to them.

Civil society and the private sector are crucial if we want to achieve socio-economic growth and make a difference. Let us – all together – tackle the task of using new media and the means they offer us of making the world a little bit better. Because that is precisely what the post-2015 agenda is about.

** Günter Nooke also previously served the German Government as Commissioner for Human Rights Policy and Humanitarian Aid at the Federal Foreign Office.*

DEVELOPING INNOVATION ECOSYSTEMS IN AFRICA

A NEW APPROACH TO ECONOMIC GROWTH, SUSTAINABILITY AND SOCIAL INCLUSION

Prof. Dr. Stefan Schepers
Formerly, Secretary General of an Independent, Tripartite High Level Group on Innovation Policy Management in the EU

Technology has always determined the quality of life of people. From the invention of the first agricultural tools, millennia ago, to the widespread use of new digital technologies such as the mobile phone, technology has gradually changed economies, social life and people's views. With the appearance of modern science, however, the speed of technological change has increased. Science and technology nowadays determine more than ever the competitiveness of countries and the welfare of peoples.

However, it is not always fully appreciated how to stimulate their development and how to steer the complex processes from invention to innovation, in whatever sector, be it ICT or agriculture, industrial manufacturing or services, or government and management. Management in companies, large or small, and governments of countries, including regional and municipal government, play an important role in creating the framework conditions for people to innovate.

When one considers the most successful countries worldwide, those at the top of innovation or global competitiveness ranking, then one will discover that they have all developed systemic conditions to stimulate innovation. Increased funding may lead to more research, but it will not necessarily bring more innovation in markets and thus more economic growth and social improvements. Moreover, a lot of innovation nowadays is consumer driven, which is why an open, bottom-up approach to innovation is equally important. Innovation in traditional sectors can often bring more economic benefits than desperately trying to get into a sector where others have achieved competitive advantage. However, one should add that rapid scientific and technological developments no longer offer stable advantage, but rather temporary ones, as science is by definition open, and market strategies need to be at least regional, and global at best.

A new approach: innovation ecosystems

An innovative economy and society cannot be conceived in traditional ways, as in the industrial economy. A watch is complicated, but not complex, because its mechanics interact in a predictable, linear way. Innovation does not follow such linear processes, but complex ones, with predictable and unpredictable actions and re-actions among many actors. It must be seen like an ecosystem: a complex of naturally interacting organisms, functioning with non-linear dynamics and feedbacks.

An ecosystem of innovation aims to emulate nature in its organizational complexity and to create the dynamics, interactions and feedbacks that produce desired outcomes, as well as spin-offs and cumulative effects. Paradoxically, it requires an effort of parallel construction and deconstruction and of creation of the right framework conditions, which can only be done through consistent holistic steering and collaborative efforts of stakeholders. Nevertheless, the effects may be at the start uncertain and apparently marginal before developing their full potential.

Natural ecosystems can either evolve under the pressure of contextual change, or perish. Similarly, the creation of an ecosystem of innovation will be required and stimulated by external challenges which threaten the survival of desired patterns. This brings acceptance for the need of inno-



vativeness, but only if accompanied by clear identification and communication of benefits to succeed.

The key objectives of developing an ecosystem of innovation are to create value for society, by enhancing the quality of life of its citizens and the competitiveness of its enterprises, through intelligent interaction between a variety of stakeholders, principally economic actors (large and small companies and other entities), public governance systems (AU, regional market organisations, and Member states), and universities and other centres of knowledge. This requires consistent leadership and stakeholder engagement in various forms.

Value creation should start from a wide concept of demand. This can come from the needs of industry to find solutions to specific problems in their value chain (such as resource efficiency, increased agricultural productivity) or from continuously emerging and changing societal needs (such as quality of living). Innovation will also often come through the involvement of stakeholders (co-creation). In certain cases though, such as in public administrations, push and pull will be required in order to avoid a less efficient use of opportunities or outright opposition to change.

Demand-driven value creation requires establishing a permanent strategic agility, scanning the global context, scouting for opportunities, and paying attention to continuities or discontinuities. The emergence of novel concepts or processes, products or services, is often the result of out-of-the-box thinking, improvisation, repeated trial and error, and the emergence of new tacit and explicit knowledge until some form of consolidation takes place.

A few African countries have made it to a medium level of international innovation and competitiveness rankings, which is an indication that it can be done, although there is still much effort and innovative thinking needed to start with. Future welfare depends on it.

The challenges ahead

If African governments want to stimulate innovation, they must first avoid further investing in funding, and should instead focus on creating the adequate framework conditions. There is sufficient funding in the world looking for productive investments, and if the conditions are right, it will flow to Africa

too; indeed the outflows of capital may be reversed, which would be a positive first step. Therefore, its governments need to become innovative themselves and adapt their governance methods to new challenges. They will have to adapt to the fundamental and irreversible external changes which have become apparent since more than a decade.

They must accept that the required innovation will come from a paradoxical process, combining the unknown, creativity and rigorous scientific method. It requires the opposite attitude from bureaucracy, which is about stable process and control in large entities. Strategic agility requires specific leadership skills and organizational processes, and these should not be limited to the business sector if rapid and cumulative effects are to be achieved.

It is by considering the limitations of current approaches in new contexts, but also by extracting successful elements of current approaches, that a new, competitive and socially accepted economic architecture can emerge. Thus, it must be part of a culture of innovation to accept experiment and managed risk in order to allow a widening and diversification of the innovative products, services or processes and their application.

Africa is not lacking in capacities but it does have a serious problem of coherence of vision and purpose, of creating cumulative effects, and of governance not attuned to 21st century requirements due to organisational fragmentation, bureaucratisation, persistence of multiple barriers to innovation in markets, and the absence of a system approach. It lacks the right culture and governance tools to develop an ecosystem of innovation appropriate to the present challenges. Furthermore, innovation policy is often mixed up with research policy, which is in fact different. Research policy is only one element of innovation policies. As a result, investments in research and attempts of innovation policy have brought few concrete effects on economic growth, and many signs indicate that on-going ones will not provide any better results, despite some remarkable examples, such as Africa's leadership in mobile phone usages.

The following steps should be considered to start building an innovation ecosystem which will have a better chance to succeed in delivering results.

Leadership

Clear and consistent leadership (from AU, regional market, country, regional or city government) will be needed to create the framework conditions to facilitate innovation actors, primarily companies, large or small, and centres of research and knowledge, but also civic society organisations and individual citizens, to develop and manage the dynamic inter-actions which lead to measurable innovation and added value creation.

It requires an approach of collaborative governance. Today, innovating capacities lag behind new and increasing needs because of a tendency towards incrementalism and a focus on procedure and control.

This needs to be replaced urgently by pushing for innovative government paradigms and a focus on coaching and mentoring the available capacities towards the emergence of an ecosystem of innovation in order to succeed in responding to the present challenges. This demands a departure from a legalistic culture of power preservation towards a cooperative and result-oriented culture. Africa's age old communal cultures should in fact be helpful to develop bottom-up innovation, instead of only relying on imported models of governance. Foresight and assessment of paradigm shifts

Correctly assessing change is a difficult task in business and government because of a tendency to compare to the past. It is therefore essential to develop a realistic cognitive map, based on an assessment of the interacting developments. This must be done externally, through a network of centres of knowledge.

Inspiration and methodological examples can be found in the work of the International Panel on Climate Change, the World Economic Forum on Risk Interconnection and Convergence or the strategic outlook of the World Business Council for Sustainability. The horizon must be 2030 and beyond.

The resulting scan of innovation challenges in Africa should be formulated solution neutral. This will enable the emergence of creative ideas, which are the embryonic solutions whose potential impact can then be further analysed. It will also avoid that future innovation efforts are determined by tactical considerations.

Thinking the unthinkable.

Conditions of development cannot be overcome by incremental, but rather by a radical approach, in order to achieve trend mutation. This is not just a matter of catching up in sectors of high innovation and rapid productivity growth, where Africa is seriously lacking behind, but also in traditional sectors, where there is often competitive advantage, and obviously in public governance, whose policies and accumulation of rules, often dating from pre-independence times, are the main cause of this lack of competitiveness.

In any governance system, there is a risk that the established underlying policy paradigms will dominate critical re-examination in view of fundamental contextual shifts. Therefore, a zero-based approach is needed to respond to the paradigm shifts, and to challenge conventional wisdom about who should proceed how in order to achieve results. The inter-relationship between national, regional and municipal governments, AU and regional institutions, business, and centres of knowledge, is central to value creation.

This will make it possible to clearly distinguish the complementary roles of the various government levels in the innovation ecosystem and new methods of steering and cooperation. The governance system designed to respond to the challenges of the post-war period was greatly innovative, but it is in need of a fearless re-design to facilitate the creation of an innovation ecosystem.

To achieve a higher degree of innovativeness, there should be more clear distinction between governance functions which are essentially routine, and those where innovation is the priority. Inspiration can be found in the functioning of other inter-state systems (e.g. EU, ASEAN, and OECD) and may lead to a greater diversification of governance organisation and tools, even within institutions, depending on objectives and competences.

Strategic capability development

In order to align the contrasting, open and hidden interests of stakeholders, it is necessary to develop a learning mind-set. Therefore, cross-disciplinary research and multi-experience inputs, as well as open-mindedness and incentives, and finally tolerant handling of failures, will be also necessary after the assessment phase.

In fact, it can probably only be achieved through consistent and courageous leadership, but one which is also sensitive to the requirements of an innovation ecosystem functioning and to the continuously changing context. Leadership is often assumed in Europe, seldom developed, yet the complexity of ecosystem steering requires doing so now.

Change is necessary to move beyond a culture of regulation and control and towards a culture of mentoring and coaching of all stakeholders. Stewardship tools are more suited to promote a culture of innovation and of change among various actors than traditional command and control approaches.

Ensuring coherence

Coherence is a key ingredient to bring cumulative effects in an innovation ecosystem. It demands an overall perspective, in particular in the early stage of innovation development, when inertia and status quo approaches risk to undermine the need for radical new departures. Therefore coherence cannot be provided through traditional coordination set-ups which usually serve only short term interest defence.

In order to ensure a focus on the mega-issues determined during the assessment phase, to avoid their premature absorption in policy-as-usual, and to create serendipity, experimental attitude to reality and risk taking in the face of uncertainty, innovation must be steered centrally. It must be an overarching objective to which all other must converge. This way, one can take useful inspiration from the concept and work on regional market integration.

Ensuring stakeholder engagement

To properly assess the paradigm shifts and align the various agendas, it is essential to involve the economic actors alongside the centres of knowledge, because they often possess an understanding of market needs, second to none. This demands the development of a deliberation culture and tools which go beyond mechanistic stakeholder consultations in order to bring a shared vision and cooperation during implementation.

However, research and centuries of experience have shown that there is a positive correlation between a society's degree of tolerance for the independent, creative and entrepreneurial minded, and its economic success. Bringing a

scientific approach to all forms of risk requires consistent efforts from those in government, business and science, to promote these values in the education systems and through the media and reforms of rules and accountability.

Implementation

The relationship between different administrative units within government, and between them in regional markets, the different interfaces between politicians and civil servants, and finally but not least, the capacity problems, need urgent addressing in order to facilitate the emergence and functioning of an innovation ecosystem. This requires attention to ensure equal capabilities throughout governance systems and a re-think of personnel policy to bring new qualities into public services.

Evaluation

Regular peer review, scrutiny of process and evaluation of achievements, or the lack of it by independent multi-stakeholder groups of experts, is essential to ensure firmness of purpose and agility of methodologies. Experimenting with fundamentally new methods and abandoning or modifying programs when they appear not to move fast enough towards tangible results must be a full part of an innovation ecosystem.

Included in evaluation approaches must be tolerance for failure, provided the right efforts have been made of course, because without some form of controlled gambling there will be not sufficient innovation. This will be a radical departure from existing bureaucratic culture, and requires strong leadership support, transparency and communication with stakeholders.

Evaluation is not only part of constant learning under circumstances of uncertainty; it also will help to develop a more constructive approach to risk management in the broadest sense. Learning capacities and risk acceptance are major characteristics of an innovation ecosystem. They provide the basis for adjustments and often lead to additional innovativeness, hence to improve value creation and competitive advantage.

**For Prof. Dr. Stefan Schepers work with the EU, see www.highlevelgroup.eu. Prof. Dr. Stefan Schepers is also chairman of the think tank Mazungumzo – the African Forum in Brussels. See www.mazungumzo.eu*

" Provide innovative, affordable, clean and energy-efficient solutions for a better tomorrow"

Franck Thierry,
CEO, Stimaken SAS

Project Overview & Business Model

Initiated in September 2013, Samburu Solar PV project aims to bring 71 million dollars in investments and involve and mobilize 700 people to set up the solar plant over a period of two years.

The site will have over 160,000 modules on 104 ha (256 acres) of land, representing 40 Mw of power in phase 1. An additional 40Mw is expected after completion of phase 1,

With an annual production of 68,040,048 kWh, this site, developed by Stimaken, will:

- provide electricity for nearly 20,000 families a year,
- avoid the production of more than 2,420 metric tons of CO2 a year.

With this innovative contribution, "Stimaken remains convinced of the need to fight against greenhouse gases. It is important for us to make our modest contribution toward the diversification of energy sources and to preserve our planet for future generations."



Social Impact

Alongside the solar operations, an original approach will also be adopted to preserve the landscape:

- the solar panels, set up in a system without any concrete foundations, will be recycled at the end of their lifetime (20 years) to leave the land clean and exploitable for future use.
- Stimaken will launch a remove one tree plant one tree programme in the surrounding area.

Stimaken will also, as part of its Corporate Social Responsibility, launch a foundation in Samburu County that will:

- support social projects in the communities harboring our solar plants: building schools, classes, boreholes etc.
- Jointly with international institutions, distribute free portable solar lamps students take home and bring back to school for recharging

Project Site advantages

- The project is located 5 km from the Loyangalani Sub-Station serving the Loyangalani-Suswa 400kv transmission line.
- The project is next to the 300 MW Lake Turkana Wind Power Project (LTWP) – (300 Mw, 600 million euros investment)
- No human settlement, arid and semi-desert region of North Eastern Kenya.



Samburu Solar PV Project

Ground-Mount Solar Power System

LOCATION

Samburu County, Kenya

TYPE

Utility-Scale Ground-mount Installation

SIZE

40 Mw

TOTAL INVESTMENT

71 million dollars

OFF TAKER / GUARANTOR

**Kenya Power Company Ltd /
Ministry Of Energy & Petroleum**

OF MODULES

160.000

GHG EMISSIONS SAVED

2,420 metric tons

COMPLETION DATE

October, 2016



PROMOTING APPLIED SCIENCES, ENGINEERING AND TECHNOLOGY IN AFRICA

Prof. Goolam Mohamedbhai

Former Vice-Chancellor of University of Mauritius, former Secretary-General of the Association of African Universities, and consultant to the World Bank on PASET (Programme on Applied Sciences, Engineering and Technology)



In 2012, the World Bank launched the Partnership in Applied Sciences, Engineering and Technology (PASET), an initiative for skills development in applied sciences over the whole spectrum of education – from technical and vocational training (TVET) to higher education, research and innovation – through partnerships between Sub-Saharan African countries and identified Partner countries such as Brazil, China, India, Japan and Korea, which are already making significant investments in Africa.

Background

A series of consultations with nine African countries in the first half of 2013 enabled an assessment of existing engagements in those African countries by the Partner countries and helped the African countries to frame proposals for further engagements with the Partner countries.

Addis Ababa Workshop

The results of this first phase of PASET were presented at a workshop held in Addis Ababa in July 2013, which brought together high-level representatives from the African countries as well as

the Partner countries. The African countries present agreed on a number of follow-up actions: a) obtain support for the PASET initiative in their respective countries from stakeholders beyond the education sector, such as the ministries of finance and economic development, and the private sector; b) ensure greater coordination between higher education and TVET, which usually operate under different ministries; c) collect and create a database of all S&T engagements with the Partner countries; and d) follow-up with Partner countries on specific

identified proposals.

Follow-Up

Over the period February-April 2014, follow-up consultations were held with eight of the African countries present in Addis Ababa (Ethiopia, Liberia, Mozambique, Nigeria, Rwanda, Senegal, Sudan and Tanzania) to assess progress made on action plans presented and commitments made at the workshop. A couple of the countries were unable to consult the key stakeholders and several of them reported that creating a national consultative body proved

to be difficult. Coordination between higher education and TVET was also a challenge, which made it difficult to implement a national strategy covering the whole education sector. All countries found setting up a central database of engagements and S&T activities to be a major challenge, one constraint being the difficulty in deciding where such a database should be located. And a couple of the countries failed to develop clear, specific proposals for consideration by the Partner countries.

But there were also several success stories. Senegal, for example, which had held its major national consultation prior to the Addis Ababa workshop, had developed a well-focused plan of creating a University of Agriculture and a Virtual University, and had approached China and Korea, respectively, for funding. Nigeria had set up a Presidential Committee to develop a strategy to valorise its TVET sector. Rwanda used an existing consultation forum involving all ministries and other stakeholders to share information on PASET; it had also set up employer-led Sector Skills Councils involving all stakeholders in identified priority sectors, and had contacted China, Korea and India to support its initiatives. Tanzania had consulted different ministries and the private sector and had identified training of science teachers as its topmost priority; it was also in the process of approaching China for the creation of a University of Agriculture, and Korea for equipping the four TVET Centres that Korea had built.

Additional African Countries

Over the same period in 2014, consultations were held with an additional group of African countries to assess their engagements with Partner countries. These countries were: Angola, Burkina Faso, Cameroon, Malawi and Zambia. Several of the challenges identified earlier in the first group of countries were also found in these countries. Angola, with its specific post-war situation, had hardly any engagement with the Partner countries, except for some scholarships from Brazil and India, most of which were awarded directly without going through the government system. An interesting situation in Angola is that the foreign oil/gas companies are funding local higher education programmes in various areas, not just in oil/gas related subjects.

In Malawi and Burkina Faso there were no national plans for skills or human re-

source development, making it difficult to identify projects of interest to Partner countries. In Malawi, TVET fell under several ministries – labour, youth and education – making coordination within that sector difficult.

What came out clearly was that Partner countries were providing significant infrastructural development support to the African countries. China was building a new S&T University and a Technical College in Malawi, as well as a Technical Training College in Cameroon. Japan had helped to build a bio-medical laboratory for controlling the quality of drugs in Burkina Faso, and it was also planning to set up a Teacher Training College in Malawi. Korea had built several TVET centres in Cameroon.

Priority Areas and Clustering

The thirteen African countries consulted were specifically asked to identify priority areas for targeting their engagements with Partner countries. The priority areas identified by the countries were: agriculture, ICT and construction (10 countries); mining (9); energy (7); health (6); manufacturing (5); and tourism (4). The consultations also revealed that Partner countries were funding the African countries in several of these priority areas. A way forward, therefore, could be for the Partner countries to provide a more focussed support to African countries grouped in priority clusters, especially as clustering would promote regional collaboration, a key objective of PASET. Some possible clusters could be:

Agriculture: China is providing support to Senegal and Tanzania in putting up an Agricultural University; Brazil has several higher education projects in agriculture, mostly in Mozambique but also in Sudan; and a long-standing collaboration in agricultural research exists between Burkina Faso and India.

ICT: Korea is planning to help create a Virtual University in Senegal as well as a College of Open and Distance Learning in Rwanda; India and China also have ICT projects in Africa.

TVET: Korea supports the TVET sector in five SADC countries under the Better Education for Africa Rise (BEAR) project; China, India and Japan also support TVET in several African countries, and the TVET could specifically target the construction sector, an identified priority sector for most countries.

Dakar Workshop and Call for Action

In June 2014, a PASET workshop was convened in Dakar, Senegal where representatives of the African and Partner countries, as well as other stakeholders, including the private sector, met to take stock of the findings so far and to plan the way forward. The main outcome was the Dakar Call to Action, an ambitious commitment to various stakeholders: Sub-Saharan African countries and their higher education, research and TVET institutions; Partner countries from the South and their investment firms; technical and financial partners that have cooperation programmes with countries and institutions in Africa; and the African Business Champions for Science, a new initiative that aims to better connect business and scientific communities in Africa.

In the Call to Action, the participants committed to work towards achieving the following medium-term objectives in Sub-Saharan Africa over the next ten years: training of 10,000 new PhD holders through an African regional scholarship programme; doubling the number of students in ASET programmes in at least ten countries; creation of five regional TVET centres of excellence for training TVET faculty; development of a regional quality assurance mechanism for ASET programmes; and establishment of data systems and benchmarking of ASET programmes and institutions in at least ten countries.

To implement these objectives, it was also agreed in Dakar to create: an Executive Steering Committee comprising mainly of selected African policy makers and representatives of the World Bank; a Consultative Advisory Group of relevant experts to advise on the implementation of the plan; working groups as required to design and develop tools and programmes for the various initiatives; and a Partners Forum to meet regularly to take stock of progress and propose further development. The Executive Steering Committee and the Consultative Advisory Committee have already been constituted and preliminary meetings have been held.

The PASET initiative can become an important tool in the Post-2015 Development Agenda for Africa, helping to transform economies for jobs and inclusive growth and to forge global partnerships.

CLOUD COMPUTING

THE NEXT IT INNOVATION IN AFRICA

By Shiyghan Navti

Africa is well positioned for the next wave of technology innovation where IT services are instantly available to end users on request. Improving and maturing Internet connectivity presents a significant opportunity for African businesses and technology entrepreneurs. Applications and services which were previously inaccessible due to a lack of locally available skills or the need for significant up-front investment in infrastructure, can be made more accessible on a pay-as-you-go business model, with IT services delivered over the Internet.



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frica is well positioned for the next wave of technology innovation where IT services are instantly available to end users on request. Improving and maturing Internet connectivity presents a significant opportunity for African businesses and technology entrepreneurs. Applications and services which were previously inaccessible due to a lack of locally available skills or the need for significant upfront investment in infrastructure, can be made more accessible on a pay-as-you-go business model, with IT services delivered over the Internet.

In some parts of Africa, this business model, which is commonly referred to as “cloud computing”, is already being adopted as a way of overcoming IT infrastructure deficiencies. According to the International Telecommunications Union (ITU) more than 50% of ICT operators in Africa have begun to implement or are already using cloud computing. The cloud is no longer an emerging business model. It is essential.

Cloud computing optimizes the use of scarce resources by consolidating what is available into a resource pool which is efficiently allocated to users based on their needs. This approach to IT service delivery is set for a major take off in Africa, provided certain enabling measures are put in place. Although a large segment of the IT user community experience cloud services through public cloud service providers such as IBM, Microsoft, Google and Amazon, uptake of cloud has been largely driven by internal enterprise adoption. Many enterprises are exploring or preparing to introduce this new business model. Studies by the International Telecommunications Union have shown that banking and the educational sectors are potential early adopters of cloud computing. However, significant opportunities for cloud computing also exist across government, in retail,

media and entertainment. For a local cloud computing based economy to thrive, a basic investment in data centre infrastructure is needed. Some African countries are in the process of building data centers capable of delivering cloud services.

While cloud computing holds a lot of promise in Africa, it also faces adoption challenges. Chief among these is weak or lack of a regulatory framework governing the delivery of cloud services, particularly the protection of sensitive and personal identifiable information. Many African countries do not have local data protection legislation or cross-border agreements that facilitate the exchange of sensitive and personal identifiable information. In order to accelerate the growth of cloud computing services in enterprise organizations, African governments need to put in place data protection legislation as well as codes of conduct governing the handling of data and personal identifiable information across borders. Cloud computing in Africa needs to be built on a solid legal and policy framework, in order to inspire confidence in widespread domestic and foreign use of cloud services.

Besides questions of data security, privacy and ethics, cloud computing also comes with the risk of loss of IT jobs. Many believe cloud computing is synonymous with moving IT services to an overseas public cloud infrastructure, resulting in reduced local employment. However, by cloud enabling new levels of business agility, cloud computing can create employment opportunities beyond the IT sector.

A 2014 report by Harvard Business Review Analytic Services “Business Agility in the Cloud” (<http://www.verizonenterprise.com/resources/media/large-134784-hbr.xml>) found that 70% of organizations were us-

ing cloud services. According to the survey:

- 74% of respondents say the cloud has given them a competitive advantage.
- 61% say it has increased employee productivity.
- 71% say the cloud reduces complexity within their business.
- 41% named agility as their primary driver for adopting cloud.
- 65% say cloud doesn’t adversely affect security.
- 36% say it actually increases security.

In Africa, the mobile can be used to enable the delivery of cloud based IT services to every citizen. As with the communication infrastructure gap that led to the rapid adoption of wireless mobile services in Africa, the delivery of public cloud computing services will initially be largely accessed via mobile devices. Over the next few years, we predict that as broadband penetration improves, cloud computing will take centre stage as Africa’s technological innovation platform of the twenty-first century.

The ITU has identified the need for better understanding of the cloud environment and technical considerations related to the delivery of cloud services. To ensure rapid adoption of cloud services, a regulatory environment that adheres to international standards of data protection and data security is key, along with the availability of local efficient datacenters, services and applications that address the needs of African businesses. Finally, the development of local cloud computing skills, research and development on the continent will also be critical.

Dr. Shiyghan Navti is the Africa Cloud Ambassador for the Cloud Credential Council, a founding member and Director of the Africa 2.0 Foundation. Prior to founding Tech Equity Ltd, Dr Navti led the IBM Europe private cloud technical sales business and the IBM Africa expansion strategy. Tech Equity has delivered services in the US, UK, Germany, Kenya, Ethiopia, Mali, Mozambique and the UAE.





DON'T MAKE OUR HISTORY A FARCE!

REFLECTIONS OF A YOUNG CARIBBEAN TRADE ANALYST

By Yentyl Williams

From left to right:
Karine Lubambu (DRC),
Neema Toyb (Comoros
Islands), Miriam Poretti
(Cameroun) and Yentyl
Williams (Trinidad and
Tobago, UK) at the 2014 WTO
Public Forum in Geneva.



Having taken an early plane from the heart of the EU in Brussels, and arrived promptly an hour and a half later for the opening session of 2014 WTO Public Forum (or WTO #PF2014 – as was the twitter hash tag), I immediately felt suffocated from the hot and crowded plenary room. As I leaned against the only space of wall possible next to the entrance, I could not help but feel a very strong sense of *deja vu*. Except I hadn't been here before, neither had I personally witnessed WTO debates first-hand, but I had read of so many like them, which ended up being more of a discussion than producing any concrete outcomes, one in which rhetoric would prevail over concretely impacting realities.

I left the room as I felt a prickly heat run over me and headed for the nearest water dispenser. After one cup of water, I took the second to a comfortable looking sofa nearby. A young African guy was far too absorbed on his smart phone to notice I'd joined the other side and I was happy that I didn't catch his attention. I sat back, drank the water and breathed calmly as I mentally prepared myself for the coming two days of continuous debate on trade and Africa. When I felt good enough to return to the room, I found the young lady that had shared her piece of wall with me earlier on. She was sat in between the two door entrance to the plenary room and I decided to join her there. We

immediately began chatting and within the space of a few minutes, it seemed like we'd been friends for years.

Our conversation dived straight in at the deep end, life and politics, trade and underdevelopment, inequality and integration, the job market, youth unemployment. Neema, was a young woman from the Comoros islands with a brilliant smile and great aura. We automatically connected as I knew her story and she knew mine. Young diaspora with few connections to the top echelons of the international cities that we were implanted in struggling to pay our rent each month and struggling to enjoy our youth at the beginning of our pro-

staying in Geneva's most expensive hotel and invited me for a drink. Unimpressed, I took his card, smiled and continued a more intellectually stimulating conversation with my new friend. As we were talking, again we were interrupted, this time by a young woman whose face looked familiar. She asked us a practical question about the building, and then the embarrassment on her face said that she mistook us for WTO building staff, she smiled and shuddered away, as we both knew that we'd met before in her professional environment, the European Commission.

Meetings aside, how was I to know that this simple meeting beyond any fancy grand session between ministers or CEOs was going to be the most fruitful of my time at the WTO. And importantly, an experience which taught me a lifelong lesson. We often seek what is big and grand, to be included on the world stage, for the attention of the room, but all too often, we fail to look at what is right beside us. We often overlook our neighbour who can be our best friend because we have our eyes fixed straight ahead at the stage, we often pay great importance to the words of esteemed strangers with impressive positions, and neglect those who swim along the tide beside us.

Sometimes, striving ahead, we don't look around. This can equally be said of the African regions that are now signing Economic Partnership Agreements under the pressure of deadlines. We can equally say that these African countries didn't spend enough time to look, learn and listen with their regional partners, until an exogenous force, the EU, forced them to.

Who is to blame? There shouldn't be pointing of fingers but we should learn now and learn quickly. We, the young diaspora generation have seen the whole thing unravel with our double-hatted ability to understand both sides of negotiations, both cultural tendencies and eventually, both points of view.

We have to deal with both the challenges

and the opportunities of the agreement whether we like it or not. This fait accompli was not our choice but we shall inherit it and embrace it as if we conceived it. But because our eyes and our ears have been wide open, because we ourselves are products of trade and development, we don't want to make our history a farce. Once a tragedy, twice a farce. EU Trade Commissioner Karel de Gucht recognised that the EU-ACP preferential system has not worked, and many development officials concur with this trade point of view. There is no guarantee that the EPAs will work, and if we look at the Caribbean case which is five years senior to the new African EPAs, we can see that implementation was slow and so the agreement is thus far substantially superficial. We don't want to relive failed history and we don't want history to repeat itself - we have lived the tragedy and we will not put our efforts into a farce.

I left WTO with a smile, glad with the individual friendships I had made with several young African diaspora. I felt a much more liberating feel than when I first entered the previous day. I feel that our generation will not allow history to repeat itself, young Africans want change and the diaspora will join this evolutionary process. We won't be a farce but we shall make history.

Yentyl Williams is regional Trade Researcher at the Technical Centre for Agriculture and Rural Cooperation (CTA). Prior to joining CTA, Yentyl worked as an independent consultant pioneering research on the subject of 'TTIP: What implications for Africa?' She also worked on competition policy and internet governance at Burson Marsteller, and on the Economic Partnership Agreements with the African, Caribbean and Pacific states at the Directorate General of Trade in the European Commission. Yentyl is a graduate of King's College London, Sciences Po Paris and post-graduate of the College of Europe, Bruges. She has researched, published and travelled widely in the African and Caribbean regions, and is a national of Trinidad and Tobago and the UK.



We, the young diaspora generation have seen the whole thing unravel with our double-hatted ability to understand both sides of negotiations, both cultural tendencies and eventually, both points of view.



essional careers in new cities we were at pains to discover because of budget constraints.

While we were getting on like a house on fire, a diplomat from a country that shall remain nameless, decided to introduce himself and as we talked, he quickly directed the conversation to my after-Forum activities. And without hesitation, he modestly said that he was

Editor's Note:


On October 3, 2014, ACTS convened a Session at the 2014 WTO Public Forum in Geneva. The entire Audio Podcast of the Session - An Empirical Analysis of the Future of Africa's Trade Relations with Europe and the US - is available here: http://www.wto.org/audio/pf14_session26.mp3; <http://www.acts-net.org/media-centre/podcast>

THE TRANS-ATLANTIC TRADE AND INVESTMENT PARTNERSHIP

WHAT IMPLICATIONS FOR AFRICA?

By Yentyl Williams

The Trans-Atlantic Trade and Investment Partnership (TTIP) currently being negotiated by the European Union (EU) and the United States of America (US) has direct implications for Africa's economic transformation. TTIP represents the largest bilateral trade agreement in history; insofar as the nations of the African continent have significant trade relations with both the EU and the US, the continent's leaders should aim to harness African economic development and mitigate the harm that would arise from merely resting on the sidelines of this potentially historic agreement.



Learning from history and being driven by challenges

The historicity of trans-Atlantic relations should not be forgotten. Indeed, recalling the dominant role of the transatlantic powers of the West in history, should inform and empower endogenous policy-making on the African continent. The power of the Atlantic does lie in the size of the EU and US markets – accounting for one third of international trade, half of world GDP – and other formal measures of comparative economic weight. But the power of the Atlantic is also one of ideology. Conviction and globalisation of this ideology has been used as benchmarks for global standards, most prominently fixating Africa within a still frame of poverty and underdevelopment.

Our reality today is evidence of this historic power that established the post-War World War II multilateral institutions for international economic cooperation, including the Bretton Woods system (the International Monetary Fund (IMF) and World Bank group) and the World Trade Organization (WTO). As history repeats itself – just like the 1999 Seattle WTO protests, the recent European Citizen's Initiative (ECI) to 'Stop TTIP' and the European Commission being inundated with official stakeholder consultations to the extent that the database crashed – there is already much evidence of the endogenous rejection of TTIP in the EU and US.

How does TTIP affect Africa?

Firstly, TTIP can impact the image and reality of 'Africa rising'. While the EU and the US are the negotiating parties to TTIP, their weight on the world scene, not merely economically, but also politically and socially, can wield monumental impact beyond these two regions. It may impact both endogenous policy-making and the much needed exogenous image-change of the continent. On the latter, exogenously, the image of Africa must catch-up with the reality of the fast-paced, entrepreneurial and dynamic continent that Africa has become. On the former, endogenously, African people and African leaders must lead this change. In this regard, the strong geopolitical motivations and global standards-setting goals of TTIP will either be a stumbling block or building block for the holistic transformation of the African continent.

Secondly, and intrinsic to the first point, TTIP can impact Africa's international trade relations. The EU and the US remain Africa's main trading partners, while each region maintains different trade and preference schemes with African nations. By way of existing trade agreements, African products would face increased competition with either EU or US exports within the transatlantic market place.^[i] African products would also face higher compliance costs, which could in theory have the positive effect of raising standards of African exports and products in general or in practice undermine the competitiveness of African products and services in both markets.

Herein lies the case for African 'agency' or 'strategic interest' in the TTIP negotiations. Depending on the final legal, economic and development provisions, given Africa's trade agreements with both the EU and the US, TTIP can have either positive or negative implications for Africa's development – or indeed, a hash of both. The fundamental challenge for TTIP negotiators and African policy makers is therefore three-fold: How to translate potential benefits of TTIP into real benefits globally, especially with regards Africa's development? How to mitigate the negative development impacts of TTIP? How to elevate Africa from rules and standards-taking to being a veritable global trade player?

Harnessing African growth and delivering beyond past failures

As Africa continues to grow at im-

pressive rates, at 4% compared to 3% globally,^[ii] can it not rise to the challenge of becoming a 21st century trading power? Yes. But this will require discarding outdated models of development and being bold about policy reform at the international, regional and national levels. It will also require prioritizing investments in national and regional production through a wide range of economic tools, including infant industry protection and additional regulation – all of which might be constrained by TTIP, as well Africa's own trade agreements with the EU and the US. Enhancing intra-regional African trade is the first foundation upon which African nations can compete in an increasingly globalized world, where trade rules. Africa can no longer afford to be reactionary; the result of inaction is too costly. At the WTO, inter alia, African countries must unite.

As a young observer of international relations, optimism is built in the face of numerous failures. Former European Commissioners of DG Trade recognized the failed economic history of the EU and its ex-colonies, grouped together as the African, Caribbean and Pacific (ACP) states.^[iii] The Economic Partnership Agreements (EPA) have been promoted as a response to change this history, but in over 12 years of negotiations, a hash of agreements – including the interim EPAs and one full EPA which is yet to be ratified by all national parliaments – is revealing that relations are still wrought with tension. This includes continued internal institutional infighting at the EU level.^[iv] The unfinished story of the EPAs surely does undermine continued obedience and loyalty to the straitjacket of neoliberal economic policies. This history underscores a trichotomous failure of economics, development and trade policy between the EU and the ACP states. In light of the 2015 expiry of the current US African Growth and Opportunity Act (AGOA), it may not be far-fetched to imagine the US promoting the adoption of similar EPA style agreements with African nations.

Forcing developing states to open their markets regardless of their development, trade and financial needs does bring into question the ethics of the dominant logic of international trade. The current state of play of the Doha Round, like the feet dragging witnessed with the EPAs, is critical evidence that something is not right in international relations. International institutions

should be the heart at which economically sustainable decisions are taken, prioritizing equitable human development and the protection of the planet. Holistic, evidenced-based policy-making can benefit all policy-makers worldwide. However, arrogance and failure to learn from history merely allows history to repeat itself to the detriment of human and ecological evolution.

Appropriating 21st century opportunities and challenges

TTIP is merely the most prominent amongst a list of so-called mega-regional trade agreements (MRTA) being carved out internationally. If Africa is ever going to punch its weight in the world, it has got to be now or never. Efforts must be coordinated to foster and accelerate African regional integration. After all, if Africa is ready to enter into free trade agreements with the EU, surely Africa should be ready to trade more freely with itself. Moving on from a history of development and under-development requires breaking with the past and appropriating 21st century opportunities. One of those opportunities is greater intra-African trade and enhanced regional integration. Harnessing the benefits of greater intra-African trade puts Africa as a continent on a better footing to harness the potential benefits that may be reaped from the EU-Africa EPAs, or the US African Growth and Opportunity Act (AGOA) as currently constituted. Few things could accelerate Africa's economic transformation faster than deeper and faster regional integration within the continent. Not only do the African peoples and diaspora deserve it, but the world deserves Africa playing its part on the international scene. A more regionally integrated Africa is much better placed to play this role.

Yentyl Williams is regional Trade Researcher at the Technical Centre for Agriculture and Rural Cooperation (CTA). Prior to joining CTA, Yentyl worked as an independent consultant pioneering research on the subject of 'TTIP: What implications for Africa?' She also worked on competition policy and internet governance at Burson Marsteller, and on the Economic Partnership Agreements with the African, Caribbean and Pacific states at the Directorate General of Trade in the European Commission. Yentyl is a graduate of King's College London, Sciences Po Paris and post-graduate of the College of Europe, Bruges. She has researched, published and travelled widely in the African and Caribbean regions, and is a national of Trinidad and Tobago and the UK.

“ONLY THE BEST IS GOOD ENOUGH FOR AFRICA”

THE PORTRAIT OF AN AFRICAN SCIENTIST

Dr. Cosmas Milton Obote Ochieng
Executive Director, ACTS

Dr. James Emmanuel Kwegyir Aggrey (1875 – 1927) or ‘Aggrey of Africa’, a Ghanaian-African-American scholar, remains one of Africa’s foremost thinkers and educationists. Co-founder of Achimota College, Ghana, he held two doctorates (one from Columbia, another from Hood Theological Seminary), two Masters Degrees (Columbia and Livingstone College), several diplomas, and was first in most of the examinations he took. Not surprisingly, he held that “only the best is good enough for Africa”.

The purpose of university education in Africa, he argued, should be to foster “original thinking, encourage research, help to add to human knowledge”. Making the case for harnessing of applications of science, technology and innovation for African development, he continued “we of West Africa have proved that we can get the classics, theology and philosophy. We are past masters in jurisprudence and dialectics.

The question is, can we turn such knowledge more and more into the service of the common weal? Can we give back with interest what we have received? I believe, we can. It is for University Education to prove what scientific training can do”.

Aggrey of Africa made these statements at the beginning of the 20th century. He would be horrified to see what has become of many an African university, government or nation-state in the 21st century. Virtually no African university, government or nation-state today can pass what might be called ‘The Aggrey of Africa Test’: “only the Best is Good Enough for Africa”. Governance by exclusion, corruption, incompetence, and lack of ambition have combined to ensure that few African organizations can pass this test.

While African organizations and institutions might have a difficult time passing the test, many individual African scientists, scholars, writers, artists, industrialists, inventors, innovators, farmers and human rights activists

easily pass the test. There are few world class laboratories or ‘Big Science’ projects without African scientists or scientists of African descent – CERN, NASA, Los Alamos, name it. This suggests that a key constraint to Africa’s development is lack of effective organizational and institutional leadership across sectors: academia; public and private sectors, civil society and the media.

To accelerate its economic development, the continent will have to find ways to tap into the vast pool of exceptionally talented and gifted Africans, many, but by no means all, currently living outside the continent. This will require policy and institutional incentives that celebrate, attract and reward excellence, ambition and expertise. The Ethiopian ‘Yellow Card Programme’ extended to persons of Ethiopian descent who acquired nationality of other countries is a good model. Focusing on the diaspora has become increasingly popular with many African governments – no doubt due to the huge remittances associated with the diaspora. It is good policy.

Nonetheless, the fundamental question of brain drain in Africa is not one of how to get the African diaspora to participate effectively in the continent’s socio-economic and political development (for the most part, they already do), rather, it is why so many qualified Africans feel compelled to leave the continent in the first place. Creating local conditions (social, economic, political, etc) that value and

reward science, technology, innovation and merit is the best to ensure that the continent not only makes the most of its own talents but also increases its odds of making the most of the available global talent pool.

Tapping into the vast pool of Africa’s expertise is a no brainer. Make no mistake: such expertise exists in numbers sufficient for the task. To exclude the very best of what Africa has to offer, in the toughest challenge for the continent since decolonization, arguably since the 1500s, is insanity personified. That was not the approach that the continent followed in its successful decolonization movement. It is simply not a winning development strategy.

Here, we profile three African scientists who are blazing the trail in three different fields:

- Prof. Babatunde Ogunnaike, an expert in control and systems theory;
- Dr. Tilaye Tadesse Asfaw, an astrophysicist with NASA,
- Mr. Moses Gichanga, a drones for development technology innovator.

Their individual stories reinforce the overall argument of this Magazine: Africa has the expertise or the ability to access the expertise needed for its economic development. What it needs to do is to find the political will and business model for harnessing that expertise.

Prof Babatunde Ogunnaike



Prof. Babatunde Ayodeji Ogunnaike is the William L. Friend Professor of Chemical and Biomolecular Engineering at the University of Delaware. He is an American Chemical Engineer of Nigerian descent. He was born in Ijebu-Igbo, Ogun State, Nigeria and attended the University of Lagos, graduating with First Class Honours in Chemical engineering in 1976. He also holds an M.Sc. in Statistics and a PhD in Chemical engineering both from the University of Wisconsin - Madison.

Prof. Babatunde's research focuses on modelling and control of industrial processes (polymer reactors, extruders, distillation columns); identification and control of nonlinear systems; the application of process analytical technology for control of pharmaceutical processes; the interaction of process design and process operability; applied statistics; biological control systems for process applications; and systems biology with application to neuronal responses and cancer. He is the author of many journal articles and books including *Process Dynamics, Modelling and Control* (Oxford University Press, 1994) and *Random Phenomena: Fundamentals of Probability and Statistics for Engineers* (CRC Press, 2009). He has been Associate Editor of the *Institute of Electrical and Electronics Engineers' (IEEE) Transactions on Control Systems Technology* and of *Industrial and Engineering Chemistry Research*.

He was a Research Engineer with the Process Control group of the Shell Development Corporation in Houston, Texas from 1981 to 1982. From 1982 to 1988, he was first lecturer and later Senior Lecturer at the University of Lagos. He joined DuPont's Central Research & Development Department in 1989, becoming a Research Fellow in 1995, and until

September 2002, was the Technology Leader of the Process Control group. While at DuPont, he pioneered the development and implementation of model predictive control (MPC), nonlinear state estimation, nonlinear control, and product quality control for industrial polymerization and granulation processes. He joined the faculty of the University of Delaware in 2002 and became the Dean of the College of Engineering in July 2011. He has been a visiting professor at the African University of Science and Technology, Abuja.

Prof. Ogunnaike is the recipient of several awards including: American Institute of Chemical Engineers (AIChE) 1998 Computing and Systems Technology (CAST) Division's Computing Practice Award; University of Delaware's College of Engineering Excellence in Teaching award (2004); 2007 Instrument Society of America's Donald P. Eckman Education Award (2007) and American Automatic Control Council's Control Engineering Practice Award (2008). He is a Fellow of the following professional bodies: American Institute of Chemical Engineers, American Statistical Association, American Association for the Advancement of Science and American National Academy of Engineering.

ACTS Executive Director, Dr. Cosmas Milton Obote Ochieng interviewed Prof. Babatunde Ogunnaike for the African Technopolitan.

AFRICAN TECHNOLITAN:
Hello Prof. Ogunnaike. We are very pleased to explore the application of science, technology and innovation to Africa's development with one of the world's leading experts on control and systems theory. How would you describe control and systems theory, and what do you see as its potential applications in social, economic and sustainable development in Africa?

PROF. OGUNNAIKE:
In the most general sense, "Control and Systems Theory" is an interdisciplinary branch of engineering concerned with the design, analysis, and implementation of systems that enable the operation of complex processes (such as refineries, or other manufacturing processes), complex machines and equipment (such as airplanes, automobiles, and even rockets) consistently at desired operating conditions. For example, process control systems enable refineries and chemical manufacturing processes to operate at safe conditions and generate

products with consistent product quality in the face of changing atmospheric conditions and varying raw materials. Automatic control systems are responsible for rocket and missile guidance, the cruise control in automobiles, and even the hard drives on our computers, and in our CD players. It is also very important to note that physiological life as we know it will not be possible without control systems inherent in physiological systems. The human immune systems is an example of an exquisite physiological control system that helps us maintain good health in the face of ever-present

pathogens. The nervous system, with the brain as the central computer, is the ultimate physiological control system by which we are able to walk, breathe, and carry out both external and internal activities that support life. In fact, many diseases arise as a consequence of the failure of one or more physiological control systems. For example, diabetes arises as a result of a malfunctioning blood glucose control system; hypertension is the failure of the blood pressure control system. Consequently, the applications of control are broad, extending into many areas including manufacturing, electronics, transportation, and medicine, just to name a few.

AFRICAN TECHNOLITAN: **What led you to focus your research in this area? Is this an area in which Africa (i.e. African universities) has the capacity to focus its research and applications of that research for socio-economic development?**

PROF. OGUNNAIKE: That I focused my research in this area was simply fortuitous. When I was completing my Bachelor's degree at the University of Lagos in 1976, my undergraduate thesis advisor, Professor Ayodele F. Ogunye, encouraged me to go to graduate school and to work in this area. I listened to his advice and in actual fact, I ended up carrying out my PhD thesis work at the University of Wisconsin—Madison, under the supervision of Professor W. Harmon Ray, whose very first PhD student ever happened to be the aforementioned Professor Ogunye!

As to whether this is a good area for African universities to consider focusing on, the answer is not so straightforward. On one hand, a significant portion of the work in this area is theoretical—which means that to contribute to the field does not require a lot of sophisticated equipment. This may make the theoretical aspect of the work attractive for African universities who may not have access to sophisticated and expensive equipment. However, there is an aspect of this work that requires practical implementation.

Whatever the case, Control & Systems Theory as a research area plays a significant role in finding solutions to many of the technologies needed to address such pressing problems as water, power, and health care.

AFRICAN TECHNOLITAN: **How would you enhance Africa's capacity to harness applications of science, technology and innovation for sustainable development and what do you see as the key to promoting STEM (science, technology, engineering and mathematics) development in Africa?**

PROF. OGUNNAIKE: We need to start our students early by introducing them to the concepts of the grand challenges facing the African continent and indeed the world at large, and then show them how developed nations have hitherto approached their own challenges. We need to encourage our students to be innovative in their thinking. To enable this, we need to provide them with the opportunity to “tinker”. I do not subscribe to the notion that only a “select few” can learn STEM subject. I agree that the truly gifted in these areas will be relatively few in number, but with good teaching, everyone can understand the basic principles. To maximize our chances for success, we need to find the truly gifted and provide them with special advanced and challenging training, but we need to ensure that such a programme truly serves the gifted and not just another programme that the rich and powerful will co-opt for their children.

While it is important to teach fundamental principles of each subject, it is just as important to engage students in unsolved problems and to provide the students with hands on experiences. We need to engage our students early in STEM fields and let them know that within these subject matters lie the secrets to solving some of the nagging problems faced not just by Africa but by the world at large. We also need to find and train dedicated teachers who can inspire this next generation. From my memories of growing up in Nigeria learning Mathematics, Physics, Chemistry and Biology, African students are just as bright and just as gifted as any other student in the world. I went to school in Nigeria with some of the most intelligent students I have ever met anywhere in the world.

The various national governments in the continent need to invest in the delivery of high quality STEM education, because nothing will happen if there is no infrastructure. Once we turn students on to the potential of STEM and

its implication for development, and if we are patient in sustaining this effort over the long haul, I am certain that we will start to see results by and by. South Korea and India are the perfect examples of what such a strategy can produce.

Before I leave this subject, I would like to sound a bit of a warning. Many in the developed world are (justifiably) emphasizing STEM education. This is good, but we should not do so to the exclusion of the arts and humanities. Developing technically sound (and even financially viable) solutions to problems facing mankind is good, but such solutions are ultimately bound to fall short without incorporating a social component to these technical solutions. By all means, let us train our students in STEM, but not at the expense of sociology and the humanities. To be successful, scientists and engineers must know how to communicate well; they must also understand some of the not-so-algorithmic and predictable characteristics of the human being.

AFRICAN TECHNOLITAN: **You have been a visiting professor at the African University of Science and Technology in Abuja, Nigeria (AUST). What are your thoughts on the general concept of AUST? Is it a viable vehicle towards the creation of an African MIT?**

PROF. OGUNNAIKE: No one can or should expect to reproduce the achievements of MIT, or even the IITs in India, simply by blindly copying what these folks did for their respective countries back in the day. However, we can learn from these historically successful enterprises and evolve a similar system of higher education that is customized to fit our continent, and which will therefore enable us to address the unique challenges posed by our uniquely African problems.

As such, the concept of the AUST in Abuja and its other sister institutions is a sound one. The objective is that these institutions will become a place where we train the next generation of scientists and engineers to tackle the problems facing Africa today and in the future.

AFRICAN TECHNOLITAN: **What do you see as the role of science and technology cooperation, particularly between Africa**

and the US, in increasing Africa’s access to vital applications of science, technology and innovation for development? How might Africa best leverage not just the technological capabilities of advanced economies but also of the African diaspora or scientists of African descent?

PROF. OGUNNAIKE: I believe that for Africa to reach its full potential, it will be essential that we have “all hands on deck”. First, we can benefit significantly by forging collaborative and cooperative relationships with the developed world. Africans in the diaspora (in these developed countries) have a huge role to play in catalyzing and facilitating such relationships. In the end, every person of goodwill interested in seeing sustainable development in the African continent must join hands and strive for this singular purpose.

I am not sure why, but there seems to be elements of a low-grade mutual tension of sorts between the Africans that “stayed at home” and the ones who, for one reason or the other, had to leave the shores of Africa to go into the diaspora. Whatever the lingering problems, we all need to realize that things will not change unless people make them change, and, like it or not, one group by itself cannot implement the changes necessary without the other. This reminds me of a proverb that I suspect exists in one form or the other in many African languages: “If you want to go fast, walk alone; if you want to go far, walk with a group”. There is ancient wisdom in these words: if we want to go far as a continent, we have to work together, all of us—those at home and those abroad. The groups complement each other.

AFRICAN TECHNOLITAN:

What is your best memory of growing up and studying in Nigeria? How would you characterize Nigeria’s development strategy over the last 50 years, at least in so far as science, technology and innovation is concerned?

PROF. OGUNNAIKE: I recall that in the 1960s (at least in the Western Region of Nigeria, but I imagine the same might also be true of the Eastern Region), we had an enviable educational system that was truly remarkable overall, but one that was particularly strong in STEM. I recall that when I was in my “Lower Sixth” form (the first of the 2 years of what was known then as the “A-Levels”), our mathematics program at Government College Ibadan, in Western Nigeria, was so strong that some of us could look at a second order differential equation and tell you the solution! Many of us who went through that rigorous training discovered just how good our training was when we went abroad to study, especially in the US. (My professors in graduate school at the University of Wisconsin could not believe what I just said about solving simple linear differential equations by mere inspection until I demonstrated it to them!)

Alas, that education system has systematically degraded to the point where STEM training is no longer a strength in Nigeria. The earlier pre-independence generation of leaders got it right by investing in high quality teachers and schools, and in pioneering Universities, laying the foundation for what our generation enjoyed; a chronic lack of investment in high quality education and infrastructure perpetuated by the subsequent generations is primarily responsible for the current state of weakness in education in general across all ages. This, I believe is one of the biggest mistakes that the country

made. Access to a quality education should not be just for the wealthy; in fact, without broad access to quality education across the entire spectrum of society, no nation will succeed in the 21st century.

AFRICAN TECHNOLITAN:

If you had an opportunity to share your thoughts and ideas on the development of science, technology and innovation with an African leader, what would you say?

PROF. OGUNNAIKE: It will be too easy to point to all the missteps and ineffectiveness of many African leaders of the past. This is not likely to be productive. Instead, I will appeal to the leaders to learn from the mistakes of the past and then learn from the successes of other nations, especially South Korea, and to an extent India. But for any suggestion to have any chance of successful implementation, there has to be a genuine soul-searching by each leader. In the end, each leader needs to make up his or her mind that the time has come to put everything else aside and focus on doing lasting good of the nations they lead.

That said, African leaders need to understand that (a) Africans are just as talented and naturally intelligent as anyone else in the world; and (b) that education in general, but STEM education in particular, provides the best opportunity for rapid development; and (c) that without good, selfless, and inspirational leadership, African nations will never reach their potential.

Much of what I have said earlier is what I will repeat to our leaders and then end by noting that developing a culture of scientific and technological innovation is the hallmark of the nations that will prosper in the 21st century. We are fortunate that technological advances such as the internet, and communication tools such as the smart phone, have made the playing field a little bit more level, and the world just that much flatter, making it possible for developing countries not just to play catch-up, but to leap frog. But the leaders must have an internal conviction that they have a role to play: that of providing true leadership. How committed they are will be reflected in the actions they take. It is not too late.

We, the young diaspora generation have seen the whole thing unravel with our double-hatted ability to understand both sides of negotiations, both cultural tendencies and eventually, both points of view.

FROM ETHIOPIA TO NASA

DR TILAYE TADESSE ASFAW

By Dr. Tilaye Tadesse Asfaw and
Dr. Cosmas Milton Obote Ochieng



Conventional opinion regards space science, technology and innovation as the preserve of a few advanced economies. Whenever a developing country launches a space programme, there is no shortage of domestic and international criticism.

The level of poverty in such a country would be highlighted and the country would be advised to spend its time and money on ‘real’ problems. That applications of space technologies and innovations can be harnessed to alleviate poverty or to promote socio-economic development is hardly ever considered.

The idea that poor countries should not dare to harness applications of space science, technologies and innovations for their sustainable development is seriously flawed. Space is a strategic natural resource and it has been viewed as such ever since the dawn of the space age. More importantly, while space research is expensive and should be subject to rigorous national debate and cost benefit analysis, contrary to conventional opinion, the potential application of space science and technology to social and economic development is not only vast but potentially more beneficial at lower levels of economic development.

The world is increasingly dependent on space technologies and innovations for weather forecasting; global

communications and broadcasting; air traffic management, biodiversity and natural resource management; etc. Space applications offer effective tools for monitoring and conducting assessments of the environment and climate; managing the use of natural resources (e.g. biodiversity, marine and fishery resources); managing responses to natural disasters (e.g. floods); and in enabling ‘smart agriculture’, ‘smart schools’ and ‘smart health’ services provision.

Globally, more than 50 countries have some spaceflight capability or ability to launch satellites into orbit either independently or through a third party. In Africa, this includes the two main regional space hubs, Nigeria and South Africa. Across the continent, satellite capacity has nearly tripled since 2010. This has catalyzed Africa’s ‘mobile and data revolution’ and contributed indirectly to the continent’s recent impressive economic growth rates. Satellite mapping has also been used in natural resource management (e.g. mineral exploration). The technology recently led to the discovery of the vast underground water aquifer

in Kenya’s Turkana County.

All this means that as Africa seeks economic structural transformation, space science and technology should be seen as an integral part of Africa’s development strategy. Earth observation systems, meteorological satellites, communication satellites and global navigation systems already make significant contributions to the pursuit of sustainable development in Africa. Navigation satellite systems and satellite communications enable Africa to connect and communicate with people around the world. Satellite imagery can help with ‘smart’ and ‘resilient’ city planning – an urgent need in Africa given the continent’s rapid urbanization and demographic changes. Satellite imagery can also be used to monitor and track land use change, deforestation, habitat loss, environmental degradation; crop productivity, precision farming, food insecurity, etc. According to the OECD, globally, revenues derived from space related products and services amounted to some USD 150 – 165 billion in 2009. The space economy (one based on products and services derived from space sciences,

technologies and innovations) is just getting started. Africa cannot afford to lag behind in this economy, both as a user and producer of space technologies and innovations.

The world's reliance on space technologies, products and services makes it vulnerable to disruptions by extreme space weather conditions. A better understanding of space weather and a capability to provide timely and reliable space weather forecast is critical to the viability and sustainability of the nascent global space economy. Severe space weather storms present a variety of hazards to modern economic installations and social services. Severe space weather storms can disable GPS systems, damage power grids and disrupt satellite communications, potentially leading to large economic losses or humanitarian crises.

Given the world's increasing dependence on space technologies, products and services, high quality forecasting of space weather is of paramount importance. This requires a better understanding of the behaviour of the sun. The sun is the main driver of space weather through the violent eruptions caused by its magnetic field.

Although Africa has only a handful of space programmes (South Africa, Nigeria, Morocco, Egypt – and more recently Ethiopia, Ghana and Kenya) and the continent spends little resources on space education, space studies or space research, Africa is increasingly a credible player in space science and technology. South Africa and Nigeria have fairly large and sophisticated space programmes. Kenya, Ghana, Ethiopia, Morocco, Namibia and Senegal, among others have nascent but credible space programmes. African scientists or scientists of African origin have long made distinguished contributions in space science, technology and innovation at some of the world's leading space research centres.

One such young African astrophysicist is Dr. Tilaye Tadesse Asfaw. A native of Ethiopia, Dr. Asfaw is a Postdoctoral Fellow at the NASA Goddard Space Flight

Center, Space Weather Laboratory in Greenbelt, Maryland. Dr. Asfaw holds a PhD in Astrophysics from the Max-Planck-Institute for Solar System Research in Germany and a B.Sc. (Physics) and an M.Sc. (Astrophysics) from Addis Ababa University in Ethiopia.

Dr. Asfaw's research focuses on numerical modelling of the magnetic field in the solar atmosphere. The magnetic field in solar atmosphere plays a key role in almost all active physical phenomena such as solar eruptions and coronal heating. Solar flares, prominence eruptions, and coronal mass ejections (CMEs) are tremendous explosions in the Sun's atmosphere. Intense magnetic fields around sunspot regions drive these eruptions. These eruptions can in turn produce hazardous space weather conditions close to Earth.

Dr. Asfaw has developed nonlinear force-free coronal magnetic field solver (or a software tool), which calculates the 3-D magnetic field from the photospheric boundary into the solar atmosphere using spherical geometry. Dr. Asfaw is currently involved in developing a numerical code that is going to be integrated into NASA Community Coordinated Modelling Center (CCMC) to predict solar eruptions with a view to enhancing the accuracy and timeliness of space-weather forecasting. He also has a leading role in the development of a set of tools for use in modelling the quasi-steady evolution of coronal active region magnetic fields using data from HMI/AIA on-board the Solar Dynamics Observatory and other ground based telescopes.

Dr. Asfaw grew up in the Harar region of Ethiopia. While his high school teachers noted his aptitude for science, especially physics and mathematics, space science was the furthest thing from his mind. Ethiopia did not have a space education or studies at either secondary or undergraduate education levels. Moreover, since the country had no space programme (prior to 2004), public awareness of potential applications of space science and technology was negligible.

After graduating with a B.Sc. in Physics from Addis Ababa University in 1996, Dr. Asfaw taught high school physics for eight years – in a rural school 350km from Addis Ababa. It was only after he graduated with an M.Sc. in Astrophysics from Addis Ababa University in 2005 that his interest in space research exploded. By then, the Ethiopian Space Science Society (ESSS) was just 1 year old. ESSS was founded in 2004, as a self-funding member based organization, with a mission to promote astrophysics, astronomy and applications of space sciences for social and economic development in Ethiopia.

Today, Ethiopia has a nascent space programme, courtesy of the Ethiopian Space Science Society (ESSS). For a national space programme that is not directly funded by the state, ESSS has done phenomenally well. Its advocacy led to the launch of Astrophysics and Astronomy courses in Ethiopia in 2007. Its public awareness and space literacy campaigns in primary and secondary schools in Ethiopia has seen an increased spike in public interest and public policy in space science and technology for development. In 2013, Ethiopia became the third regional space hub in Africa with the construction of the largest observatory in Eastern Africa designed to promote astronomy and space research. The USD 3.4million Entoto Earth Observatory is located in the Entoto Mountains (3,200 metres) on the outskirts of Addis Ababa.

The Observatory launched with a bang, taking amazing photographs as can be seen from figure 1 and figure 2 below. ESSS, together with the Ethiopian government is planning on launching a second Observatory in the ancient town of Lalibela for national security and development purposes. For a programme that was initially called the 'Crazy Peoples' Club', ESSS has been a resounding success. Through individual private effort, it has persuaded the Ethiopian government to embrace the social and economic impacts of space sciences and technology.

Ethiopia is just one among a growing number of African countries with nas-

cent space programmes. There is in fact a continental space programme underway in the continent. In 2009, the African Union called for the establishment of the African Space Agency.

If Ethiopia launched a space programme on a 'shoe string' budget, Nigeria has had a fairly credible and publicly well-funded space programme for over a decade now. Nigeria's National Space Research and Development Agency (NASRDA) headquarters in Abuja. To date Nigeria has successfully launched five satellites into space, at least 3 of which are currently orbiting the globe. Four of Nigeria's satellites were designed for noncommercial or public purposes while the fifth, NigComSat-1R is used for commercial purposes. Each of the country's satellites has a range of purposes but typically these include: disaster monitoring and control; national security; natural resource management; agricultural development and broad based socio-economic development.

Nigeria's first satellite Nig Sat 1, cost USD 13 million and orbited the earth 2012 when it was replaced by NigeriaSat-2 and NigeriaSat-X. All three satellites were built by the UK firm Surrey Space Technologies but launched into orbit by different space faring nations. Nig Sat-1 was the first satellite to send back pictures of the US east coast during Hurricane Katrina. Since then, Nigeria's satellites have been used to among others: track crops and weather in order to ensure food security; improve urban planning and tax collection in Lagos; monitor ecological change within the Niger delta and to provide cheaper wireless and internet coverage. Nigeria has also used its satellites for election monitoring (2011) and review of electoral boundaries. Nigeria plans to design, build and launch a satellite of its own from a Nigerian Launchpad by 2020.

The National Space Research and Development Agency (NASRDA) is the national space agency of Nigeria. It was established in 2001 and it has six "centers of excellence" throughout Nigeria including its main headquarters in Abuja. The initial cost of establishing NASRDA is estimated at USD 93 million.

The experience of world class space scientists of African origin such as Dr. Asfaw and the successes of ESSS, the Nigerian Space Programme and the

South African Space Programme, confirms that Africa has the expertise, technology and financial resources or ability to access the expertise and technologies needed to establish and run scientifically and developmentally beneficial national or regional space programmes. The development needs of the continent and the sustainability of its human welfare and ecosystem health, demands that the continent joins to race to harness applications of space sciences, technologies and innovations.

The African space race might be getting off in earnest now, but this is not Africa's first rendezvous with space exploration. Africa has had false starts with the space race before. With the help of NASA, South Africa launched a sophisticated national space programme in the 1960s although during the apartheid regime,



Fig 1. Spiral Galaxy spinning in the anticlockwise direction observed by the Ethiopia Earth Observatory: <http://www.ethioss.org.et/index.php/en/home/news/131>



Fig 2. Mars as captured by the Entoto Earth Observatory in Ethiopia. (<http://www.ethioss.org.et/index.php/en/home/news/131-the-first-light-observed-by-ee-telescopes>)

it was mostly deployed for military purposes. Since the end of apartheid, the South African space programme has generated applications of considerable commercial and humanitarian uses. Sadly, Kenya failed to leverage its association with NASA and Italy (University of Roma, 'La Sapienza') to develop a viable and independent homegrown space programme. Nevertheless, the country is associated with pioneering space efforts through its San Marco

Launchport (now known as the Broglio Space Centre) built in Malindi in 1964. In 1970, on the 7th anniversary of its independence, jointly with NASA and Italian engineers, the world's first satellite dedicated to celestial X-ray astronomy was launched from Kenya at the San Marco launch platform - a converted oil platform.

The NASA built and operated satellite was named 'Uhuru' or the Small Astronomical Satellite 1 (SAS-1). It stayed in service for nearly three years. Uhuru's main mission was to survey the sky for cosmic X-ray sources. It provided the earliest signs of the existence black holes. It also discovered and mapped X-ray sources (e.g binary star systems, supernovas and galaxies) and x-ray pulsars.

To date, the San Marco Platform has launched 18 rockets (carrying scientific payloads) and 9 satellites into space - all of them successfully. The San Marco or BSC Space Programme has two segments: (a) a sea segment dedicated to orbital and suborbital launches (b) and a land segment that besides supporting the sea based launches, has 3 ground stations for Satellite Data Acquisition and a Remote Sensing Centre. While all the data at the remote sensing centre is freely available to Kenyan researchers and government agencies, the San Marco Space Research Project is largely led and driven by the Italian Space Agency, under a cooperative agreement with the Kenya Government. Kenya leads to harness and leverage its nearly 50 years of collaboration in space research through the San Marco Space Centre to create a credible and development oriented national space programme.

Should Africa or African countries have a space programme? This magazine believes that on the balance of strategic scientific, economic, technological and cultural (i.e. catalyzing the development of the continent as a scientific region) spillover effects, the answer is yes. The fundamental question of the African space programme is one of how best that continent can harness applications of space science, technology and innovation for its socio-economic development. Should the continent have a regional space programme (i.e. the African space agency) or should it have sub-regional (i.e. East, West, South, North) or even national space agencies or should it have a combination of two or more of the above? Given the combination of the enormous human, fi-



**The San Marco Launch Platform
off the Kenyan Coast**

nancial and physical expenditures needed for a credible space programme; Africa's limited resources, and competing socio-

economic or development needs these are strategic choices or policy trade-offs worthy of serious and evidence based consideration.

With clear missions and objectives, principle of subsidiarity or a clear division of labour and smart allocation of resources, it is possible to have a tiered national and regional system that pulls resources and works in a coordinated fashion to address a few fundamental development challenges: health, education, energy, food security, environmental management. We believe that Africa has the expertise, technologies and resources, or the ability to access all three to successfully harness the application of space science and technology for its socio-economic development.

Potential applications of space science and technology to Africa's social and economic development are numerous:

- Economy wide scientific and technological spill-over effects
- Crop productivity monitoring and food security tracking
- Improved health and education outcomes
- Better management of biodiversity and natural resources
- Better control of natural and humanitarian distances
- Environmental and climate change monitoring
- Improved scientific image of the continent (i.e. to purge the image of the continent as a land of disease, ignorance and poverty.
- Reversing the brain drain from the continent or fostering a 'brain gain'



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DRONES FOR AFRICA'S DEVELOPMENT

AN INTERVIEW WITH MOSES GICHANGA

By Dr. Haile Michael Teshome Demissie,
Senior Research Fellow, ACTS

The military application of drones has thus far eclipsed their civilian use – both in popular imagination and in the level of technological advancement or sophistication. However, drones or Unmanned Aerial Vehicles (UAVs) are multi-purpose use capable technologies with potentially significant civilian or development applications.



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any UAVs for civil or commercial uses, including development purposes are still in the early phases of design and implementation. Significant technical, infrastructural, financial and legal barriers would need to be overcome if UAVs are to play substantial roles in Africa's economic development. Africa would need to train the necessary human capital or otherwise access it from elsewhere. Electrical innovations capable of powering drones for longer hours and distances would be necessary, drone payload capacity might need to be increased and above all, bandwidth for processing live imagery would be needed. All these are significant obstacles but they can and will likely be overcome by 2020.

Numerous research and development projects designed to address some of these challenges are currently underway globally. Perhaps among the best known is the Swiss based, USD 10 million Flying Donkey Challenge. The Flying Donkey Challenge is a global technology contest that seeks to revolutionize the transportation of goods in remote rural communities in Africa by connecting African countries with cargo drones. The open challenge seeks to create, by 2020, commercially viable cargo robots or UAVs capable of carrying a load of at least 20 kilograms over a distance of 50 kilometres in less than an hour.

Many people will be surprised to learn that Africa has been involved with the drone business, both for national security and civilian or commercial purposes for some time now. More than a dozen sub-Saharan African countries – including regional giants Kenya, Nigeria, Ethiopia and Ghana – already deploy surveillance drones to track pirates, militants, poachers and drug traffickers across their land, sea

and air borders. Many of these are imported but some countries are reported to be working on indigenous drones. Botswana, Senegal, Uganda and Mauritania are in the process of acquiring UAVs. Drones have also been deployed for civilian uses in Africa, most prominently to track poachers at Africa's national parks and conservancies, especially in Kenya and South Africa, although both governments later banned use of private drones for anti-poaching activities citing security considerations. A lot of legal and legislative work with specific reference to privacy, human rights, civil liberties and handling of data needs to be undertaken if the drone is to be safely and successfully deployed in Africa for both military and civilian uses.

In the meantime, research and development on potential applications of drone technologies for development isn't only happening outside Africa. Among the many innovators leading this type of work in Africa is Moses Gichanga of Kenya. Mr. Gichanga is an aviation & robotics enthusiast and innovator. He is a Computer Scientist by training specializing in Software Engineering. His current research interest focuses on autonomous aerial platforms for environmental conservation and natural resource management.

Mr. Gichangi. I grew up in Matügüta Village in Githunguri, Kiambu, Kenya. He attended Gathirũinĩ Secondary School in Central Kenya before joining the Kenya College of Accountancy for a Diploma and Higher Diploma in Information Systems and the Multimedia University for an International Advanced Diploma in Information Systems majoring in Computer Science. He obtained his BSc in Computing and Information Systems with a major

in Software Engineering from London Metropolitan University in the United Kingdom.

H. T. Demissie: How did you become interested in drones – or to use the word you prefer, unmanned aerial systems (UAS)?

Mr Gichanga: I studied Computing and Information Systems in college and majored in Software Engineering. In High School I was purely an electronics and hardware enthusiast. I fiddled with many electronic gadgets and built transistor radios and switches. After my encounter with digital circuits and computing, I realised software is the soul of hardware, and decided to study it in College to animate my inanimate hardware. After a five year stint in the software world, I decided to return to my true passion.

As a small boy my brother and I made and flew a giant glider from a polythene sheet that we liberated from my father's tea seedling nursery sparking an interest in aviation. So naturally when I returned to hardware the first thing I revisited was my work on the glider. I built it out of locally available materials. Flying it, albeit for short distances, gave me the confidence I needed to evolve better and sounder designs.

All the while I was blogging about my exploits, and an American aerospace engineer (and now a good friend) Coby Leuschke asked about my purpose with the design. At the time I was eyeing wildlife conservation. Eventually we formed a partnership to build UAS for various purposes starting with wildlife conservation. We've since explored various other uses including forestry conservation, geospatial and remote sensing functions including mineral exploration to mention but a few.

H.T. Demissie: What are your major achievements so far and what are you currently working on?

Mr Gichanga: I have developed several 'smart devices' including a 'walking guide' device known as a 'smart cane' for the visually impaired. I have also developed an Email and SMS delivering platform for the visually impaired and an autonomous tractor for sustainable food production. I'm privileged to have

worked with Rocketship Systems Inc. (RSI) in Fort Collins Colorado since 2011. I recently started my own aerospace initiative in Kenya known as Con-trail Robotics.

I have forged an alliance with RSI to locally assemble UAS platforms with various capabilities and functions. Work on the smart cane project was supported by a grant that I received from the Kenya National Commission for Science, Technology & Innovation (NACOSTI) in 2013. The design is meant to be open source to encourage its adoption by as many who need it as possible. The cane can receive and send SMS and email messages. It is also audio responsive which means that a user can speak to it and receive feedback via a haptic handle.

I am also a past recipient (2013) of a grant by the international Institute of Electrical and Electronic Engineers (IEEE) through their Engineering in Community Projects (EPICS) programme.

I am currently exploring a number of projects based on the UAS technology. I'm exploring search and rescue scenarios using UAS to identify distressed persons in remote regions in Kenya. I am using a platform I developed for my entry for the Australian UAV Outback Challenge to find Joe, a dummy hidden in the Australian outback. I am also working on various ways to perfect the use of UAS for environmental monitoring and natural resource management.

H.T. Demissie: The drone technology is developing fast amidst an ethical and legal vacuum. What are the main legal, regulatory or safety challenges with the drone technology in Africa?

Mr Gichanga: Safety and security is a key aim of many rules and regulations concerning aviation. While UAS are indeed aircraft, they should not necessarily be classified as conventional aircraft. CAAs impose similar regulatory requirements to anything that flies as they do conventional aircraft, greatly stifling design and development of UAS. We need to start from air safety and regulations and then modify these to fit both the nature and functionalities of various drone technologies.

This is because the use of UAS whether for military or civilian purposes raises questions that are not generally applicable to conventional aircraft. For example, concerns over privacy are rather specific to UAS. Secondly, because UAS might compete with conventional aircraft for airspace, rules governing relations between UAS and conventional aircraft, with particular reference to use of air space are needed.

The current application of existing regulation on aircraft to UAS in Africa is stifling. Safety devices such as transponders that transmit location and attitude data about an aircraft are bulky and cannot be applied to small UAS. Majority of UAS are no more than 8ft in wingspan. Smaller transponders have been developed but they are prohibitively expensive. Yet under the current framework these are mandatory.

Concerns raised by many CAAs regarding use of UAS especially in Africa is valid and can be addressed through establishment of entities for the service provision of UAS and associated services for its citizenry. For instance, in the conservation of wildlife, the UAS may be run by a government recognized entity. In Kenya, that would be the Kenya Wildlife Service [KWS], which is legally constituted to address all issues related to wildlife and their habitat. Similarly the Kenya Forestry Service could run forestry related UAS missions. Since these concerns are relatively easy to fix, they should not stand in the way of R&D on UAS.

H.T. Demissie: What is the future of UAS in Africa?

Mr Gichanga: The future of UAS will be characterized by increases in computing power, greater miniaturization, reliability and affordability. Research is underway to develop 'sense and avoid' technology, including use of transponders for conventional aircraft and UAS alike to declare their locations, as in Traffic Collision Avoidance Systems [TCAS]; use of radio detection and ranging [radar], sound detection and ranging [sonar], visual detection using software and object detection, among others. All these developments will enhance the harnessing of UAS applications for socio-economic development in Africa.

SHARING AFRICA'S DEVELOPMENT TECH-INNOVATIONS

By Winnie Asiti, Research Fellow, ACTS

“We need to stop being lazy analysts and take our challenges for ourselves; stop wasting resources and implement our own ideas,”

Steve Kayizzi-Mugerwa,
Acting Chief Economist and Vice-President AfDB



In this issue's Africa's Development Tech-Innovations we feature 'KilimoHub'. KilimoHub is a web based extension service where all extension service and market data is collected and stored in a website and users can access the information from the website and also through smartphone applications for young farmers. However, developers have also developed a server (Sikizi) where farmers without internet access can access this information from normal SMS platform. KilimoHub also links farmers to buyers.

KilimoHub was developed and is being used in Baringo County, Kenya. It was developed by Bunifu Technologies, a local company, together with Baringo Change Makers and the Baringo County Department of Agriculture, livestock and fisheries.

Contact KilimoHub:
info@bunifu.co.ke www.bunifu.co.ke

'Kilimo'

Swahili meaning for farming;

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Swahili meaning for innovative!

Africa's Development Tech-Innovations features innovations and technologies that are transforming the continent.

Have something to share or would like to be featured? Send us a brief profile of your tech innovation at: info@acts-net.org

OPPORTUNITIES AND CHALLENGES OF SOCIAL IMPACT INVESTMENT IN AFRICA

By Dr. Janice Golding



Social impact investments appear to have come of age in 2014. Within the last three years, even Pope Francis, as well as UK Prime Minister David Cameron and former US Treasury Lawrence Summers, have provided convincing arguments for social impact investments. A report commissioned by the UK Prime Minister at the G8 Summit in 2013 and released on 15 September 2014 (*The Invisible Heart of Markets*), follows these leaders in explaining the potentially powerful role that impact investing can play in poverty alleviation, social inclusion, environmental protection and good corporate and public governance.

Social Impact Investments are those that intentionally target specific social objectives along with a financial return and measure the achievement of both. Impact investing refers to making investments that generate positive impact beyond financial return - to include social and environmental returns, for example. According to a 2010 study by JP Morgan and the Rockefeller Foundation, impact investments are an alternative asset class that could grow to represent a global market of US\$ 500 billion by 2020. The implications for Africa could be considerable although few comprehensive assessments of the opportunities and risks posed by impact investments in Africa have been conducted. The 2014 African Investing for Impact Barometer Report by the Univer-

sity of Cape Town's Graduate School of Business reports acceleration of this investment type in Africa's two biggest economies. Its survey of 1,200 funds finds that impact investments in South Africa constitute 41% of funds (USD 67 billion) and 34% in Nigeria (representing USD 2.3 billion), mainly private equity and asset management. Given Africa's social, economic and environmental development needs, the continent could be a gigantic impact investment hub, serving as the world's experimental test case for implementing a values-driven investment framework.

However, that would depend on a number of measures at global, regional and national levels. While the concept of impact investing is not new to Africa, few investors in Africa are either aware or self-identify with the concept. The Economist has characterized the G8 Report as a "special pleading for a market that cannot stand on its own two feet." Many still view impact investment as a "slippery concept" because for the most part it rests on case studies from the developed world.

Overcoming the structurally amorphous nature of impact investments is important, else they may amount to nothing more than an ideological brand at odds with itself, causing harm despite good intentions. Widespread agreement exists that successful investments in emerging economies depend on first-mover strengths and analytical advantage. But major barriers prohibit impact investments from becoming a mainstream phenomenon, and here, the devil is in the definition and the detail.

Firstly, fiduciary duties obligate investors to maximize risk-adjusted financial returns to beneficiaries. However, it is unethical and unsustainable no matter how much money and social impact is made from returns generated from crushed mountains and child labour, corrupt practices and unsustainable consumption. Clarifying contracts of fiduciary responsibilities of trustees across the investment value chain and revisiting the regulatory set up with governments are key.

Secondly, without well-defined frameworks and methodologies, the accountability of corporate stakeholders will undoubtedly fall into question. Designing and using fit-for-purpose investment tools are required, and environmental, social and governance (ESG) factors must be integrated into identifying risks over realistic timeframes. Fund managers can insist on recalibrating exposure profiles of investment portfolios according to ESG criteria and doing away with blanket approaches on how risk and growth performance is monitored and managed. Also, using verifiable ESG data rather than narrative assumptions in investment scenario mapping and other forecasts will be required. At present, these new methods remain fragmented and incoherent, and greatly in need of consolidation by academic investment scientists and practitioners. This implies drawing in multi-disciplinary expertise and data.

Thirdly, training and capacity building are required on investment floors as well as in university and college curricula in order to build a new cohort of company boards, investment managers and analysts. In tandem, shareholder education and public awareness campaigns about the non-financial derivatives of impact investments will help stimulate the market base. It would auger well for bilateral investors such the Chinese, and prospective players on the continent, such as the BRICS's New Development Bank, to take inspiration from the G8 report and inculcate this new investment paradigm.

Social impact investing can take off in Africa. However, it will require comprehensive analytical and policy work by academics, private sector, governments and civil society before an enabling institutional framework is established.

**Dr Janice Golding works in economic co-operation at an embassy in Pretoria. She writes in her capacity as an independent consultant. She holds a PhD from Oxford University (Environmental Change Institute) and is an Honorary Research Associate (Plant Conservation Unit) of the University of Cape Town.*

ACTS' CRYSTAL BALL 2015

KEY TECHNOLOGY AND DEVELOPMENT TRENDS TO WATCH IN 2015

ACTS TOP TEN STRATEGIC TECHNOLOGY AND DEVELOPMENT TRENDS IN AFRICA IN 2015.

- 1** Mobile Applications, Technologies and Solutions: For example, MPesa, Mkopa, Msoko, Mhealth, Mservices, Meducation, etc. The mobile revolution is only getting started in Africa. Mobility based technologies and solutions will continue to grow, evolve and adapt in 2015. Kenya likely to remain a leader here but expect more competition from Nigeria, South Africa, Rwanda and Senegal.
- 2** Increasing Computing Access: Partly powered by the success of the mobile revolution and increasing affordability, more African governments, cities and institutions will join the effort to provide Free Wifi in public places; free or subsidized computers/ laptops/tablets to African primary or secondary schools. Increasing affordability of smartphones will result in their continued growth and use in Africa.
- 3** New Trade Agreements with the European Union and with the USA: Game changing trade agreements, especially with the EU fully coming into effect in 2015. The African Growth Opportunity Act (AGOA) must also be renewed or replaced by an alternative agreement by September 2015. Both agreements likely to impact African economic fundamentals from 2015 onwards.
- 4** More countries to lean towards the 'Addis Ababa-Kigali Consensus' Model of Development': Some 'Big Push' infrastructure development projects, extractive sector development (oil and gas, mining and mineral projects); Sustainable Development Goals (SDGs); Chinese influence (i.e. the 'Beijing Consensus') in African policy making and practice likely to increase. Key African economies to watch: Nigeria (elections 2015); Ethiopia (elections 2015); South Africa (the political and economic system needs to regain some level of 'optimism' and confidence); Ghana (needs to come out of economic crisis); Ebola hit countries of Guinea, Sierra Leone and Liberia (might suffer significant economic contraction); oil exporting countries (especially, Angola, Gabon and Nigeria) – likely to be affected by fall in oil prices. Since a majority of African economies
- 5** are net-oil importers, the fall in oil prices will be a positive development to African economies overall. Development Analytics or Data for Development: Increasing policy debate and use of big data analytics to inform and/or influence development policy making and practice. Expect more push towards open data access policies; quality collection, analysis and presentation of conventional data (i.e. national statistics) and nascent moves to link big data analytics to national statistics in a few countries (i.e. data interoperability).
- 6** Next Generation Computing: Big Data, Cloud Computing, Data Localisation, Mobile Computing, High Performance Computing (i.e. Supercomputers), and Smart Machines.
- 7** Cyber Security, Internet Governance and Information Rich Democracy: Cyber Security Legislation and Policy with specific reference to privacy, trust and connected enterprises; some effort to monitor and or control social media or internet use by citizens; growing calls for democratization of the internet and social media and the creation of information rich democracy. All three likely to result in tension between governments and civil liberty and human rights advocacy groups.
- 8** Biodiversity Conservation and Natural Resource Management – The continent will have to do something substantive about poaching and wildlife trafficking in 2015. The impetus for this will continue to come from the outside. External country actions to watch: China, US, UK, EU and the G8. African countries to watch: South Africa, Tanzania, Kenya, Mozambique, Zimbabwe and Botswana.
- 9** Big Science: e.g. space science and technology; nuclear power projects; technology or science parks. Countries to watch: South Africa, Nigeria, Ethiopia, Kenya.
- 10** Climate Change Adaptation and Resilience: A number of African countries likely to enact/change/revitalize their climate change adaptation and resilience policies, legislation and practice in 2015.

The first issue of this Magazine provided highlights of ACTS' research, policy engagement and capacity building activities in the first half of 2014 (Jan-June). This section highlights ACTS' research, policy engagement and strategic partnership activities in the second half of 2014.

POLICY ENGAGEMENT

ACTS Convenes the Kenya Climate Science, Technology and Policy Roundtable

On the 26th of November 2014, ACTS convened a High Level Climate Science, Technology and Policy Roundtable at the Hilton Hotel in Nairobi to review the Kenya Climate Change Bill 2014. The Roundtable featured a distinguished panel of experts:

- Hon. Dr. Wilbur Ottichilo, Member of Parliament, Emuhaya Constituency
- Dr. Alice Kaudia, Environment Secretary, Ministry of Environment, Water and Natural Resources
- Dr. Saleemul Huq, Senior Fellow, IIED
- Dr. Richard Munang, Climate Change Programme Coordinator, Regional Office for Africa, UNEP
- Dr. Cosmas M.O. Ochieng, Executive Director, ACTS
- Dr. Arthur Mugisha, Head of Country Office, IUCN Uganda
- Prof. Erastus Gatebe, Chief Research Scientist, Kenya Industrial Research Institute (KIRDI)
- Mr John Kioli, Executive Director, Green Africa Foundation and Chair, Kenya Climate Change Working Group
- Mr Vincent Nzau, Senior Economist, Ministry of Devolution and Planning

The Roundtable drew participants from academia, public service, private sector, NGOs, civil society and the media. The chief message coming out of the Roundtable was the importance of evidence informed policy making and practice in climate change legislation, policy making and project implementation. The Kenya Climate Science, Technology and Policy Roundtable is a project funded by the Vakayiko grant from the International Network for the Advancement of Scientific Publications (INASP).



Dr. Saleemul Huq answers a question at the ACTS Climate Science, Technology and Policy Round Table.

ACTS Joins Kenya in Marking the International Day of Persons with Disabilities

On 3rd December 2014, ACTS joined the National Council for Persons with Disabilities (NCPWD) Kenya, the Government of Kenya, the UN, private sector, NGOs, civil society and members of the public to mark the International Day of Persons with Disabilities at the Kenyatta International Conference Centre in Nairobi.

The theme of the 2014 International Day of Persons with Disabilities was: Sustainable Development: The Promise of Technology. ACTS teamed up with Contrail Robotics to showcase a number of 'assistive technologies'. A GPS enabled Smart Cane, a wheel-able Energy Saving Cook Stove, and Disability Friendly Agriculture technologies were particularly popular and yielded demands for mass production or fabrication.



Kenya's Cabinet Secretary for Labour, Hon. Kazungu Kambi (centre) tours ACTS' exhibition stand at Kenyatta International Conference Centre during the International Day of Persons with Disabilities.

ACTS Attends the Planet Earth Institute (PEI) Science Africa Festival in London



Lord Paul Boateng addressing delegates at the Planet Earth Institute Workshop on Data for Development in London, 18th November, 2014.

ACTS hosted two workshop sessions on Harnessing Big Data for Sustainable Development in Africa at Planet Earth Institute's Science Africa Festival in London on November 18th, 2014. The Workshops explored ways through which Africa can harness the data revolution – big data, open data and the digital revolution – for accelerated economic development. The Planet Earth Institute (PEI) is an international NGO that is working for the scientific independence of Africa. They aim to lead Africa to scientific independence through promoting higher education, technological innovation, and policy and advocacy.

ACTS Participates in the Kenya National Epilepsy Awareness Month!

Millie Ocholla, ACTS Communications Officer



Kenya marked the National Epilepsy Awareness month in November 2014. The theme of the year was, “Angaza Kifafa” or “shining the light on epilepsy”. The objective was to create public awareness of the disease, which is still surrounded by mystery and often associated with supernatural forces in Kenya. ACTS joined the National Epilepsy Coordination Committee (NECC) Eskar Communications and Kenyans from all walks of life to help create awareness on the causes of epilepsy and how to manage the disease.

Epilepsy is a disorder of the brain that is physically manifested or characterized by repeated seizures. These seizures can vary from brief nearly undetectable episodes to long periods

of vigorous shaking. The condition, once diagnosed, can be effectively controlled with the use Anti-Epileptic Drugs (AEDs) in most cases. There is no fixed or pre-set dosage in epilepsy treatment. Each prescription has to be individually tailored and adjusted. Many people can outgrow this condition and enter permanent remission after which the treatment can sometimes be reduced and finally discontinued.

An estimated one million Kenyans suffer from epilepsy. A majority of these never get to see a doctor due to lack of knowledge about the disorder or social stigma. As a consequence, many people continue to have seizures, which could otherwise be controlled through the available medication. People who are at greater risk of epilepsy include those with a history of febrile seizures, head trauma, birth trauma and neonatal and infantile infections.

What can you do to help in this campaign?

Read more about epilepsy and spread the facts about it. For more information, please contact: info@ekarcommunications.com

ACTS Attends the World Bioenergy Forum, India



ACTS Director of Programmes, Dr. Ben Muok (first right) at the World Bioenergy Forum in India.

The World Bioenergy Association (WBA) is the global organization dedicated to supporting and representing the wide range of actors in the bioenergy sector. Its members include national and regional bioenergy organizations, institutions, companies and individuals. The purpose of WBA is to promote the increasing utilization of bioenergy globally in an efficient, sustainable, economic and environmentally friendly way. Since its foundation in May 2008, WBA has been working to address a number of promising issues including certification, sustainability, standardization, bioenergy promotion and debates about bioenergy's impact on food, land use and water supply.

ACTS Director of Programmes Dr. Ben Muok is a Board Member of the WBA. The WBA Board held two board meetings in 2014 (June 2nd 5nd in Jonkoping, Sweden and Kolkata, India on 25th to 27th November). The India meeting was followed by a Bioenergy Roundtable co-organized by WBA and India Chamber of Commerce. Dr. Ben Muok gave a presentation on Bioenergy policy development in Africa.

For more information, please see: http://zeenews.india.com/news/eco-news/africa-needs-indias-cooking-stove-solar-know-how-think-tank_1505345.html

ACTS RESEARCH



ACTS Contributes to the Development of the Natural Capital Protocol - A Harmonised Framework for Valuing Natural Capital in Business Operations.

The Natural Capital Coalition is running a project to draft a harmonised framework for valuing natural capital in business decision making to enable better measurement, management, reporting and disclosure. Fragmented methodologies and practices are underway regarding the valuation of natural capital in the private and public sectors. A key challenge in scaling out the uptake of natural capital valuation is the lack of a harmonised approach to be used in typical business applications: internal management, reporting and disclosure. Such a harmonized framework would constitute a Natural Capital Protocol. The Natural Capital Coalition (NCC) has selected two consortia to develop the Natural Capital Protocol. The World Business Council for Sustainable Development (WBCSD), of which ACTS is a member, leads one consortium while the International Union for Conservation of Nature (IUCN), leads the other. Dr. Joel Houdet, ACTS' Senior Research Fellow and Head of its Natural Resource Economy Programme belongs to the consortium led by the WBCSD. Funding for the project is provided in part by the Gordon and Betty Moore Foundation and the Swiss Economic Ministry (SECO) to IFC at the World Bank.

The Natural Capital Protocol will be an open source, global multi-stakeholder framework for understanding, measuring and valuing the impacts and dependencies on the natural environment, as well as understanding the risks and opportunities presented for businesses when natural capital is accounted for in business decision making. Through a consultative approach, it will bring together and harmonise the multitude of methodologies that exist around the world into one framework; this will serve as the basis for future standard setting and methodologies in this field. The Natural Capital Protocol is intended for use by, and will be pilot tested and developed in collaboration with, business. It is expected that a fully tested first version of the Protocol can be presented by December 2015.

The WBCSD's consortium is composed of Accenture, ARCADIS, The B Team, Climate Disclosure Standard Board, Conservation International, Deloitte, eCountability Ltd, eftec, ERM, GIST Advisory, Imperial College, ACTS, Integrated Sustainability Services and Synergiz, Natural Capital Project, PwC, Sustain Value, The Nature Conservancy, World Resources Institute and WWF US. IUCN's consortium includes the IUCN National Committee of the Netherlands, Ernst and Young, Trucost, Institute of Sustainability Leadership (CISL) at the University of Cambridge, True Price, Industrial Ecology Research Services (IERS), and the Food and Agriculture Organisation of the United Nations (FAO).

For more information on the natural capital coalition, please visit: <http://www.naturalcapitalcoalition.org/natural-capital-protocol/project-coordination-team.html>

ACTS Contributes to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Regional Assessments



Dr. Joël Houdet, ACTS Senior Research Fellow and Head of Natural Resource Economy Programme has been nominated by the Republic of South Africa to participate in the development of the scoping document for the regional / sub-regional assessments for consideration to the third IPBES Plenary in Bonn in January 2015. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) aims to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development. The decisions of the IPBES Plenary will provide supporting and enabling mechanisms for African academics, civil society and business representatives to get actively involved in the African regional and sub-regional assessments on Biodiversity and Ecosystem Services.

For more information, please visit: <http://www.ipbes.net/>

ACTS joins the Ecosystem Services Partnership (ESP)



ACTS recently joined the Ecosystem Services Partnership (ESP). ESP is a global platform that brings together researchers from multiple countries and disciplines to work towards developing a better understanding and application of the concept of 'ecosystem services' in policy making. ACTS' Natural Resource Economy Programme will Working Group 5: Ecosystem Services in Business. Working Group 5 already has over 30 academics and policy analysts as its member. We invite you to join us in the ESP.

For more information on the ESP, please visit: <http://www.es-partnership.org/esp> or Working Group 5: <http://www.es-partnership.org/esp/81939/5/0/50>

ACTS CAPACITY BUILDING

THE AFRICAN LEADERSHIP ACADEMY FOR SCIENCE, TECHNOLOGY AND INNOVATION FOR SUSTAINABLE DEVELOPMENT (ALASTID)

ACTS has long been a premier capacity building institution in harnessing applications of science, technology and innovation policy for development in Africa. Through partnerships with leading global universities, research institutes, national councils for science and technology, government ministries and departments, we have provided doctoral, MA and certificate level training in science, technology and innovation policy for development to hundreds of African graduates and policymakers.

For the last ten years, ACTS has offered these types of courses through the ACTS Science and Technology Policy Institute (STPI). ACTS has also undertaken other capacity building initiatives (e.g. internships, modular or curriculum development, online courses, faculty training or mentorship, PhD fellowships, PhD academies, scholarships, policy Master Classes, Executive Courses, Summer Schools and other non-degree training through its various projects and programmes).

To allow us to continue offering cutting edge, high quality, demand-driven, timely and regular capacity building services and support in harnessing applications of science, technology and innovation policy for development in Africa, ACTS has now consolidated all its capacity building efforts into a new programme or initiative: The African Leadership Academy for Science, Technology and Innovation for Sustainable Development (ALASTID). The purpose of ALASTID is to equip current and future policymakers, the professoriate, leaders of industry and civil society with skills to harness applications of science, technology and innovation for sustainable development in Africa.

Consistent with our mandate, ALASTID will emphasize capacity building emerging but strategic technologies in which Africa relatively lacks research, technical and analytical or policy capacity. The Leadership Academy will also focus on capacity building in 'mature' technologies with the largest potential for positive social, economic and ecological impact in Africa. Courses, internships, mentoring, fellowships, scholar-

ships, summer schools, policy master classes, staff placements and curriculum development in ALASTID will be undertaken in collaboration with global and African universities, research institutes, national councils for science and technology, government departments and agencies, private sector, NGOs and civil society partners.

UNDER THE PROGRAMME OF WORK FOR 2015, ALASTID PLANS TO OFFER THE FOLLOWING COURSES AS POLICY MASTER CLASSES, EXECUTIVE COURSES OR SUMMER SCHOOLS:

- Low Carbon Economy Development in Africa
- Big Data Analytics and Economic Development
- Climate Compatible Development Policy and Practice in Africa
- Harnessing Applications of Nanotechnology for Sustainable Development in Africa
- Harnessing Applications of Space Sciences and Technologies for Socio-Economic Development in Africa
- Harnessing Applications of Nuclear Sciences and Technologies for Socio-Economic Development in Africa
- Local Content Development in the Extractive Industry Sector
- Africalics PhD Academy
- Innovation and Development
- Gender, Youth and Climate Change
- Research, Academic Writing and Publishing
- Proposal Writing and Fundraising

ACTS, through ALASTID, will also co-supervise a number of PhD and Masters Students in collaboration with a number of Northern and African universities.

To participate in the above Courses – or in ALASTID - as a Student, Faculty, Partner or Sponsor, please contact us at: info@acts-net.org

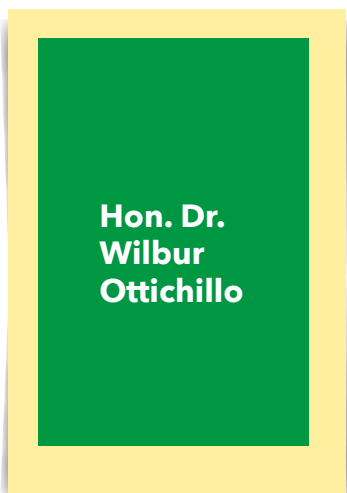
The Executive Director of ACTS Dr. Cosmas Milton Obote Ochieng with Dr. Parto Terehani Kroenner and Dr. Guelay Caglar, both of Humboldt University, meeting in Nairobi, Kenya. ACTS and Humboldt University are currently co-supervising three PhD students under a Gender and Horticultural Value Chains in East Africa Project, funded by Humboldt University.



ACTS WELCOMES DISTINGUISHED AND NON- RESIDENT RESEARCH FELLOWS

ACTS is very pleased to welcome two Distinguished Policy Fellows and thirteen Non Resident Research Fellows under its 2015-2017 Work Programme. The two Distinguished Policy Fellows are Hon. Dr. Wilbur Ottichillo, Member of Parliament for Emuhaya Constituency, Kenya and Dr. Alice Akinyi Kaudia, Environment Secretary, Ministry of Environment, Water and Natural Resources, Kenya.

ACTS Distinguished Non-Resident Research Fellow



Hon. Dr. Wilbur Ottichillo

ACTS Distinguished Non-Resident Research Fellow

Hon. Dr. Wilbur Ottichillo is the Member of Parliament for Emuhaya Constituency, Kenya and the sponsor of the original Climate Change Bill in Kenya. From 2002-2008, he was the Director General of the Regional Centre for Mapping of Resources for Development (RCMRD), an affiliate institution of the United Nations Economic Commission for Africa (UNECA). He holds a PhD in Environmental Science from the Institute of Geo-Information and Earth Sciences in the Netherlands.



Dr. Alice Akinyi Kaudia

ACTS Distinguished Non-Resident Research Fellow

Alice Akinyi Kaudia (PhD, EBS, and HSC) holds a Bachelor of Science in Agriculture from the University of Nairobi, and a Doctor of Philosophy degree in Forestry, Extension and Development from the University of East Anglia, United Kingdom. She is the Environment Secretary in the Ministry of Environment, Water and Natural Resources, a position she has held since 2008, being the first holder of that office in Kenya. She was previously the Regional Director of the IUCN East Africa Regional Office; Assistant Director of the Kenya Forestry Research Institute (KEFRI); Associate Research Officer at the World Agroforestry Centre (ICRAF) and Assistant Programme Officer at the African Academy of Sciences. Dr. Kaudia sits on the boards of the World Resources Forum; Green Growth Knowledge Platform; Kenya Agricultural Research Institute, among others.

ACTS NON-RESIDENT RESEARCH FELLOWS



Dr. Chris Huggins

ACTS Non Resident Research Fellow

Adjunct Professor, Institute of African Studies, Carleton University. Chris Huggins is a researcher, lecturer, and trainer with more than 15 years' experience on land and natural resources rights in Africa. He was previously based in Nairobi as a Research Fellow with ACTS, and in Kigali as Rwanda Researcher for Human Rights Watch. He has consulted with U.N. agencies, bilateral donors, policy think-tanks, International Non-Governmental Organizations, and for-profit institutions. He has a PhD in Geography (specialization in political economy), and is co-author (with Scott Leckie) of *Conflict and Housing, Land, and Property Rights: A Handbook on Issues, Frameworks, and Solutions* (Oxford University Press, 2011) and editor (with Jenny Clover) of *From the Ground Up: Land Rights, Conflict and Peace in Sub-Saharan Africa* (African Centre for Technology Studies/Institute for Security Studies, 2005). Dr. Huggins lives in Ottawa, Canada, and is married with two young children. He enjoys hiking and mountain biking in the nearby Gatineau hills, and watching live music performances. He travels frequently to Africa.



Dr. Philip M. Osano

ACTS Non Resident Research Fellow

Dr. Osano is currently involved in the preparation of the African Union Strategy for the Accelerated African Agricultural Transformation Goals to guide the continent-wide implementation of the CAADP (Comprehensive African Agricultural Development Programme) for the 2015-2025 decade. He is a multidisciplinary scholar with a diverse research and academic interest at the science-policy interface in environment and development. He has published and lectured on topics that span a range of disciplines, including environmental policy and governance, biodiversity and livelihoods in African dry lands, sustainability science, ecological economics, climate change adaptation, environmental-security linkages, agricultural development, and sustainability education. He also serves as a reviewer for several international peer reviewed journals. He has worked and consulted for several organizations and universities, including Birdlife International, United Nations Environment Program (UNEP), International Livestock Research Institute (ILRI), the Florida Gulf Coast University (USA), and the Swiss Federal Institute of Technology (ETH) – Zurich, among others. A Fellow of the Sauvé Scholars Program (Canada), he holds a PhD degree in Geography from McGill University, Canada, an MSc degree in Conservation Biology from the University of Cape Town, South Africa, and a BSc degree in Environmental Science from Egerton University, Kenya.



Mr. Prajwal Baral

ACTS Non Resident Research Fellow

Prajwal Baral joined ACTS as a non-resident Research Fellow with effect from October 2014, where his research focuses on climate resilient economy and green growth in Africa. With a strong background in climate policy, his research extends to energy policy, clean technology, international trade and impact investment.

Mr. Baral previously worked with World Trade Organization (WTO), CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and World Wide Fund for Nature (WWF) in different capacities in South Asia and Europe. He has also worked extensively with NGOs and CBOs in Nepal and India, and conducted training sessions on sustainability issues in Bangladesh. He has consulted for a number of organizations on projects related to climate change adaptation and climate finance.

Currently, he works at Global Challenges Division of World Intellectual Property Organization (WIPO) in Geneva where he is playing a crucial role in advancing a multi-stakeholder platform for the accelerated transfer of clean technologies to developing and emerging economies.

He has an academic background in Engineering from Maulana Azad National Institute of Technology (MANIT), India, and Environmental Management from University of Oxford. A keen runner, swimmer and cyclist, he strongly believes in low carbon lifestyle.



Dr. AKANIMO ODON

ACTS Non Resident Research Fellow

Dr. Akanimo Odon is an international business and strategy development expert who has gained experience working in several capacities to several global and international bodies. With a specialization in education, energy and environment, oil and gas, media, charities and government, he has an in-depth understanding of global issues but with special reference to Africa. He was an Adviser to the British Government on developing international education policies under the National Student Forum, International Ambassador for Lancaster University for two years, On-call Education Partnership Consultant for British Council, Nigeria for three years, Business Development Consultant for the Grow Creative Scheme under the European Regional Development Fund (ERDF) for two years and Africa Adviser for several UK and African organisations.

He has a Master's Degree in Environmental Rehabilitation from the University of Wales UK and a Doctorate Degree in Environmental Management from Lancaster University. Recently, he was appointed the African Strategy Adviser for Lancaster Environment Centre, one of the most reputable Environmental Centers in Europe. He has also been the African Strategy Adviser for Scada Access US (www.scadaaccess.com) – oil and gas communication monitoring and field optimization Company and Smart Metering Solutions Ltd (www.sms-plc.com), an international gas and electricity metering company.

Dr. Odon also holds enterprise and business development certifications from Judge Business School of Cambridge University UK and the Massachusetts Institute of Technology (MIT), USA under the Enterprisers Programme and an International Fellowship Award from Stanford University Business School, USA under the Round-table for Entrepreneurship Education (REE) programme. He is a multi-award winner with awards including the DFID Scholarship Award, the British Council best UK international student Shine Award, Stanford University REE Fellowship Award and the Young Entrepreneurs Scheme (YES) Award in a programme sponsored by BBSRC, Unilever, BIA, Lonza and a host of other reputable companies.

For two years, Dr. Odon was the Local Content Adviser for one of the world largest Oil and Gas firms (BG Group, UK)

and provided advice on strategy, capacity building, policy development and market entry for their Nigerian operations. As a Local Content expert, he was recently asked to support in the development the Local Content Policy for the Extractive Industry of the Tanzanian Government and also leads Local Content Strategy for First Exploration and Production Nigeria Limited, an indigenous Nigerian operator. He has worked as a Strategy Consultant for the National Centre for Energy and Environment under the Energy Commission of the Presidency, Nigeria and was recently appointed an Editorial Board Member for the first International Journal on Energy and Environment in West Africa.

Currently, he is the Principal Consultant/CEO of Envirofly Consulting Limited UK (www.envirofly-group.com) which is a strategic and sustainable solutions company with expertise in bridging the competence gaps between Africa and the rest of the world using different capacity building and knowledge transfer models.

Dr. Odon is also the Co-Founder of Xn Foundation (www.xnfoundation.org), a UK, Canada and Nigerian based NGO, and currently the UK Country Director (voluntary) of the same and has helped develop several charitable projects aimed at youth and community development including the International Conference of Nigerian Students (ICONS), which is the single largest programme for African Students in the UK. In the past eight years, five UK Universities, involving liaison with over 20,000 African students, the delivery of over 40 workshop seminars to over 3000 students, and garnered over 100 top profile speakers, have hosted this programme.

Dr. Odon is a seasoned poet, novelist and international award winning author, who has published two outstanding literary works in London. The first being a book of poetry titled 'Rhymes from the Heart' (www.amazon.co.uk) and the second being a fiction novel titled 'A Parallel trail' (www.amazon.co.uk), with best seller reviews including full features in the media. Recently, he was one of the Producers of an international feature length movie titled DRY, which tackled the issue of Child Brides and VVF in Africa, a global human right and health crises with over 2.5 million women suffering from this in Africa alone – www.themoviedry.com.

Akan, as he is usually called, currently lives in Lancaster, UK, with his wife Ifeyinwa and they have a daughter, Kaela and a son, Kanaan. He plays the bongo drums and football.



Dr. Jackson Maogoto

ACTS Non Resident Research Fellow

Dr Jackson Maogoto holds a Bachelor of Laws with First Class Honours from Moi University (Kenya); three postgraduate degrees from the University of Cambridge (Masters in Law with Hons), University of Technology Sydney (Masters in Law) and University of Melbourne (Doctorate in Law). Jackson is currently a senior lecturer at the University of Manchester. His teaching and research interests are in Public International Law. His international law interests encompass the fields of international criminal law, international humanitarian/use of force, human rights law, transitional democracy, and space and cyber law.

Jackson has published extensively in his fields of teaching and research interest. He is the author of seven books, a dozen book chapters and dozens on articles in general and specialist Australian, American, European and African journals. He has participated and delivered numerous conference papers in regional and international fora. His professional affiliations include: American Society of International Law, Asian Society of International Law, Australia & New Zealand Society of International Law, International Law Association, International Institute of Space Law, International Society for Military Law & the Law of War and the Royal Institute of International Affairs.



Dr. Elvin Nyukuri

ACTS Non Resident Research Fellow

Dr. Elvin Nyukuri is a researcher in climate change adaptation, resilience and social protection. She is also a Lecturer at the Centre for Advanced Studies in Environmental Law and Policy (CASELAP)-University of Nairobi where she is developing a course curriculum on Environmental diplomacy. For nearly a decade, Elvin actively engaged in multi-disciplinary research including environmental governance and policy, climate change, and food security while working at African Centre for Technology Studies (ACTS).

At ACTS she coordinated the International Agricultural Assessment for Science and Technology Development (IAASTD)-sub-Saharan Africa, Community Based Adaptation to climate change(CBA), Ecological sources of conflict in the Horn and East Africa, Pan-African Programme on Land and Resource rights, and the CLACC mentorship programme for East Africa. Elvin has consulted for various international organizations including the AU, UN IIED and International universities. She continues to inform policy through research and teaching.



Dr. Justin Muhoro Nyaga

ACTS Non Resident Research Fellow

Dr. Justine Nyaga is a Lecturer and Head of Department, Embu University College, Kenya. He is also a Visiting Scholar, University of Colorado at Boulder, CO, USA. Mr. Nyaga has also been a Research Scientist at the South Africa National Biodiversity Institute (SANBI) and a Programme Officer, Tropical Biology Association/East Africa Natural History Society.

Dr. Nyaga has served as a Programme Manager, Volunteers for Africa (VFA) Organization and as a Consultant /E.I.A/E.A Expert, Resource Planning Consultants (Repcon Associates). He has also served as an Evaluation and monitoring officer, Environmental Friendly Services.

Dr. Nyaga holds a Ph.D. in Botany from the University of Cape Town and an MSc. In Biodiversity and Conservation Biology from the University of the Western Cape, South Africa.



Mr. Tobias O. Nyumba

ACTS Non Resident Research Fellow

Mr. Tobias Nyumba is a Ph.D. Student in Geography at Churchill College, University of Cambridge. He holds a Master of Philosophy (MPhil) in Environment, Society and Development from Downing College, University of Cambridge and a Bachelor of Science (BSc) in Environmental Science from Egerton University, Kenya.

He has over nine years' experience in research, conservation and management of the African elephant (*Loxodonta africana*). He has worked previously with specific reference to the mitigation of negative impacts of interactions between elephants and people; elephant ecology and behaviour; conservation policy; and, public awareness and education. Tobias first worked as a research assistant for the Darwin Initiative funded project under the University of Cambridge's Department of Geography titled: Building Capacity to Alleviate Human-Elephant Conflict in North Kenya. Subsequently, he became Project Manager for Space for Giants Trust in Kenya.

His research focuses on the social and ecological implications of human and wildlife interactions, especially within human dominated landscapes. He is particularly interested in both applied and practical perspectives, including research and development of tools and policies to sustainably mitigate the direct and hidden negative impacts of human elephant interactions.

His PhD research explores the "hidden" aspects of the interactions between humans and African elephants (*Loxodonta africana*) within a heterogeneous land use mosaic in Trans Mara District, Kenya.



Florence Gathoni

ACTS Non Resident Research Fellow

Florence is a PhD Fellow at the University of Copenhagen, Denmark. She is working on a project on "Economic Assessment of Innovative Drainage Filter Technologies" under the Sustainable Phosphorous and Nitrogen Remediation Technologies (Supremetech) Project (<http://www.supremetech.dk/>). She holds a MSc. in Agricultural Economics specializing in Agribusiness and Food Economics from the same university and a BSc. In Agricultural Economics from Egerton University, Kenya.

Florence has over 10 years' cumulative experience in: agricultural business development, agricultural value-chain coordination and micro-economic research focusing on agriculture, natural resources and environment. Her current career interest is in economic analysis of agricultural and environmental technologies.



Mr. Suresh A. Patel

ACTS Non Resident Research Fellow

Mr. Suresh Patel is a results-focused professional/entrepreneur/manufacturer with multi-industry experience with environmental improvement bias covering strategic business planning, research, process management, marketing, public relations, training and diversifications. He enjoys the challenges presented by new situations, opportunities and problems arising out of Climate Change regime. He is well versed with environmental and natural resource related issues for businesses and industries, both from legal and technological points of view.

Mr. Patel is a Chemical Engineer with a First Class degree in Chemical Engineering from Gujarat University, India. He is a Certified Energy Manager (CEM), and a National Environment Management Authority Lead Expert.



Mr. Brian Omwenga

ACTS Non Resident Research Fellow

Brian Omwenga is a Computer Science doctoral candidate at the University of Nairobi, School of Computing and Informatics. He holds a Master of Science in Engineering Systems, Technology and Policy from the Massachusetts Institute of Technology and a Bachelors in Business Information Technology from Strathmore University, Kenya. Brian is an adjunct lecturer at the University of Nairobi.

He has previously worked for Microsoft and Nokia Research Centre. He is an appointed official champion of the Africa Innovation Foundation's, Innovation Prize Africa. He is also currently the chairman of the Software Engineering technical committee (TC94) that sets national software engineering standards at the Kenya Bureau of Standards as well as the chair of the Kenya National Workshop on electronic waste standards.



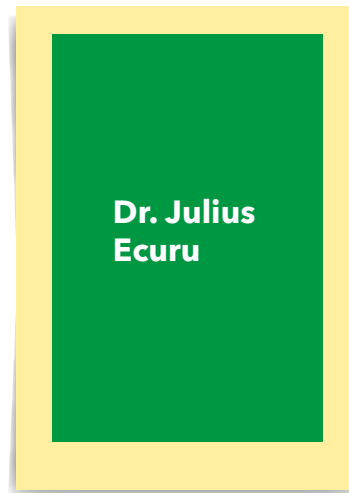
Grace Muthoni Mwaura

ACTS Non Resident Research Fellow

Ms Grace Muthoni Mwaura is a Co-convenor of the IUCN-wide Task Force on Intergenerational Partnerships for Sustainability (IPS) and a Steering Committee member of the IUCN Commission on Education and Communication (CEC). Prior to these, she served as a Global Council member for IUCN (2010-2012) advancing the engagement of young professionals and intergenerational partnerships within the Union.

She co-founded the African Youth Initiative on Climate Change (AY-ICC), where she still serves as an advisor on policy and communications. She holds a bachelor's degree from Kenyatta University (Environmental Sciences), an MPhil from University of Oxford (Nature, Society & Environmental Policy) and is currently undertaking a doctoral programme at the University of Oxford in Geography & the Environment.

Her doctoral research 'Educated Youth, Livelihoods, and Politics in Africa' examines the meaningful engagement of young people amidst the global economic restructuring. She is particularly interested in new and emerging opportunities to address global environmental crisis in a youthful African continent.



Dr. Julius Ecuru

Dr. Julius Ecuru

ACTS Non Resident Research Fellow

Julius Ecuru is a Chemist and Science Policy Analyst. He is currently the Assistant Executive Secretary at the Uganda National Council for Science and Technology, a semi-autonomous government agency that aims to advise, develop, and implement policies and strategies for integrating science, technology, and research development in Uganda.

Mr. Ecuru's research focuses on bio-science innovation systems, direct payments during HIV research, and the morality of research in developing countries.

He has previously worked for BIO-EARN, a program aimed to build capacity in biotechnology in Ethiopia, Kenya, Tanzania, and Uganda and promote appropriate research and related policies. Mr. Ecuru has also been instrumental in building a coherent research management system in Uganda including national frameworks for human and animal experimentation, biosafety and access to genetic resources, and benefit sharing.

ACTS RECOMMENDS 12 TECHNOLOGY AND SUSTAINABLE DEVELOPMENT BOOKS FOR 2015

We live in a world of rapid economic, technological and climatic changes. Nowhere are these changes faster and more likely to have greater impacts than in Africa. Many of the world's fastest growing economies over the last decade have been African. However, this economic growth is characterized in many countries with high income inequality and Africa is yet to achieve the much needed economic structural transformation – meaning that any gains from recent economic growth are still easily reversible.

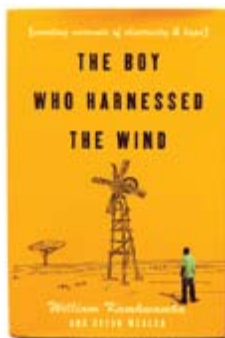
According to the 2014 Global Competitiveness Index (GII) Sub-Saharan Africa has seen the most significant improvement of all regions in the GII rankings. According to the report, among “low-income countries displaying above par-performance, the Sub-Saharan African region now makes up nearly 50 percent of “innovation learner” economies”. ‘Innovation learners’ are economies that perform at least 10 percent higher than their peers for their level of gross domestic product. Africa is bubbling with innovation and creative energy. The continent has over 50 Innovation Hubs and co-creation labs or online laboratories (ilabs).

These range from large, Big Science-lite technology parks such as the Botswana Innovation Hub to small but vibrant ihubs and ilabs dotted all over the continent. A new generation of African scientists, inventors, innovators and entrepreneurs are busy transforming ideas into development solutions – from medical tablets that enable heart examinations to be performed in remote rural locations (i.e. Cameroon’s Cardiopad) to phone applications that enable early, non-invasive malaria diagnosis with a customized piece of hardware or Matiscope (i.e. Uganda’s Matibabu). Nevertheless, Africa is also the region likely to suffer the most from the impacts of climate change.

Our top 15 recommended books in sustainable development and technology reflect this duality of opportunities and challenges facing Africa post 2015. We would strongly recommend them to students of African development, policy makers, technocrats, donors and others with an interest in global sustainable development, science, technology and innovation.

- **THE BOY WHO HARNESSSED THE WIND**

*By William Kamkwamba and Bryan Mealer
Publisher: William Mr (2009)*



A truly inspirational autobiography of Malawian boy, born into poverty, who, at age 14, defied all odds to invent an electricity-producing windmill (from spare parts and scrap) to power his home. His story highlights a fact often missed in Africa: innovation happens everywhere, often outside ‘formal’ institutions such as universities, research institutes, public or private laboratories.

- **CHINA’S SECOND CONTINENT: HOW A MILLION MIGRANTS ARE BUILDING A NEW EMPIRE IN AFRICA**

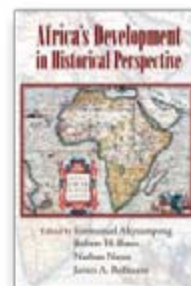
*By Howard French
Publisher: Alfred A, Knopf (2014)*



The relationship between Africa and China might be one of the most important geopolitically in the 21st century. How that relationship has evolved over the last 10 years has been the subject of considerable debate. Howard French, a former New York Times Bureau Chief in Shanghai and West Africa brings a fresh, rich and critical insight into this debate.

- **AFRICA’S DEVELOPMENT IN HISTORICAL PERSPECTIVE**

*Editors: Emmanuel Akyeampong, Robert H. Bates, Nathan Nunn, James Robinson,
Publisher: Cambridge University Press (2014)*



Some of the best students of African development get together to grapple with the question of the root causes of Africa’s underdevelopment or persistent. They explore the impacts of slavery, colonialism, culture, diseases, demography, and institutions of and economic and political governance on Africa’s development in historical perspective.

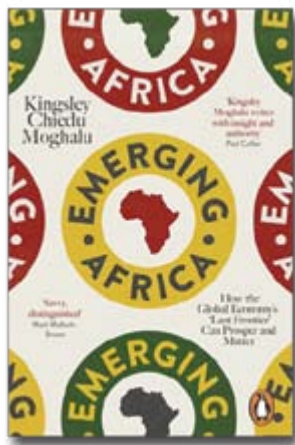
- **THE SIXTH EXTINCTION: AN UNNATURAL HISTORY**

*By Elizabeth Kolbert
Publisher: Barnes and Noble (2014)*



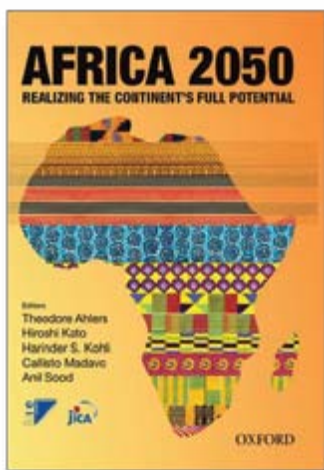
Africa is the region of the world, likely to be most affected by the impacts of climate change. That upto 50 percent of living species (plants and animals) could be lost within this century should be a wake-up call to all to take action both against climate change and in favour of biodiversity conservation. A reminder, if any was needed, that Africa must take the fight against wildlife poaching very seriously indeed.

EMERGING AFRICA: HOW THE GLOBAL ECONOMY'S 'LAST FRONTIER' CAN PROSPER AND MATTER
By Kingsley Moghalu
Publisher: Bookcraft (2013)



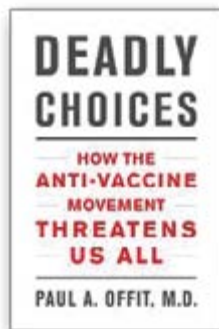
Sound policies, strong institutions and political will are critical to Africa's ability to transform current opportunities to lasting economic gains. Kingsley Moghalu, a former deputy governor of the Nigerian central bank argues. A welcome addition to the growing literature on the 'Africa rising' debate.

- **AFRICA 2050: REALIZING THE CONTINENT'S FULL POTENTIAL**
Editors: Theodore Ahlers, Hiroshi Kato, Harinder, S. Kohli, Callisto Madava, Anil Sood
Publisher: Oxford University Press, 2014



This book falls within the genre of long term visions of Africa's development (e.g. AU Agenda 2063). It provides a framework of action and a vision – not a prediction – of what Africa could look like by 2050.

- **DEADLY CHOICES: HOW THE ANTI-VACCINE MOVEMENT THREATENS US ALL**
By Paul A. Offit
Publisher: Basic Books (2011)



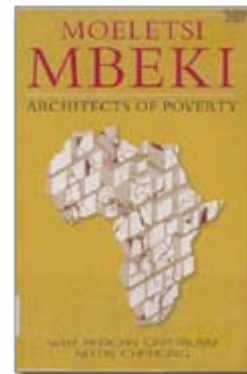
In recent years, a number of anti-vaccine movements have emerged in both developed and developing countries. In this methodical work, infectious diseases expert, Paul Offit examines the origins, influence and impact of the anti-vaccine movement in the United States and demonstrates that it is not only based on 'pseudoscience' it constitutes a grave danger to the entire global public health system. Anti-vaccine proponents in Africa, as well as their supporters and critics, would do well to read this book.

- **WHAT'S GONE WRONG? SOUTH AFRICA ON THE BRINK OF A FAILED STATEHOOD**
By Alex Boraine
Publisher: New York University Press (2014)



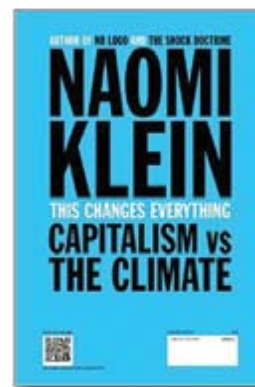
The sheer number of revered icons of the anti-apartheid movement coming forward to warn that South Africa is headed in the wrong direction should force the country's political, economic, intellectual and civil society leadership to hit the 'pause button' and to engage in the serious national self-examination and course correction that the country bequeathed to the world in the 1990s. In this book, Alex Boraine, a clergyman, Member of Parliament and deputy chair of the National Truth and Reconciliation Commission joins the legendary Archbishop Desmond Tutu, in warning his country that it is on the verge of betraying its promise of 20 years ago.

- **ARCHITECTS OF POVERTY: WHY AFRICAN CAPITALISM NEEDS CHANGING,**
By Moeletsi Mbeki
Central Books (2009)



Moeletsi Mbeki, one of South Africa's sharpest political economists warns Africa's political elite, especially in South Africa and Zimbabwe to re-think their economic systems and political governance. The book is now 5 years old but its central message is as absolutely spot on today as it was five years ago.

- **THIS CHANGES EVERYTHING: CAPITALISM VS THE CLIMATE**
Naomi Klein
Simon and Schuster (2014).



Before world leaders, including African leaders head to the UN Conference of Parties in Paris in December this year, they should take time to (re) read Naomi Klein's This Changes Everything. The global climate crisis is transformational. It will remake global economic and political systems, either voluntary (i.e. countries choosing to change their economic and political systems in order to mitigate and/or adapt to the impacts of climate change) or involuntarily. As the continent likely to suffer the most from the impacts of climate change, African leaders and students of African development would do well to read this book.



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