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THE POVERTY OF DEVELOPMENT STRATEGY IN AFRICA

Dr Cosmas Milton Obote Ochieng, Executive Director, ACTS

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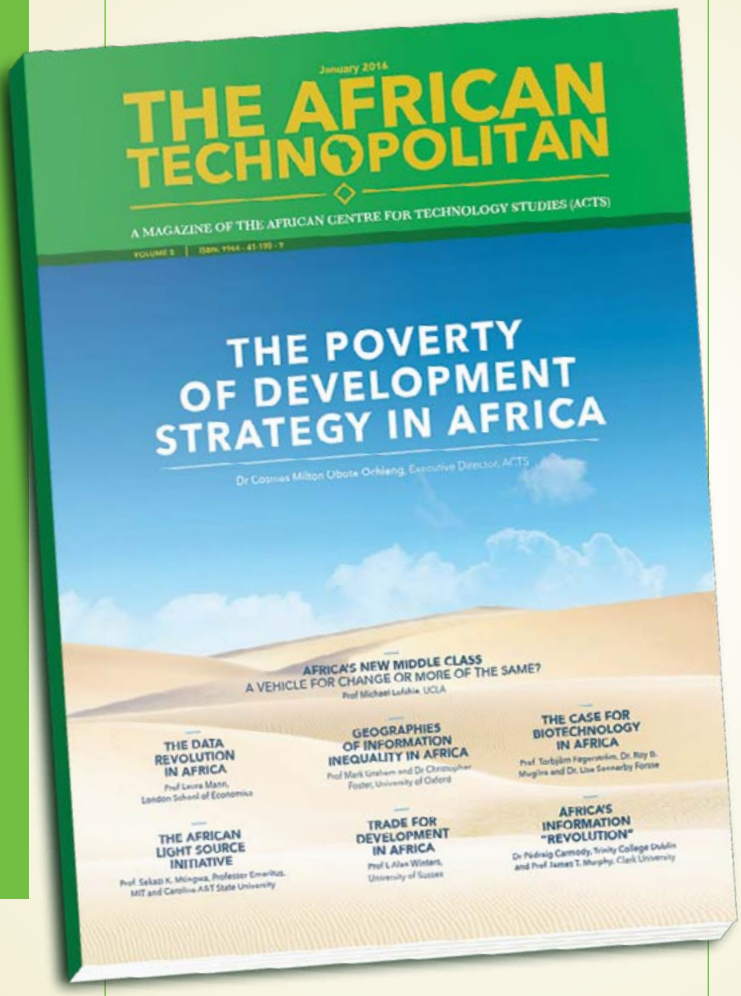

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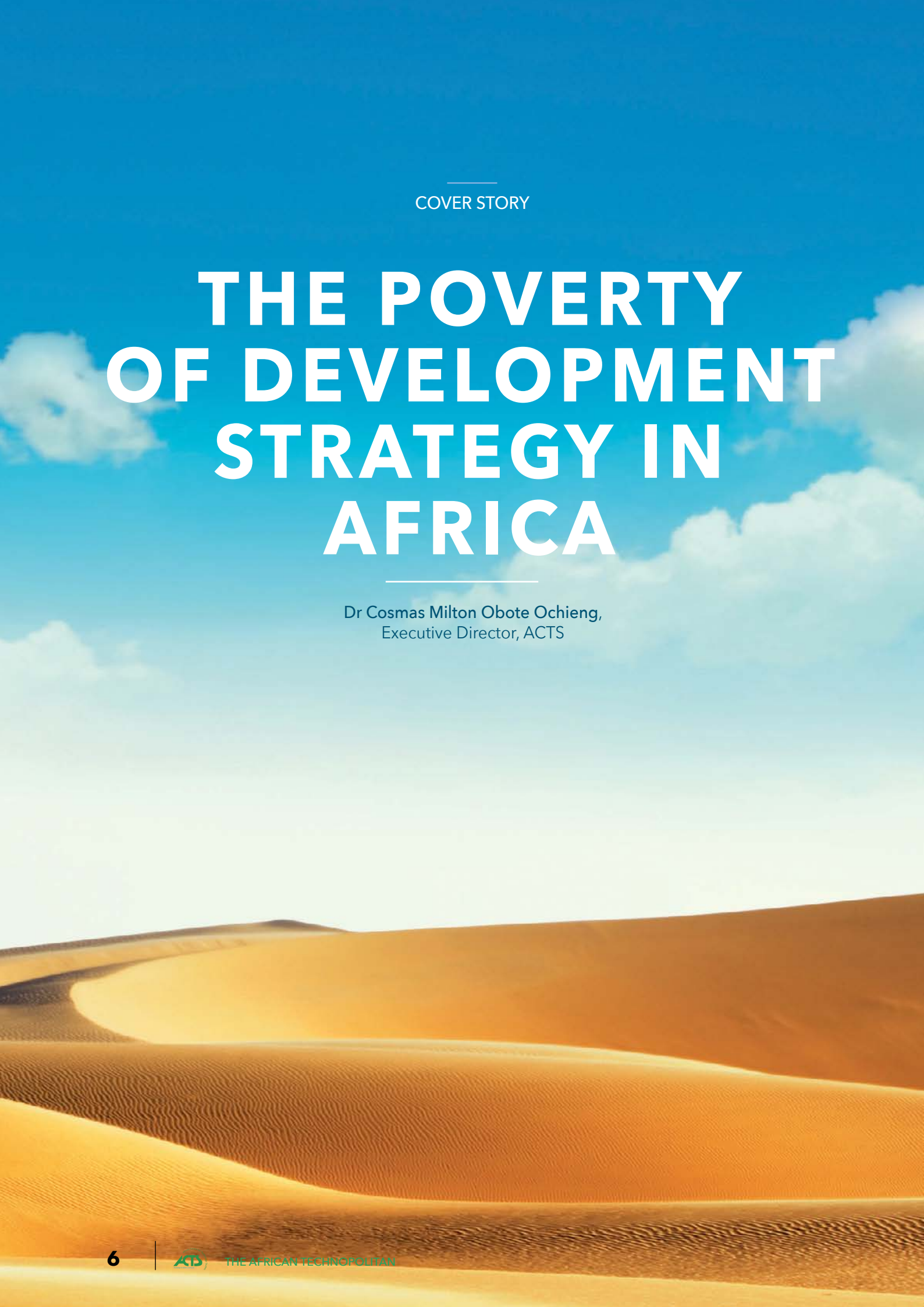


Abstract

A combination of robust economic performance and an uptick in scientific and technological indicators over the last two decades has given rise to exuberant assessments of Africa's development prospects in the 21st century. Loose parallels are being drawn between development in Africa today and economic development in East Asia (i.e. the 'East Asian tigers') and the rise of 'Silicon Valley'. This article argues that Africa's economic and techno-scientific progress is being lionized prematurely, to the detriment of its long term development. The 'Africa rising' narrative masks a poverty of development strategies: lack of coherent development policies and capacity for strategic thinking necessary to consolidate recent gains and to harness future global megatrends.

The poverty of development strategy manifests itself in at least four interrelated ways. The morphing of 'Economic Advisors' into 'Policymakers' in all but name has restrained 'development ambition' and 'strategic policy space' in Africa. 'Palliative' or policies focused on poverty reduction have been mistaken for development policy. Africa has failed to bet big on science, technology and innovation for its development. Policy making has proceeded as if Africa is a country, yielding dubious one-size-fits-all prescriptions.

Introduction: Two Decades of Robust Economic Performance but Nothing Miraculous

In 2000, the World Bank published an assessment of Sub Saharan Africa's development prospects in the 21st century: Can Africa Claim the 21st Century? The Bank hedged its bets. Africa entered the 21st century with dismal socio-economic indicators. It had many of the world's poorest countries and a growing share of the world's absolute poor. Its total income was not much more than Belgium's, and its "average output per capita in constant prices was lower at the end of the 1990s than 30 years before" (World Bank, 2000, 8). The continent was characterized by financial and human capital flight; declining export shares in traditional commodities; limited economic diversification; widespread civil strife (with one in five Africans living in a conflict stricken country); and limited popular participation in political governance.

At the turn of the century, 40 percent of Africa's private wealth was held abroad, an amount equivalent to the size of its debt or 90 percent of its GDP. By comparison, only 6 percent of East Asian and 10 percent of Latin American wealth were held abroad. Between 1960s and 2000, Africa had lost a third of its human capital through emigration. In 2000, 1 out of 8 Africans with a university education lived in a country in the OECD. This was the highest rate among developing regions, with the exception of the Caribbean, Central America and Mexico. Moreover, the continent appeared in danger of being marginalized by the information revolution. In the estimation of the World Bank, many development problems had become largely confined to Africa. These included lagging primary school enrollments, high child mortality, and endemic diseases—"including malaria and HIV/AIDS—that impose costs on Africa at least twice those in any other developing region" (World Bank, 2000, 1). The World Bank concluded that Africa's development challenges went beyond low incomes, low savings, slow growth and falling trade shares to include inequality, uneven access to resources, social exclusion, and insecurity.

Against this background, it is easy to see why the broad-based and sustained economic growth, falling poverty rates, and the unexpected uptake of information and communication technologies in much of Africa over the last two decades has generated a dramatic shift in elite and popular perception of Africa's development prospects. Consider the following. Over the last two decades, real economic activity in Africa more than doubled. According to *Africa's Pulse*, the economies of Sub-Saharan Africa grew at a relatively strong pace of 4.5 percent a year on average between 1995 and 2013. This is comparable to that of other developing

regions (4.4 percent). Africa was outperformed only by East Asia and the Pacific at 5.1 percent (*Africa's Pulse*, Vol. 9, 2014). Over the same period, Sub-Saharan Africa witnessed more than a 30-fold increase in foreign direct investment (FDI), an expansion "7.5 times faster than in high-income countries and nearly 10 times faster than global GDP" (Ibid.). The share of the African population in extreme poverty fell from 56 percent in 1990 to 43 percent in 2012.

While Africa's total income was not much larger than Belgium's at the turn of the century, according to the IMF's World Economic Outlook, by 2014, Nigeria had become the 21st largest economy in the world (by nominal GDP). In global rankings (by nominal GDP) it was a larger economy than: Sweden, Belgium, Norway, Austria, United Arab Emirates, Colombia, Denmark, Malaysia, Singapore, Israel, Finland, Ireland, Pakistan, Portugal and Greece. According to McKinsey's study in 2010 (*Lions on the Move*), at $ 1.6 trillion, Africa's combined GDP in 2008 was roughly equal to Brazil's or Russia's. The continent has also become less prone to macroeconomic instability. The "incidence of sharp declines in real output per capita (peak-to-trough drops that exceeded 10 percent) was reduced from 36 percent during 1974–94 to approximately 18 percent during 1995–2011...Furthermore, the duration and depth of recessions also declined...On average, the duration of recessions across the region dropped from 2.2 years during 1974–94 to 1.9 years during 1995–2011, while the median contraction declined from 9.3 percent during 1974–94 to 5.4 percent during 1995–2012" (Ibid.). Unlike the 1980s and 1990s, Africa's debt ratios are currently lower than those for other developing regions.

All these indicators confirm that Africa's economic performance over the last two decades has been robust and broad based. What this performance is not, however, is anything near 'miraculous' relative to successful economic development cases of the last 60 years (e.g. Japan, South Korea, Taiwan, Singapore, China et cetera) or relative to what is needed to transform a majority of African countries into newly industrialized economies, say by 2030-2040, going by most national development aspirations. In other words, sustained economic and techno-scientific development in Africa is far from being around the corner.

The most important illustration of this is the industrial stagnation or decline in much of Africa over the last two decades. A 2011 study by UNCTAD and UNIDO (*Economic Development in Africa: Fostering Industrial Development in Africa in the New Global Environment*) found that the share of manufacturing in GDP in Africa fell from 15.3 percent in 1990 to 12.8 percent in 2000 and 10.5 percent in 2008. The share of manufacturing in GDP in Africa rose from 6.3 percent in 1970 to a peak of 15.3 percent in 1990, just before the structural adjustment program of the 'Washington Consensus' went into full bloom across much of Africa. It has been declining ever since. The share of manufactures in Africa's total exports fell from 43 percent in 2000 to 39 percent in 2008. Nearly half of Sub Saharan African countries had negative MVA (Manufacturing Value Added) per capita growth from 1990 to 2010. Even Africa's share of low-technology manufacturing activities in MVA also fell from 23 percent in 2000 to 20 percent in 2008, while its share of low-technology manufacturing exports fell from 25 percent in 2000 to 18 percent in 2008.

Even on its own terms, the African economic story of the last two decades is not an unqualified success. Take the case of poverty reduction. While poverty rates have fallen, the number of people living in poverty increased by more than 100 million, partly as a result of population growth. There are now more people living in poverty in Africa than there were in 1990. Africa is also the only developing region to have failed to reach the UN Millennium Development Goal (MDG) of halving poverty by 2015. The growth of FDI might have been impressive but because of weak linkages between foreign investors and local economies, its economy-wide spill over effect has been limited. The lower debt-to-GDP ratio is a result of two debt cancellation programs (the Heavily Indebted

Poor Countries initiative and the Multilateral Debt Relief Initiative) and fast economic growth. There is limited room for further debt relief, in part because many African countries are back to borrowing from the private market (as opposed to official lenders such as the World Bank and the IMF). Personal, corporate and government debts are all on the rise in Africa. Since 2008, the debt-to-GDP ratio is on the rise in many African countries. If economic growth falters, the debt burden might become unsustainable.

Africa's economic performance over the last two decades has been attributable to a combination of benign external factors and domestic improvements in macro-economic management. There are signs of changes in both fronts. "On the external front, growth performance in the region was boosted by rising commodity prices, the emergence of China as an important trade and investment partner, and the surge of foreign capital into developing countries due to accommodative monetary policies in the advanced world" (*Africa's Pulse*, Vo. 9. 2014, pp 25). Other than the 'China effect', commodity prices and monetary policies in advanced countries are already on different trajectories. Domestically, recent budget deficits (e.g. Ghana and Tanzania), currency crises (Ghana and Zambia), sovereign bond issues (at least 16 African countries have issued 'Eurobonds') and growing cases of corruption raise questions about fiscal discipline and macroeconomic management in a number of countries.

To be sure, some accounts of the 'Africa rising' narrative recognize that the continent continues to face significant challenges. The World Bank's latest study, *Poverty in a Rising Africa*, notes that despite falling poverty rates, more people in Africa are poor today than in 1990, that violence is on the rise and that illiteracy levels on the continent remain significantly high. Nonetheless, many accounts of the 'Africa rising' narrative give the impression that Africa has reached the 'economic take off' stage – as in Rostow's theory of economic development.

While poverty rates have fallen, the number of people living in poverty increased by more than 100 million, partly as a result of population growth. There are now more people living in poverty in Africa than there were in 1990.

McKinsey's *Lions on the Move* exemplifies this. "Looking ahead, a critical question is whether Africa's surge represents a onetime event or an economic takeoff. The continent's growth also picked up during the oil boom of the 1970s but slowed sharply when oil and other commodity prices collapsed during the subsequent two decades. Today, while individual African economies could suffer many setbacks, our analysis suggests that the continent's long term growth prospects are strong, propelled by both external trends in the global economy and internal changes in the continent's societies and economies" (McKinsey, 2010, 3).

Economic development is not a 'zero-sum' game. Development in one country or region does not equate to underdevelopment in another. Nevertheless, theoretical thinking on economic development always benefits from comparative analysis. The 'Africa rising' narrative suffers from a lack of keen attention to comparative analysis. This has led it to over-estimate Africa's economic and techno-scientific 'successes'. While the last two decades have been good for economic and techno-scientific progress in Africa, they have also been a period of even more unprecedented economic, social, technological and political transformation in the rest of the developing world (see Steven Radelet's: *The Great Surge: The Ascent of the Developing World*).

The 'era' of the 'Africa rising' narrative is also the period during which China became the second largest economy in the world and Brazil and India joined the club of the 10 largest global economies. While an 'African economy' the size of Russia's or Brazil's is an improvement on an 'African economy' slightly larger than Belgium's, what this really tells us is that Africa is still a very poor continent. Brazil has undergone phenomenal economic change over the last few decades. Nevertheless, it is barely a 'developed country'. That its economy is roughly the same size as dozens of African economies combined, this tells us more about Brazil's current state of economic development. Nigeria and South Africa together constitute 55 percent of the GDP of 48 Sub Saharan African countries. When they are taken out of the equation, Africa's economic performance over the last two decades begins to look less impressive.

In sum, the nature of economic and techno-scientific development in Africa does not measure up to the hype. The 'Lion State', 'Silicon Savannah' and related analogies are false and premature. The Africa rising narrative would benefit immensely from greater attention to comparative analysis. By hyping the nature of economic progress in Africa, the 'Africa rising' narrative under-emphasizes the complex, multi-faceted development challenges that still face the continent. In spite of its recent economic and 'techno-scientific gains, and in spite of opportunities in global megatrends over the next decade or so (which according to a 2012 Report of the US National Intelligence Council

(Global Trends 2030) includes demographic patterns, diffusion of global power or 'emancipatory multi-polarity', individual empowerment, urbanization, disruptive technologies and food-water-energy pressures; see also Prof Nwadiuto Esiobu's article in this Issue of the Magazine), Africa faces a number of fundamental development challenges, including: structural transformation and economic diversification; inequality and social exclusion; insecurity and political instability; underdeveloped scientific, technological and innovation capabilities, to mention but a few. Even after two decades of solid economic growth, Africa is still more or less where it was at the turn of the century: many development problems remain largely confined to the continent.

Addressing these challenges will require a more creative, bold and innovative approach to development policy than currently employed by many African countries. Most accounts of the 'Africa rising' narrative assume that African countries have the requisite development policies and leadership necessary to move the continent to the next 'level' of development. Below, I argue that Africa lacks coherent development strategies and leadership required for this task. Even if the proposition that Africa has reached the 'economic takeoff' stage is correct, according to Rostow's theory, a country could still take anywhere between 50 to 100 years to transition to the next 'stage' of economic development: 'Drive to Maturity'. That would require a long interval of sustained economic growth, something that is currently doubtful given the present makeup of what constitutes 'development policy' in many African countries.

Rostow's theory of economic development is problematic and a critique of it is beyond the scope of this article. For our purposes, suffice it to say that we know from the case studies of economic development in South Korea, Singapore and Taiwan for example, that with the 'right set of development policies', economic development can be achieved within a generation. Regardless of its current 'stage' of economic development, if Africa is to realize the dream of industrialization by 2020, 2025, 2030, 2040 or 2063, going by different national and continental aspirations, at a minimum, the continent will need greater techno-scientific and industrial capacities. This will in turn require more than 'palliative policies' or policies primarily focused on poverty reduction. This will also require that the continent reclaims the role of 'Policymaker' from 'Economic Advisors'. Finally, this will require that development policy-making recognizes that Africa is not a country: a one-size-fits-all development approach might be counterproductive to Africa's development objectives, whether it is deployed by 'home grown' African institutions such as the African Union, NEPAD and the African Development Bank or Africa's 'development partners' such as the World Bank, IMF, UN agencies, bilateral and multilateral 'donors'. The rest of this article discusses each of these in turn.

PROMISING TECHNO-SCIENTIFIC PROGRESS BUT STILL A LONG WAY TO GO

Africa's techno-scientific progress over the last few years mirrors that of its 'economy': impressive but nothing miraculous in comparative perspective or relative to its development needs. This is not to diminish Africa's recent techno-scientific gains. At the turn of the century, there was a real concern that the information revolution would marginalize Africa. While the techno-scientific and industrial gap between Africa and the rest of the world remains wide, today, it looks more likely than not that the information and digital revolutions will help Africa to bridge this gap. Africa's ability to harness applications of information and communication technologies (ICTs), especially mobile technologies and the internet, is partly responsible for its current economic and techno-scientific dynamism. A 2012 joint study by the African Development Bank and the World Bank (*The Transformational Use of Information and Communication Technologies in Africa*) estimated that ICTs directly contribute about 7 percent of Africa's GDP, a figure higher than the global average. The study also found that two-thirds of African adults now have access to ICTs.

In many countries in Africa, ICT applications are being harnessed in the fields of finance, education, agriculture, health, climate change and public service. In 2014, the 'mobile ecosystem' supported 4.4 million jobs and "generated 5.7 percent of GDP in Sub Saharan Africa, a contribution of just over $100 billion in economic value", according to GSMA's Mobile Economy, Sub Saharan Africa report of 2015. It is estimated that 88 percent of Africa's population is covered by a mobile-cellular signal. Africa's mobile penetration rate now stands at 67 percent while its internet penetration rate

stands at 26.5 percent or nearly 300 million people. The number of mobile subscribers in Africa grew from less than 25 million in 2001 to nearly 650 million by 2012. According to the GSMA report, more than one-fifth of mobile connections in Africa are connected to a mobile money account and there are "more registered mobile money accounts than banks accounts in a number of countries".

African mobile innovations such as MPesa have given rise to a vibrant mobile economy on the continent. There are currently over 200 tech hubs or innovation labs (also known as co-working spaces, innovation hubs, collaboration spaces, innovation clusters or business incubators) across the continent. Among the most famous of these are Nairobi's Ihub, Kigali's KLab, Liberia's ILab, Nigeria's Co-Creation Hub and FabLabs (i.e. engineering based hubs) in Nairobi and Namibia. The proliferation of these tech hubs, together with planned or nascent formal but fairly ambitious state led science, industrial and technology parks, cities or clusters such as those in Kenya (Konza Techno City or Technopolis); Nigeria (Anam New City, Eko Atlantic, and Centennial City), Botswana (Botswana Innovation Hub); South Africa (Science and Technology Park) and Egypt (City of Scientific Research and Technological Applications (SRTA-City) is what has given rise to the concept of the Silicon Savannah.

Africa's surprisingly speedy uptake and adaptation of ICTs has done a lot for its techno-scientific image. This has somewhat overshadowed its gains in scientific research and development. Two new publications find that the quality and quantity of Africa's research output increased over the last decade (Andreas Blom, George Lan, and Mariam Adil, *Sub-Saharan African Science, Technology, Engineering, and Mathematics Research: A Decade of Development*, and *UNESCO Science Report, Towards 2030*). Sub-Saharan Africa more than doubled its yearly research output from 2003 to 2012. The region's share of global research increased from 0.44 percent to 0.72 percent over the same period. Between 2008 and 2014, the number of research articles published in Africa rose by 60 percent, with Africa's share of global publications increasing from 2 percent to 2.6 percent. The number of researchers in Africa grew from 150,000 in 2009 to 190,000 in 2013, while the continent's gross expenditure on research and development (GERD) grew from US$12.9 billion in 2007 to US$19.9 billion in 2013 or 0.36 percent to 0.45 percent as a percentage of GDP.

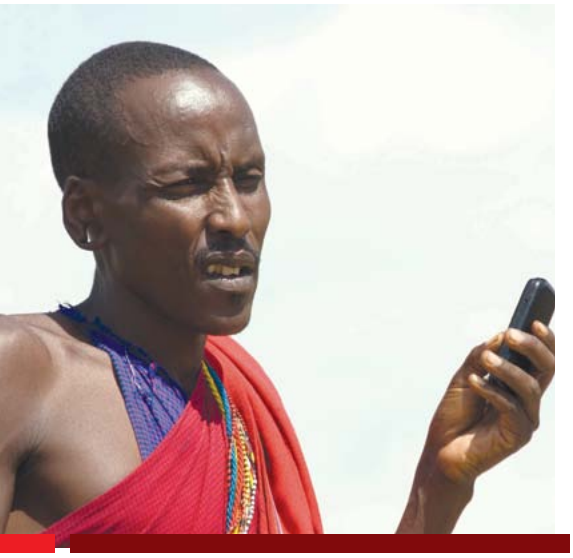
While the techno-scientific and industrial gap between africa and the rest of the world remains wide, today, it looks more likely than not that the information and digital revolutions might help Africa to bridge this gap.

The ICT and R&D figures are impressive relative to Africa's historical performance. However, from a global comparative perspective, they don't look as impressive. McKinsey's 2011 study, *Lions go Digital*, found that the Internet's contribution to Africa's GDP at 1.1 percent was just "over half the levels seen in other emerging markets and well below the average of 3.7 percent in developed economies". (There are significant variations across African countries with countries such as Kenya and Senegal performing particularly well, at 2.9 percent and 3.3 percent respectively). All the ICT related papers in this Issue (i.e. Mark Graham and Christopher Foster, Laura Mann, Padraid Carmody and James T. Murphy, Graham, Mann and Friederici, Mrinalini Tankha and Ken Banks) demonstrate that the African ICT sector is still far from meeting its full potential.

Much has been made of the proposed Konza Technopolis in Kenya and similar techno-scientific or innovation cluster proposals/projects in Africa. While the proliferation of these proposals is a positive sign that much of the continent is finally waking up to the power of science, technology and innovation as a driver of economic development, the hype is misguided. To begin with, outside South Africa, most countries in Africa have a dismal record with 'mega projects' in general and 'mega scientific or technology projects' in particular. Early attempts at 'mega projects' in the 1960s through the 1980s resulted in many 'white elephants' or investment projects with negative social surplus. More recently, simple plans to supply schools with laptops in many African countries have stalled. Apart from the fact that without a skilled manpower base, proposed mega techno-scientific projects are more likely to turn into 'white elephants', bureaucratic difficulties in executing relatively simple projects do not inspire much confidence in the fate of the proposed mega projects.

Secondly, and perhaps more importantly, even assuming successful completion, African techno cities or innovation clusters wouldn't be the most ambitious, innovative or competitive in the world. A number of countries have either successfully developed similar or more advanced initiatives (e.g. Biopolis in Singapore, Software Technology Parks in India, Israel's Silicon Wadi, Edinburgh's BioQuarter, Hsinchu Science Park in Taiwan, Tsukuba Science City in Japan – not to mention the original Silicon Valley and its many variants in the US). Others are racing to complete similar projects: Paris-Saclay (France) Skolkovo (Russia), Cyberjaya (Malaysia), Chilecon Valley, (Chile) and Tech City London, (United Kingdom). Many of these projects have two advantages over those in Africa: (a) more developed scientific infrastructure (i.e. larger pools of science, technology, engineering and mathematics (STEM) graduates, world class universities and research centers, heavy private sector concentration and participation, large outlays of both public and private sector funding, established or functional industry-state-university partnerships) and (b) greater 'ambition' and 'innovation'. Each of the non-African projects has a holistic talent strategy to develop and attract world-class scientists, whether local or international

(e.g. flexible visa rules, 'seed' funding, nationality, ethnicity and race blind immigration policies). For example, Singapore's A*STAR Program provides scholarships for the best students in Singapore to pursue undergraduate and graduate scientific training at top universities in Singapore and around the world. It also allows brilliant international postdocs to conduct research in Singapore. Singapore is also able to attract many capable and talented foreign students into its national science ecosystem through its world class higher education system. Brazil's Scientific Mobility Program (BSMP) is a government initiative designed to grant 100,000 Brazilian university students the opportunity to study



abroad at the world's top universities. 'Start-Up Chile' is a Chilean government funded start-up incubator program that since 2010 has spent US$40 million in grants to attract the best and brightest entrepreneurs from all around the world by providing them with a one year residency visa, US$ 40, 000 in seed funding, office space, and opportunities for mentoring and coaching.

By comparison, many of the African initiatives lack coherent strategies to either build and/or to attract the best global talent. It is estimated that Africa needs 10,000 STEM graduates over the next 10 years. Nothing much has been done about this so far. While other countries are investing in world class research centers and universities, many African countries seem more interested in expanding the 'quantity' rather than the 'quality' of university education. If Africa is not going to compete aggressively for global talent, including Africa's own talent, it is unlikely that many of the planned techno-cities and innovation clusters will succeed.

The point is not that Africa should cede mega scientific and technological projects to others. On the contrary, the point is that in terms of economic development, Africa can longer afford to leave, in the famous words of Thandika Mkandawire, "the thinking, planning, experimenting, and therefore learning, to foreign institutions' (quoted in Seyoum Hameso's 2001 book: *Development, State and Society: Theories and Practice in Contemporary Africa*). The continent already has limited scientific and research infrastructure. This acts as a major obstacle to attracting global talent. Africa has to find creative and innovative ways of making itself an attractive 'hub' for scientific research and technological innovation. Achieving this will require a coherent development policy, focused leadership and capacity for strategic thinking. Notably, this will require some world class mastery of 'industrial policy': ability to successfully identify and to effectively support sectors, industries or even firms, with the potential to fundamentally transform the structure of an entire industry or country. It is not clear that many of Africa's planned mega techno - scientific and technology projects are embedded within strategic and coherent national development policies.

Africa's promising ICT story over the last decade has occurred with limited state or government support – outside of the provision of requisite infrastructure (e.g. investments in broadband, STEM training) and enabling regulatory frameworks. n spite of this, Africa has emerged as a global leader in mobile technologies and innovations. Much of the mobile technology and innovation work in Africa has been done through an interesting combination of universities, telephone companies, 'seed funding' agencies, and thousands of entrepreneurial Africans who congregate in the more than 200 innovation hubs or labs across the continent.

Considering that the entire mobile ecosystem in Africa is still a loose, informal and precarious infrastructure, despite its vibrancy and dynamism, perhaps a more innovative and appropriate 'industrial policy' in Africa would be for the state to 'follow' its entrepreneurs and focus investments, research and development and related infrastructure on the 'mobile technology and solutions sector'. This might still require the building of a Technopolis but it would be a very different Technopolis, one perhaps better suited to Africa's already world class innovation capabilities and ecosystems in mobile technologies and innovations. A mobile, virtual or cyber Technopolis might help overcome many of the barriers to scientific and technological development in Africa, including the challenges associated with financial and human capital.

African entrepreneurs and innovators have demonstrable expertise and interest in this type of challenge. That is partly the logic and method behind the mobile revolution in Africa. It is also partly the logic and method behind the self-selection and location of the more than 200 ihubs across Africa. Many of these are already associated with leading African universities, global researchers and the private sector, both local and foreign. In other words, many of the tech hubs might be low cost and small scale but they are already 'functional innovation clusters'. Why build a 'formal' innovation cluster from scratch? Why not build on these pre-existing innovation hubs? After all, many of the pre-existing hubs focus on generating innovations with social applications.

A fundamental problem with Africa's techno-scientific development is that the continent is yet to bet big on science, technology and innovation for its economic development. Scientific development is at the heart of technological change and innovation. Since the industrial revolution, developed

countries have had the most science and technology capacity and have grown fastest. More recently, returns to research and development (R&D) have been shown to be consistently positive and high across many industries in both developed and developing countries, suggesting a correlation between innovation and growth. Developed economies have continued to invest heavily in research and development but many of the fastest growing developing countries of the last few decades have recently joined this league. According to Batelle's Global R&D Funding Forecast, in 2014, the US invested 2.8 percent of its GDP to R&D. In the same year, the figure was 2.0 percent for China, 3.4 percent (Japan), 2.9 percent (Germany), 3.6 percent (South Korea), 2.3 percent (France), 1.3 percent Brazil, 2.7 percent (Qatar), 2.7 percent (Singapore), 4.2 percent (Israel) and 2.4 percent (Taiwan).

In 1980, African leaders pledged that each African country would spend at least one percent of its GDP on R&D. This pledge was not met. In 2007, African leaders renewed this pledge. There has been little movement so far. Africa's R&D expenditure as a percentage of GDP grew from 0.36 percent in 2007 to 0.45 percent in 2013. The 1 percent target isn't sufficiently ambitious to begin with. That no more than 3 African countries have met this target since the renewed pledge in 2007 speaks to misplaced development strategies in Africa. Africa's gross expenditure on research and development (GERD) might have increased from US$12.9 billion in 2007 to US$19.9 billion in 2013 but in comparative terms all this tells us is that Africa is yet to bet on science, technology and innovation. Consider this. With nearly half a trillion dollars in R&D investments annually (or about 2.8 percent of its GDP), US annual R&D investments are just over the size of South Africa's GDP. In 2014, South Korea's gross expenditure on research and development was $ 63 billion, about the size of the entire Kenyan economy. Africa's GERD of US$ 19.9 billion in 2014, was just slightly bigger than Spain's (US$ 18 billion).

While Africa has done well in research and development over the last few years, it is worth putting this in comparative perspective. Africa's research and publication indicators might be trending upwards but Sub-Saharan Africa still accounts for less than 1 percent of the world's research output. More importantly, despite the realization that to achieve economic transformation, Sub-Saharan Africa requires more and better STEM skills and knowledge, its research output in STEM significantly lags behind that of other subject areas. The share of STEM research in Africa declined marginally by 0.2. percent annually over the last decade. While STEM constituted the largest share of Malaysia's and Vietnam's total research output at an average of 68 percent, it was only 29 percent of all research in Sub Saharan Africa. According to Blom et al, "in 2012, the quality of STEM research in Sub-Saharan Africa, as measured by relative citation impact, was 0.68 (32 percent below the global average). This is below that of all disciplines in Sub-Saharan Africa (0.92) and the global average (1.00), and it has virtually stayed the same since 2003. In contrast, STEM research in Malaysia, Vietnam and South Africa in 2012 was slightly above the world average (1.02) and has improved 15 percent since 2003". The growth in Sub-Saharan Africa's research has been largely driven by the Health sciences, which grew at an impressive rate of 4 percent annually and accounts for 45 percent of all Sub-Saharan African research.

Investments in African research and development over the last few years have been partly driven by international partnerships and external funding. While this is welcome and needs strengthening, it can be problematic, absent a coherent development strategy. According to Andreas Blom et al, in 2012, 79 percent, 70 percent, and 45 percent of all research by Southern Africa, East Africa, and West and Central Africa, respectively, were produced through international collaborations. By comparison, 68 percent, 45 percent, and 32 percent of Vietnam, South Africa, and Malaysia's research output, respectively, were produced through international collaborations.

This suggests that Sub Saharan Africa lacks internal research capacity and the critical mass to produce international quality research on its own. Blom et al also argue that the transitory nature of many researchers in these international partnerships "may prevent researchers from building relationships with African firms and governments, reducing the economic impact and relevance of research". More importantly, they conclude that there "appears to be little knowledge transfer and collaboration between Sub- Saharan African academics and the corporate sector, as measured by corporate downloads of and patent citations to African academic research, especially for STEM disciplines… Such trends suggest that corporations do not rely much on African-generated knowledge and research for their competitiveness."

By comparison, all the African initiatives lack coherent strategies to either build and/or to attract the best global talent.

Many African countries lack strategic development policies to consolidate their recent economic and techno-scientific gains and to capitalize on potentially favorable global megatrends in the future. In the absence of strategic development policies, recent gains and any potential fortunes in future megatrends are not as useful as 'enabling development conditions' as they otherwise would be. Development strategy is here defined as "an economic conception that defines the priority goals, coherently explains how set goals can be reached, identifies the policy tools and explores trade-offs and the time frame" (Priewe, 2015, 27 in UNCTAD's *Rethinking Development Strategies After the Financial Crisis: Making the Case for Policy Space*). In their assessment of successful development strategies of Japan, South Korea, Taiwan and China (or the Beijing-Seoul-Tokyo (BeST) Consensus for development), Professors Keun Lee, John Mathews and Robert Wade caution that development policies are not to be confused with 'palliative policies' focused on poverty reduction, such as the Millennium Development Goals.

"Development policies take as their touchstone building capacities of (local or joint venture) firms, especially technological capacities; and strengthening the links from profits to investment and investment to profits. In tackling the task of building the capacities of firms, public agencies can help compensate for deficiencies in the existing structure of markets - agencies such as export-import banks, export processing zone administrations, development banks, technology institutes, and high-level state coordinating)" (http://www.ft.com/intl/cms/s/0/0a9462ee-7e36-11dc-8fac 0000779fd2ac.html#axzz3uUJnuWx0). Lee, Mathews and Wade stress that BeST Consensus is not a matter of either constructing a 'developmental state' or choosing 'free markets'. Rather, it is about the national leadership embracing the norms behind the BeST Consensus, and applying these precepts in line with available capacity.

Broadly speaking, three approaches have underpinned development policy in many African countries over the last 55 years:

- 1960s -1970s: 'Dirigiste Dogma': the use of indicative economic planning to supplement the market system combined with substantial state-directed investments and incentives to promote particular strategic sectors or industries (i.e. various elements of industrial policy. See Deepak Lal's *The*

Poverty of Development Economics).

- 1980s-1990s: The "Washington Consensus": privatization, liberalization and deregulation of markets.
- 2000 – 2015: 'Palliative' (i.e. poverty reduction) and 'Institutional Strengthening': This approach builds on the "Washington Consensus" by adding a focus on poverty reduction and commitment to private property rights, rule of law, independent judiciary and other institutions that facilitate greater marketization, to the principal elements of the "Washington Consensus". This is what Ha-Joon Chang has called 'Hamlet without the Prince Developmentalism' or the substitution of the concept of economic and social structural transformation in development discourse with marginal improvements in socio-economic indicators.

The "Washington Consensus" and 'Palliative cum Institutional' Approaches have a lot in common. Both draw their inspiration from 'mainstream' neoclassical economic thinking, although the 'Institutional' approach also pays heed to tenets of 'new institutional economics'. Widespread criticism of the "Washington Consensus" partly led to the rise of 'Palliative and Institutional Strengthening' approaches. Increasingly, the Palliative and Institutional Approaches have come under fire for being ill-suited to the task of economic development, if economic development is defined in terms of structural change and transformation. Japan, China, Singapore, Taiwan, South Korea, Malaysia and a few other countries have upended economic orthodoxy by 'developing' phenomenally well in spite of (or perhaps because of) institutions and policies that markedly deviated from the principal elements of neoclassical and new institutional economics or entailed significant creativity or 'allowances' within the neoclassical/new institutional economic paradigm.

The development success of 'heterodox economies' (e.g. China, Taiwan, South Korea, Japan and Singapore), the global financial crisis of 2008 and the ensuing Great Recession, have led to a growing body of work in economics that (a) questions the efficacy and relevance of the neoclassical economic paradigm not only for developing countries but also for developed ones and (b) seeks economic or development 'lessons' that both developing and developed countries can learn from the success of 'heterodox economies'. The Chinese development experience, like that of the 'East Asian Tigers' and other successful 'heterodox' economies suggest that there are many successful visions of market economy and as many successful policy and institutional paths to achieving them. "Much of development economics had been viewed as asking how developing countries could successfully transition toward the kinds of market-oriented policy frameworks that came to be called "American style capitalism." The debate was not about the goal, but the path to that goal, with some advocating "shock therapy," while others focused on pacing and sequencing—a more gradualist tack. The global financial crisis has now raised questions about that model even for developed countries" (Joseph Stiglitz (2011) in 'Rethinking Development Economics', *The World Bank Research Observer*, pp. 230). China's economic policies and institutions in particular, have been unambiguously un-orthodox that little attempt has been made (so far) to 'package' them otherwise. "Many country economic analyses address the issue of why a particular country has not lived up to its performance expectations. Usually, the answer is deemed to be obvious. That is, the country did not follow the appropriate policy; it deviated in fatal ways from orthodox policy prescriptions associated with the so-called 'Washington Consensus'. Alternatively, if the country indeed did appear to have conformed to the tenets of this neoliberal doctrine, the literature probes the question as to why a country that dutifully carried out the policy consensus did not reap the expected benefits. China is different. Much of the China literature addresses a contrary puzzle: with institutions and policies that have deviated greatly from established orthodoxy, how could China be performing so well?" (Jefferson, G. (2008) in 'How Has China's Economic Emergence Contributed to the Field of Economics?' *Comparative Economic Studies*, pp.168).

The success of the 'heterodox economies', the global financial crisis and the Great Recession, have forced consideration - ever so grudgingly - of the validity of alternative development or economic theories, institutions and policies. In the wake of the global financial crisis, the bastions of the 'Washington Consensus' – the IMF and the World Bank – are going through what Grabel has termed an interregnum of restrained 'neoliberalism coherence' amidst 'productive incoherence': "the proliferation of responses to the crisis by national governments, multilateral institutions (particularly the IMF) and the economics profession that to date have not congealed into any sort of consistent strategy or regime" (Grabel, Ilene, 2011. 'Not your grandfather's IMF: global crisis, 'productive incoherence' and developmental policy space', *Cambridge Journal of Economics,* 35: 5, pp. 806). The IMF's response in the wake of the global financial crisis and the Great Recession has exhibited a rare lack of attachment to a rigid, one-size-fits-all strategy of global neoliberalism. (The same could be said of the actions of major advanced economies during the Great Recession, including particularly the US). For example, the crisis has had the ef-

Unfortunately, much of the new thinking On development is not happening in Africa. Much of Africa appears to be staying the course of palliative' and 'institutional' approaches to development.

fect of 'normalizing' capital controls in developing countries which Grabel considers "to be the most significant expansion of policy space in the developing world over the past several decades" (Ibid. pp 807).

Grabel also points out that IMF's conditionality programs while still 'harsh' and mostly faithful to neoliberalism, display 'incoherence' in two notable ways. "First, while the Fund continues to advocate fiscal retrenchment, it also now routinely emphasizes the need for 'pro-poor spending' to protect the most vulnerable from economic hardship. Second, there is a striking lack of consistency in conditionality programs across countries. Indeed, the IMF's crisis response strategy is marked by ad hoc measures that reflect all sorts of differences across the countries where the IMF has asserted its influence" (Ibid). Grabel is careful to emphasize that these 'deviations' from orthodoxy are far from sufficient indicators of either fundamental intellectual or policy shifts within economics in general or 'mainstream' 'development institutions' in particular. Any development policy space they might embody is presently fragile and easily reversible. Moreover, neoliberalism has a vaunted reputation for resilience even in the face of compelling empirical evidence.

While no one is advocating a wholesale return to the policies of the 1960s and 1970s, or even a replication of the exact policies employed by the BeST countries (the global development, policy and institutional landscape has changed significantly over the last 30 years), three interrelated themes are emerging from a new strand in development thinking: (a) there are many successful visions of market economy and as many successful policy and institutional paths to achieving economic development (b) notwithstanding the changed global institutional and policy landscape, there is still space and scope for successful exploitation of industrial policy and critical elements of the 'developmental state' by both developing and developed countries, and (c) there remains a great and constructive role for the government in development, particularly in facilitating technological innovation, entrepreneurship, social and physical infrastructure. Unfortunately, much of the new thinking on development is not happening in Africa. Much of Africa appears to be staying the course of Palliative' and 'Institutional' Approaches to development. This is problematic because if Africa is to consolidate and sustain its recent economic and techno-scientific gains, it is going to have to rethink its development strategies.

In 'Rethinking the Millennium Development Goals for Africa', Harvard University's Stephen Peterson, joins Professors Lee, Mathews and Wade in challenging 'palliative policies', specifically, the Millennium Development Goals, as effective development strategies for Africa. Peterson proposes an alternative strategy for Africa called DIGS or Decade Infrastructure Goals where 'I' stands for transportation, power, agriculture and revenues. Peterson argues that the DIGS prioritize investments with proven abilities to act as growth multipliers, alleviate poverty and promote sustainability. "By starting D for decade, DIGs avoids the shifting fads that blow through development and will force a discipline of direction with a time scale that promotes accountability". One need not agree with Peterson to appreciate that many of Africa's current 'mega-infrastructure' projects would likely yield greater economy-wide spill-over effects, if they were part of coherent national development strategies.

In *'Rethinking Development Strategies after the Financial Crisis,* UNCTAD argues that countries need a 'strategic compass' or development strategy for long-run economic development. This can be explicit or implicit but it must include a focus on institution building, sectoral policies (including industrial and trade policies), macroeconomic policies, 'development-friendly global governance', and policy space to adjust to the specific (and evolving) social, historical and institutional contexts. UNCTAD reflects on the Asian development experience to conclude that the key to successful development lies in the implementation of 'experimental and learning approaches' rather than narrow and rigid general guidelines. A key message of the UNCTAD report is that developing countries can benefit from learning from each other and from their own historical experiences more. (Jan Nederveen Pieterse, writing in Development and Change ('Global rebalancing: crisis & the East-South turn') sees a global rebalancing that is not only redefining North-South relations but also South-South relations. Developing countries might benefit from greater South-East relations). In its *Economic Report of 2011,* the United Nations Economic Commission for Africa (UNECA) endorses a 'developmental state' approach, based on lessons from East Asia, Malaysia and Brazil, as the best strategy for advancing sustained infrastructural, institutional and social development in Africa. For UNECA, a developmental state consists of five major elements: purposeful leadership and a developmentalist coalition; transformative institutions; industrial policy; investment in research; and enhanced social policy.

'Palliative' and 'Institutional' policies have succeeded in generating marginal improvements in socio-economic indicators in African countries. However, they have failed to deliver structural transformation (e.g. industrialization). In general, 'palliative' and 'institutional' policies are insufficient to (a) consolidate socio-economic and institutional gains in much of Africa and (b) to convert opportunities posed my global megatrends into material development gains. A new development policy mind-set is needed for this. At a minimum, this will require a re-evaluation of 'national development ambition' in Africa, the roles of Economic Advisors vis-à-vis Policymakers and the role of industrial policy. The rest of this article examines two interrelated cases to illustrate this: (a) a one-size-fits-all policymaking at the continental level which conveniently ignores that Africa is not a country and (b) and the role of 'Economic Advisors' as 'Policymakers' in all but name in many Africa countries.

Economic development is often nationally defined, for it is inextricably linked to a country's national value systems, norms and ethos. Individual countries get to define their own 'visions' of development. Historically, the pursuit of national economic development has been a very explicit and 'nation-state' centered process. There is a reason why there isn't a single version of capitalism or socialism. The 'Liberal Market Economies' of the US, UK and Australia, differ in critical ways from the 'Coordinated Market Economies' of Germany, Japan or Sweden although both sets of countries are still capitalist economies (see Peter Hall and David Soskice, 2001. *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage).*

Africa is not a country, a common currency area or even a customs union. However, since the early 2000s, much development policymaking on, and for the continent, has proceeded as if it is a country. Firstly, the 'international community' has facilitated this type of policymaking through the UN MDGs. Secondly, since at least 2003, some organs of the African Union (e.g. NEPAD - New Partnership for Africa's Development - and the African Union Commission) have led similar efforts through continental sectoral planning, strategic planning and 'grand visioning'. Together with African governments, development partners and non-state actors, these 'stakeholders' have produced continental 'policy frameworks', 'strategies', 'programs', 'visions' and 'action plans' that individual African countries are then supposed to 'domesticate', 'mainstream' or 'implement'. These include: Comprehensive African Agricultural Development Program (CAADP); African Mining Vision 2050; Program for Infrastructure Development in Africa (PIDA); Science, Technology and Innovation Strategy for Africa (STISA); and African Union Agenda 2063.

The first thing to say about this economic policymaking is that it traces its origins from the fight for African 'policy ownership', waged at the height of the structural adjustment programs. In the late 1990s and early 2000s, pressure from African 'renaissance' leaders such as Thabo Mbeki, Olusegun Obasanjo and Abdoulaye Wade as well as from development thinkers and civil society organizations both within and outside Africa forced a concession, if a rhetorical one, in the 'global development establishment' that 'policy ownership' was critical for policy outcomes. The World Bank's report at the turn of the century (Can Africa Claim the 21st Century?) captures this concession. The report found a modicum of hope for Africa in the 21st century, subject to certain conditions, including most notably, 'policy ownership'. The century offered a "window of opportunity to reverse the marginalization of Africa's people—and of Africa's governments, relative to donors, in the development agenda" (World Bank, 2000, 2). The end of the Cold War and growing participatory democracy in Africa suggested that the continent would no longer be an 'ideological' and 'strategic' battleground between competing powers in which 'trusted allies' received "foreign assistance regardless of their record on governance and development"(Ibid.).

According to the Bank, with an African designed and owned 'Business Plan' aimed at (a) improving governance, resolving conflicts and managing states; (b) addressing poverty and inequality (c) investing in people; (c) lowering infrastructure, information, and finance barriers (d) spurring agricultural and rural development; (e) diversifying exports, reorienting trade policy, and pursuing regional integration; and (f) reducing aid dependency and debt, and strengthening partnerships, Africa could 'claim' the 21st century (i.e. reverse years of social

and economic marginalization in an increasingly dynamic and competitive world). 'Policy ownership' in the form of the vaguely worded African 'Business Plan' constituted a major concession.

Can Africa Claim the 21st Century was written in collaboration with various African institutions and economists under the leadership of a 'Steering Committee' comprising of Ali A.G. Ali (United Nations Economic Commission for Africa), Tesfaye Dinka, (Global Coalition for Africa), Ibrahim Ahmed Elbadawi (World Bank), Augustin Fosu (African Economic Research Consortium), Alan Gelb (World Bank) and Kupukile Mlambo (African Development Bank). Perhaps the most interesting of its many observations was the notion of a 'Business Plan' "conceived and owned by Africans, and supported by donors through coordinated, long-term partnerships". Coming at the end of nearly two decades of structural adjustment programs in which the World Bank and the IMF had come to be viewed as calling the shots in economic policy making in many African countries, this is as close to an explicit discussion on the appropriate roles of Economic Advisors and Policymakers in Africa as the Bank has ever engaged in.

What followed in terms of economic policy making in Africa over the last 15 years is not exactly a 'Business Plan' "conceived and owned by Africans, and supported by donors through coordinated, long-term partnerships". This is true to some extent in a few African countries (e.g. Ethiopia and Rwanda). However, the degree to which this is true in all African countries is debatable. What is not debatable however, is the 'policy coordination and long term partnerships between donors and African governments' especially in the case of continental initiatives such as CAADP, PIDA and Africa Mining Vision 2050. This is also true in the case of 'global development' initiatives such as the MDGs (e.g. 'palliative' and 'institutional' strengthening policies).

The second thing to say about these continental programs, visions, strategies and action plans is that they do not constitute coherent (national) development strategies. Few African countries implement them. Take for example, CAADP, the longest running such initiative. Ten years into CAADP, only 13 African countries managed to meet or exceed the CAADP target of allocating 10 percent of the national budget to the agricultural sector. Similarly, in the first decade of CAADP, the continent was unable to meet the CAADP target of agricultural GDP growth rate of 6 percent per year. The continent surpassed the target of 6 percent agricultural GDP growth only three times: in 2003 (6.1 percent), in 2009 (7.5 percent), and in 2012 (6.9 percent).

The African Union is not a political federation or an economic union. No African state has ceded any of its sovereign functions, including economic policy making to any organs of the African Union, or to any other third parties for that matter (including the World Bank, IMF, the UN system or any donor agency). African governments do seek advice and advisors from these and other bodies.

On paper, the continent has a calendar for creating an African Economic Community by 2028. The Abuja Treaty of 1991 lays out a multi-step process for this: establishment of regional economic communities followed by the establishment of a free trade area and customs union in each regional economic community by 2017 and across the entire continent by 2019. A continent-wide African Common Market is planned to go into effect in 2023. Finally, the Abuja Treaty provides for the establishment of a continent-wide economic and monetary union and parliament by 2028, with a single currency to be managed by an African Central Bank. Apart from the creation of regional economic communities many of the other elements of the calendar are still far from implementation and it is not entirely clear that the Abuja plan remains on schedule as per the Treaty. (For historical and political reasons not related to the Abuja Treaty, 14 countries currently use the West African CFA and Central African CFA currency (in place since 1945 and now indexed on the Euro), while 5 countries currently use the South African Rand: Lesotho, Namibia, South Africa, Swaziland and Zimbabwe).

In spite of the many continental policy frameworks, programs, plans and visions, African countries continue to individually design and implement their own national development initiatives. In theory, these are supposed to be 'aligned' with continental initiatives. In practice however, rarely is there coherence, coordination or harmonization between national and continental development initiatives. The content and sequencing of continental and national policies are often out of sync. For example, many national development visions (e.g. Vision 2020 (Rwanda; Nigeria), Vision 2030 (Kenya; South Africa); Vision 2040 (Uganda), precede the AU's Vision 2063 which did not necessarily build on these visions. As I argued in this column in the last Issue of this Magazine (i.e. July 2015) these 'national visions' are in many cases merely wish lists of worthy goals, with no clear ways and means or 'capabilities' to bring about their realization. While long term development thinking in Africa needs all the encouragement it can get, the proliferation of unfulfilled and likely unfulfillable 'national visions' or more aptly 'wish lists' gives meaning to Helmut Schmidt's famous admonition that people who have 'visions' should seek medical advice!

The third thing to say about this policymaking is that it amounts to a one-size-fits-all approach. African countries and peoples enjoy strong cultural and historical links – even economic relations in a few cases. So ingrained in the African psyche is the feeling of 'oneness' or 'togetherness' of African peoples that anything deemed 'Pan Africa' is almost always looked upon fondly, almost by default. For this reason, economic policymaking at the continental level runs the risk of 'policy compromises' that might lower development ambition on the continent, collectively or in terms of individual nation states. Differences among African countries can be quite stark. Any serious development strategy would not paper over them.

Consider the following:

- Some African economies are 'large' while others are either 'medium' or 'small'. According to the IMF's World Economic Outlook, in 2014, Nigeria, Africa's largest economy, was the 21st largest economy in the world (by nominal GDP). By contrast, the Comoros, Gambia, Seychelles and Djibouti and the Central African Republic were among the 25th smallest economies in the world. The Nigerian economy was nearly 10 times as large as Kenya's, the 8th largest economy in Africa.
- Some African countries are natural resource rich while others are natural resource poor
- Some are 'mono-crop' or mono-commodity' economies while others are relatively diversified.
- Some are landlocked, others are not.
- Some are democracies, others are not

Even with this level of diversity, there might well be very good reasons why a common development 'strategy' or 'framework' might work for the continent as a whole. Arguably, there are areas where a collective or common African approach might be superior to state based 'go it alone' approaches. Common trade, foreign, defense, climate or even science and technology policies would appear to be potentially good candidates for the 'common' one-size-fits-all approach. Apart from trade and arguably climate change, these are not typical areas for collectivist policies in Africa. In trade and or regional integration where this approach has been attempted for much of the last five decades, the record is not great. Economic policymaking at the continental level in other sectors (e.g. agriculture and infrastructure) seldom grapples with this problem. There might be very good reasons why Kenya might allocate 10 percent of its national budget to its agricultural sector over a 10-year period. It is not entirely clear why Djibouti or Seychelles or even Mauritius (given its current state of economic development) should do exactly the same thing, at the same time.

If one wouldn't lump together Sweden, Belgium, Finland, Malaysia, Singapore, Pakistan, the Gambia and the Central African Republic in a 'single economic policy', why would one lump together Nigeria, South Africa, Egypt, Cape Verde, the Comoros, Benin and Lesotho in such a policy? There are many reasons why a one-size-fits-all policymaking might not be the best development policy for Africa. Perhaps the strongest is the proposition that 54 different countries provide excellent laboratories for development thinking, experimentation, learning and policy innovation. Whether a one-size-fits-all policy approach is superior to policy experimentation and learning at the national level should be an empirical question which should be debated and examined at national and continental levels. However, partly as a result of the triumph of Economic Advisors over Policymakers in Africa, even the policy space for discussing this has become increasingly diminished.

ECONOMIC ADVISORS ARE NOT POLICYMAKERS

The triumph of the "Washington Consensus" in the 1980s and 1990s ended - by fiat - a major contestation in economic policy making in Africa: the role of economic advisors vis a vis policymakers. The triumph of the "Washington Consensus" also ushered in the role of 'Economic Advisors' as 'Policymakers' in all but name, which continues to this day, in many African countries. A central premise of the "Washington Consensus"is the proposition that poor countries are poor primarily because of 'bad', 'wrong' or 'poor' policies – as opposed to 'history', 'geography' or other 'context' dependent explanations. Consequently, the key to solving their development problems lies in 'policy advice' or getting them to implement the 'right policies', which for the "Washington Consensus" essentially came down to 'greater marketization': privatization, liberalization and deregulation of markets.

To be sure, there were problems with development policies in Africa (and other developing countries) in the 1960s and 1970s. Part of this had to do with the substance of these policies, a case well made by many proponents of the 'Washington Consensus'. Substance of policy was just one part of the problem however. Analysis of the conflicts between Economic Advisors and African Policymakers in the 1960s and 1970s suggest far more complex challenges to development in Africa, many of which remain unresolved in no small part because in conflating the roles of 'Economic Advisors' and Policymakers and in enforcing a rigid set of policies, proponents of the "Washington Consensus" have succeeded in stifling development policy debate in Africa.

Many African countries started out with relatively clear national development strategies at the time of their independence. Indeed, there were nearly as many visions of the market economy and as many policy and institutional paths to achieving them as

there were of the socialist economy. Moreover, these strategies were hotly contested, both within the policymaking process, academia and the body politic. The "Washington Consensus" succeeded in reducing the complex and multi-faceted nature of development in Africa to one of simply getting the 'policies right', without offering much insight into how to get governments to implement 'good' or even 'sound' economic policies. Rather than deal with this problem intellectually (as Prof. Michael Lofchie does brilliantly elsewhere in this Magazine), proponents of the 'Washington Consensus' opted to use foreign aid as leverage to force reluctant governments to take their 'policy advice'. Apparently, the "Washington Consensus" is all for 'free markets', except when it comes to the 'market' for 'economic ideas' or 'policies'. (The "Washington Consensus" had a more narrow identification of the problem than I have allowed above. The essence of the 'Consensus' has been reduced to simply 'getting the prices right').

While much of the development scholarship and popular discourse in the 1960s and 1970s tended to characterize development policy making in Africa along the Cold War divides of 'capitalist' and 'socialist' approaches, the reality was more complex. (See for example the 'Kenyan Agrarian Debate' and the works of Birth of Robert Tignor (*W. Arthur Lewis and the Development Economics*);Tony Killick (*Development Economics in Action: A Study of Economic Policies in Ghana*); Michael Lofchie (*The Policy Factor: Agricultural Performance in Kenya and Tanzania; The Political Economy of Tanzania: Decline and Recovery*) and Robert Bates (*Markets and States in Tropical Africa ; Beyond the Miracle of the Market: The Political Economy of Agrarian Development in Kenya*). For popular illustration, the first Cabinets in postcolonial Ghana and Kenya included ministers with 'capitalist' inclinations as well as those with 'socialist' predilections. National development strategies in both countries were hotly contested although this would not last for long, in either country.

A key part of policy contestation in early postcolonial Africa took place between 'Economic Advisors' and 'Policymakers. An analysis of this contestation reveals a complex, multifaceted nature of development challenges in Africa. Parts of these challenges required economic solutions and would benefit from the tools of economic analysis. However, other parts required a broader set of solutions, beyond economic expertise and analysis. The Economic Advisors who were most successful in Africa of the 1960s and 1970s either understood or were sympathetic to this complexity. We focus on the relationship between Economic Advisors and Policymakers in early postcolonial Ghana (1957-1966) and Kenya (1964-1976) to illustrate this. The Ghanaian case study focuses on the relationship between Ghanaian leader Kwame Nkrumah and his handpicked Chief Economic Adviser, Prof. W. Arthur Lewis (who would later win the Nobel Prize in Economics in 1979). The Kenyan case focuses on the Ford Foundation Economic Advisory Service Program that sponsored a rotating group of Economic Advisors to Kenya between 1964 and 1976.
(The Ford Foundation also provided Economic Advisors to other countries in Eastern and Southern Africa. Many of the Economic Advisors also worked in more than one Africa country. Tony Killick worked in both Kenya and Ghana. Lewis went into Ghana, under the UN auspices e.g as a UN Economic Advisor to Ghana) and the UN did supply quite a few Economic Advisors to a number of African countries, including Zambia. The World Bank did not get into the Economic Advisory Support Function Properly until late 1970s and early 1980s, when it converted itself, towards the end of the McNamara presidency, into a 'development agency' and a 'knowledge bank'. Its approach to the economic advisory role – in the 1980s and 1990s – was very different from the approach employed mostly in the 1960s and 1970s. The Bank's approach through structural adjustment programs was backed by policy or aid conditionality.

The Economic Advisor-Policymaker conflicts in Africa in the 1960s and 1970s are instructive. In terms of power dynamics, the 'Advisors' and 'Policymakers' were relatively 'matched'. The 'Policymakers' needed the 'Advisors'. All early postcolonial African governments faced the problem of economy-wide lack of skilled labor.

This problem was particularly acute in what one might call the Economic Service, or Economic Planning units. Building competence in these areas was urgent and critical because this capability was essential to formulating and implementing policies aimed at solving many other development problems, including that of economy-wide shortage of trained manpower. Early postcolonial African governments approached this problem in two interrelated ways. They hired external economic advisors to provide them with economic advice in the short term and to help build a local or indigenous cadre of economic experts in the medium to long term. That their expertise was urgently needed gave the early Economic Advisors significant power. This was reinforced by

the seniority and professional accomplishments of many of them. Many of them were distinguished, celebrated economists who enjoyed independent professional prestige. Among the scholars who served in different capacities as 'Economic Advisors' to African governments in the 1960s and 1970s include: W. Arthur Lewis, Albert O. Hirschman, Nicholas Kaldor, Dudley Seers, Tony Killick, Josef Bognar, Edgar Edwards, Michael Roemer, Tom Easterbrook, Brian Van Arkadie, Reginald Green, Ben Lewis, Bevan Waide, Tim Aldington, Alan Simmance, Charles Slater, David Davies, and John Powelson.

Development policies in many African countries in the early postcolonial period drew heavily from what constituted mainstream development economics thinking at the time. This is not to hold any of these advisors or early development economists responsible for Africa's development failures in the 1960s and 1970s. It is also not to hold their 'ideas' responsible for these failures either. That criticism is the entire case for support for the "Washington Consensus". Our point here is make the observation that a majority of development policies in early postcolonial Africa was well within the 'mainstream' of economic development policy and practice. It is also worth mentioning, if only in passing, that many African countries had better economic performance in the 1960s and 1970s compared to the era of the "Washington Consensus" in the 1980s and early 1990s.

African Policymakers had leverage too. Unlike the situation today, many early Economic Advisors were hired in their individual capacities, with limited, if any, organizational support. In most cases, they 'spoke' for themselves rather than for their 'sponsoring' or 'parent' organizations. There was no aid or policy conditionality to use as leverage. For the most part, all the Advisors had was their professional standing. This wasn't insignificant influence when dealing with newly independent countries with hardly any locally trained economists, let alone experienced national planners and statisticians. It simply wasn't overwhelming power when placed against the moral force of 'strategic policy sovereignty' in newly independent states run by popularly elected leaders who enjoyed, at least for a time, massive popularity and prestige.

In any case, the differences between early Economic Advisors and Policymakers were not so much ideological as they were 'operational' or 'tactical'. As Tony Killick argues in D*evelopment Economics in Action: A Study of Economic Policies in Ghana*, a remarkable congruence existed between the ideas of mainstream development economists, socialism, and nationalism in the early 1960s. Early Economic Advisors and Policymakers were seldom ideological 'opposites'. Countries initiated requests for Advisors. They could be quite specific in their preferences. For example in a request to the Ford Foundation for an Economic Advisor in the 1960s, Uganda insisted on an economist from a 'socialist' country, while Tanzania was so determined to maintain its strategic policy sovereignty (i.e. 'independence') that it insisted on getting advisors from multiple countries. "It was Tanzanian policy to diversify their sources of development assistance in order not to become dependent on any single country or agency. At one point in the preparation of the 1969/74 Plan, advisors from 13 countries were working in DevPlan. The price of this independence from single-donor influence must have been a rather confusing mix of policy-oriented advice; but the policy definitely insulated the Tanzanians from undue donor pressures" (Ford Foundation, "Administration and Economic Planning in Eastern Africa: A Ford Foundation Program Evaluation", 1977, pp. 10).

In spite of all of this, there were still serious conflicts between Economic Advisors and Policymakers. At the heart of these conflicts are two fundamental questions, which remain as central to economic policymaking in Africa today as they were in the 1960s and 1970s:

1. Who gets to set the 'national ambition' for development? Is it Economic Advisors (local and foreign) or Policymakers (i.e. national political leadership)? Should national development ambition be determined only by what is 'economically feasible'?
2. What is the proper balance between 'politics' and 'economics' in development policy making? Is development primarily an economic enterprise or does it entail political and social dimensions?

The relationship between Kwame Nkrumah and his Chief Economic Advisor, Prof. W. Arthur Lewis, and the different viewpoints that each held with respect to these questions captures this problem.

To Kwame Nkrumah, the job of setting the national development ambition or economic agenda belonged to the political leadership. The job of the Economic Advisor or the Econo-

mist was to design mechanisms for achieving or realizing that ambition or agenda. On the other hand "Lewis believed that only the economists could determine what could be achieved, and only they could delineate the appropriate methods for realizing these goals. The proper role of political leaders was to speak truth to the people and to promote realistic views of what economic experts told them their countries could accomplish" *(Robert Tignor, 2006. W. Arthur Lewis and the Development Economics, pp. 174).*

Nkrumah conceived of national development as a broad enterprise with economic as well as social and political dimensions. He thought that economists under-estimated and misunderstood the relationship between politics and economics and the broader dimensions of 'national development'. In fact, in the first few months of Lewis' appointment as Chief Economic Advisor, Nkrumah did instruct Lewis to review Ghana's economic, financial and social policies. Lewis had been hired on a two year contract as the Chief Economic Advisor to Nkrumah. However, due to policy disagreements between them, he only served 18 months in the post. In that time, he helped draft the country's 1958-59 Budget and the 2nd Five Year Development Plan, in addition to debating and offering advice on many other development policies and projects including the Volta River Project.

Nkrumah didn't always follow Lewis' advice, particularly with respect to the Volta River Project which Lewis felt was not the most cost-effective method for achieving Ghana's objective of becoming 'industrialized'. In a now famous letter to Lewis in 1958, Nkrumah, explained the situation thus: "The advice you have given me, sound though it may be, is essentially from the economic point of view, and I have told you, on many occasions, that I cannot always follow this advice as I am a politician and must gamble on the future" (Tignor, 2006, p. 173). Political leaders in newly independent but fragile states, Nkrumah argued, "had to build coalitions, use patronage to solidify their political authority, even coerce the opposition, and be responsible to the high hopes that their peoples carried about the meaning of political independence" (Tignor, 2006, 174).

Lewis refused to buy this argument, seeing it as an excuse by Kwame Nkrumah to use 'agencies of economic development' for 'political jobbery' or what is today formally known as 'rent seeking' or corruption. (Prior to taking up his appointment, Lewis had extracted a promise from Nkrumah that economic agencies would be sheltered from political corruption, Tignor, 2006, 170-71). He made his views clear to the Prime Minister: "Alas, the main reason for this lack of balance is that the Plan contains too many schemes on which the Prime Minister is insisting for 'political reasons'…In order to give you these toys, the Development Commission has had to cut down severely on water supplies, health centers, technical schools, roads, broadcast redifusion… It is not possible to make a good development plan for £100 million if the Prime Minister insists on inserting £18 million of his own pet schemes of a sort which neither develop the country nor increase the comfort of the people"(Ibid.).

According to Lewis, "Nkrumah regarded economists as mere technicians, whose task it was to realize the economic dreams of the public and politicians, no matter how unrealistic" (Tignor, 2006, 174). Throughout his time in Ghana, Lewis objected to this view. He held firm to his advice on the Volta River Project. In the end, Nkrumah asserted his role as 'Policymaker' and claimed 'strategic policy sovereignty' for Ghana: "My mind is finally made up and irrespective of anybody's advice to the contrary, I am determined to see that at all cost the dams at Ajena and Bui are built" *(Murphy, C. N. 2006. The United Nations Development Program. pp.128).*

For the most part, the relationship between Lewis and Nkrumah, however, unfortunate it might appear to those who admire both men, speaks to what the ideal nature of the relationship between an Economic Advisor and a Policymaker should be. The Policymaker should set the economic agenda, and make final decisions on national priorities and policies, taking into full account expert economic and other advice. The Economic Advisor should provide unvarnished expert advice and provide the Policymaker with 'feasible options' or 'tools' for pursuing national development priorities. If the Economic Advisor feels that they have lost the trust of the Policymaker or that the Policymaker is not following their advice, or that the Policymaker is morally or ethically compromised, the Economic Advisor should resign, as Lewis did. The Economic Advisor should not insist on his or her advice carrying the day. Certainly, the Economic Advisor should not resort to 'extra-professional' measures (e.g. aid or policy conditionality) in order to prevail.

In principle, on the role of Economic Advisors, Nkrumah was right. National development ambition need not be determined only by what is 'economically feasible'. National development ambition can transform what is 'economically feasible' by inspiring technological, organizational, institutional or policy innovations. This is the point that Lewis appears to have missed or under-emphasized. There is of course no guarantee that an ambitious national development agenda will inspire innovation. However, the process of economic development consists of experimentation, innovation, learning and capabilities accumulation. Even an ambitious development agenda that fails might still generate valuable lessons, innovations and capabilities accumulation that might still ultimately solve the original development problem. This seems to be one key lesson from the experience of the successful 'heterodox economies'.

"The advice you have given me, sound though it may be, is essentially from the economic point of view, and i have told you, on many occasions, that i cannot always follow this advice as i am a politician and must gamble on the future." ——

In practice, Lewis was right that Nkrumah did, in fact, on several occasions, use economic policy and institutions for 'political jobbery' or corrupt aims. Lewis was always rightly concerned about abuse and misuse of public resources. Developing countries can ill afford abuse and wastage of public resources. Lewis was also rightly keen to restrain 'showy' massive projects or 'white elephants' that were either un-necessary to the development effort or which the Ghanaian economy could not absorb at the time. He did the right thing by resigning as soon as he deemed that he had lost the confidence of Nkrumah.

Nonetheless, Lewis's problems were two fold. Firstly, he did not sufficiently appreciate that economic development in a newly independent state (in which the very concepts of 'political and economic independence' had to be given material meaning) was going to 'conflate' national political, social and economic ambitions. Under the circumstances, economic policymaking was inevitably going to be a political process. National development is broader than economic development: social and political considerations always come into play. How to deal with this in a 'rational' manner is the fundamental challenge of successful economic policy making.

Secondly, Lewis was perhaps a little too willing to play 'Policymaker'. He also had perhaps a little too much faith in the superiority of the tools of economic analysis. By insisting only on what was 'economically feasible' in the formulation of development ambition and plans in Ghana, as Nkrumah alluded to, he risked failing to tap into the vast energy of a newly independent country (i.e. he did not appear to allow room for 'innovation'). All this combined to ultimately undercut his influence, as the Nkrumah government increasingly resorted to making key decisions without consulting him.

Where Economic Advisors were careful not to play 'Policymaker', were sensitive to political and social considerations and accepted the limits of their own craft, the outcome was a lot more productive, all things held constant.

The Ford Foundation Economic Advisory Program in Kenya from the 1960s through to 1976 is a good example of this. The Program was unusual in many ways. Firstly, unlike many other programs, the Kenyan Program wasn't run out of a university department. For much of this period, Harvard University's Development Advisory Service (DAS), which would later become the Harvard Institute for International Development (HIID) and later CID (Centre for International Development), was the 'administrator' or 'manager' of choice for most Ford Foundation and other donor based 'Economic Advisory Programs'. For all the 15 years that the Ford Foundation provided Economic Advisors to Kenya, these Advisors were hired in their individual capacities and mostly operated as such. An independent evaluation of the Program in 1977 described the situation:

"The Foundation has had a general policy that the professional loyalty of an advisor assigned to a government is to the government itself, and that no matters of a confidential nature are expected to be divulged to the Foundation's representatives. Edwards and subsequent advisors adhered strictly to this policy, a fact that continues to be fully appreciated by the Kenya Government. In addition, the advisors supplied by the Foundation were not considered to be a team and, although there was often a recognized senior economist among them, there was no designated team leader Throughout the life of the program, no professional meetings were held in which only Foundation advisors were in attendance, and no attempt was made to coordinate the views or advice of the advisory staff" (Ford Foundation, 1977, 6).

This arrangement more than 'levelled the playing field' between policymakers and their economic advisors. It meant that the Government was more likely to receive independent and unvarnished advice from each Economic Advisor as they were not encumbered by organizational ideologies or 'positions'. From the outset, both the Foundation and individual Advisors were keen not to play 'Policymaker'. Prof. Edgar Edwards' (the first Economic Advisor in Kenya under the Program) early reluctance to assume an official position within the Kenyan civil service, set the tone and captures the overall nature of the pro-

gram throughout its 15 years. "In July 1964, a new Directorate of Planning within the Treasury was officially established with Edwards at its head, an arrangement that made the Foundation's representative distinctly uneasy. It was one thing to provide advice on economic planning issues, but for a Foundation employee to be responsible for the planning mechanism was outside the boundaries of its own definition of its assistance….This potential difficulty was overcome when Kenya became a republic on the anniversary of its independence, and a Ministry of Economic Planning and Development (MEPD) was created. Edwards became senior advisor to the Permanent Secretary of MEPD…".

Besides being reluctant to play 'Policymaker', Foundation Advisors in Kenya were, unlike Lewis in Ghana, very mindful of and sensitive to the political considerations of their policy bosses. In particular, they understood very early on that economic development plans in Kenya served multiple purposes, besides shaping government policy. "Plans serve several functions: they are a means of communicating economic accomplishments and intentions to the people; they fulfill the requirements of donors like the World Bank who wish to see projects in a larger economic perspective; and they serve as a guide for government action for the succeeding five years…More recently, doubts have arisen about the seriousness of Government intentions to use the current plan as a guide to action. One of the principal drafters of this plan felt that the document had become more of a political than an economic instrument. He doubted that Government seriously meant to pursue the rural development and income redistribution objectives stated in the plan, and he felt that balance of payments and growth estimates had been adjusted for credibility and political acceptability" (Ford Foundation 1977, 8).

The Ford Foundation Advisors also took a more humble approach to both their abilities and the strengths of the national development plans. Firstly, the Advisors recognized the impact of external factors on the Kenyan economy and allowed that a National Development Plan might not be executed faithfully due to factors outside Kenya's control. Assessing the prospects of Kenya's Third National Development Plan (1974-1979), an independent review of the Ford Foundation Program notes: "Another factor lessening the likelihood that the document as approved will be followed faithfully is the enormous influence of the outside world on an economy the size of Kenya's. This was dramatically demonstrated by the drastic rise in oil prices, and the subsequent world recession, which occurred immediately after the plan was drafted, throwing its forecasts seriously out of kilter" (Ford Foundation, 1977, 7).

While they were reluctant to play 'Policymaker', the Ford Foundation Advisors acknowledged the limitations of their own process in the Kenyan development planning process. Kenyan policymakers, led by the Economic Planning Minister (and in the early 1960s, a Standing Development Committee of the Cabinet) played an active 'policymaker role' in setting national ambition and development objectives. Nonetheless, the Advisors had the humility to recognize that their presence could introduce a 'bias' in the process. With reference the Third National Development Plan: "it is quite possible that the plan does not fully reflect political realities in Kenya. Indeed, it would be surprising if it did, because the major drafting of this and all previous plans was by the hands of foreign advisors. The drafting was, of course, under Kenyan supervision, and both Cabinet and Parliament reviewed and approved the final version, but some departure from reality is inherent to the process".

The Kenya Government wasn't as hands-off as the humility of these Ford Foundation Advisors might suggest. Throughout much of the 1960s, including when Sessional Paper no 10 of 1965 on African Socialism and its Application to Kenya was published, perhaps the most important economic policy document in 20th century Kenya, the planning process was led by Kenya's first Economic Planning Minister, Tom Mboya, one of the ablest and intellectually capable cabinet ministers Kenya has ever produced. While the first draft of Sessional Paper no 10 of 1965 was written by Edgar Edwards, before it reached Parliament, it was "intensively reviewed and revised, first by an informal group chaired by Mboya with Mwai Kibaki, Ndegwa, Knowles and Edwards as members, and then by the Ministers sitting in the Development Committee" (Ford Foundation 1977, 3).

The Advisors readily acknowledged for example that Sessional Paper No 10 of 1965, to some extent, represented "the Government's answer to the insistent voices in Parliament, led by Oginga Odinga and Pio Pinto, demanding more radical social change. The Sessional Paper sought to elucidate its philosophy that dignity, jus-

tice and equity need a firm basis of economic growth''. It is this sensitivity to 'political reality' (i.e. intra-governmental, and in-country contestation of the 'vision of national development') that W. Arthur Lewis appeared to have underappreciated in Ghana.

In spite of the relatively functional relationship between Ford Foundation Economic Advisors and Policymakers in Kenya, the two still had significant conflicts. Like Lewis in Ghana, there were many instances in which the Economic Advisors felt that their advice was being ignored. Like Lewis, the Advisors in Kenya conceived of their jobs as using the tools of economic analysis (especially cost benefit analysis) to advise the Kenya government on what was economically feasible. They lost as many arguments as they won this as they won on this stance. They key difference between them and Lewis is that the Foundation Advisors conceived of their roles as being separate and independent from that of policymakers. The ultimate decision making rested with Policymakers. This mindset allowed Foundation Advisors to 'live to fight another day'. In the process, they helped keep the Kenya government on a sound economic management path.

To illustrate, Foundation Advisors in the early 1970s - Charles Slater, David Davies, and John Powelson - had been highly critical of various aspects of the Kenyan development model (import-substitution industrialization) that would come under heavy criticism from the ILO Mission Report of 1972 authored by Hans Singer, Richard Jolly and Charles Cooper: Employment, Income and Equality: A Strategy for Increasing Productive Employment in Kenya. By the early 1970s, Kenya's strategy of import-substitution and capital intensification had the result of promoting economic growth, while perpetuating the dualistic economy that the country inherited at independence. Over-valued exchange rates encouraged imports (especially of capital machinery which could also be labor-saving machinery) while discouraging exports (which consisted mostly of labor-intensive goods from the agricultural commodities, which employed the bulk of the population. Low interest rates, encouraged capital-intensive production at the expense of the employment of labor. Tax incentives for investment and low import duties on capital goods had the same effect.

This mindset allowed foundation advisors to 'live to fight another day'. In the process, they helped keep the kenya government on a sound economic management path. —

Foundation Advisors had recommended changes to these policies before the ILO report but the government had ignored them. However, the Kenya government did change these policies between 1973 and 1976 (following the ILO Report), in order to enhance the competitiveness of its agricultural sector. The 1974-1979 National Development Plan in Kenya was perhaps the first five-year plan in the world to be based on the 'Redistribution with Growth' paradigm following the landmark ILO report and Hollis Chenery's influential 1974 book: *Redistribution with Growth: Policies to Improve Income Distribution in Developing Countries in the Context of Economic Growth.*

On the whole, the Ford foundation Economic Advisory Program and the relationship between Economic Advisors and Policymakers in Kenya worked well. Here is how the independent review of the Ford Foundation Program summarized its achievements: ''they were able to help Kenya resist showy, plaque-hanging projects and inefficient turn-key operations by employing cost-benefit analyses. They were also helpful in curbing the strong tendency to tailor projects to meet donor requirements, to accept aid for imported goods that could be produced domestically, and to finance imports through aid even though higher costs would result… Such projects as a major steel-works and a motor car assembly plant were either avoided, delayed until the economy could absorb them, or reduced in scale as a result of economic analysis. In other cases, the economists lost the argument and the Government made large investments in dubious projects such as the fertilizer plant and sugar refineries'' (Ford Foundation, 1977, 8). Self-critically aware to the end, the Ford Foundation Program held that it was quite possible that its economic advisers were wrong in their judgments.

The Ford Foundation Economic Advisory Service Model has not been replicated anywhere in Africa since it ended in the early 1980s. The 'Lewis experience' was, and continues to be replicated in many African countries with the critical exception that nowadays, Economic Advisors do not necessarily have to worry about winning over Policymakers: many of them rely on aid or policy conditionality for this purpose. 'Economic Advice' today is mostly provided through institutional arrangements. For the most part, Economic Advisors represent 'institutional views' or positions. Their economic advice is often 'tied' - to grants, loans and other forms of foreign aid. 'The policy advice' being given is relatively uniform and predictable (i.e. one-size-fits-all). For all intents and purposes, many Economic Advisors in Africa today (i.e. those aligned to organizations rather than 'consultants') are 'Policymakers' in all but name. This sums up what I call the poverty of development strategies in Africa. It diminishes the continent's ability to creatively confront the full range of development opportunities and challenges it faces in the 21st century.

CONCLUSION

There are multiple pathways to successful economic development. A relatively diverse set of policies from a diverse cast of once poor but now developed countries has demonstrated this. These policies encompass elements of both 'orthodox' and 'heterodox' economics. Economically successful countries appear to be those that have found the right 'mix' of these policies in different sectors or industries at different points in their economic development, usually through the process of experimentation, innovation, learning and capabilities accumulation. Those countries that have struggled appear to have employed rigid or 'dogmatic' policies, devoid of experimentation, innovation and learning, both from their own economic histories but also the history of economic development in other countries.

After more than 50 years of first experimenting with dirigisme policies followed by those of the 'Washington Consensus' and then 'palliative' and institutional policies, the development debate is increasingly turning back to the merits of 'industrial policy', a key component of the dirigisme policies that many African countries attempted to implement in the 1960s and 1970s. Rather than govern fruitlessly in circles, African policymakers and intellectuals should have enough 'material evidence' now, from the history of economic development in Africa and in other regions, to learn that the process of economic development does not necessarily require them to choose one of these approaches over the others. Any successful development strategy will almost certainly require components of all of these approaches. What the 'right set' of policies is for any given African country at any given point in time is up to that country to decide, based on its independently determined national ambition and its prevailing capabilities and potential for technological, social, institutional, organizational and policy innovation.

On the balance of empirical evidence, it appears that any successful development in Africa will entail some element of 'industrial policy'. The sooner African countries realize this and reformulate their development policies accordingly, the sooner their development ambitions or 'national visions' are likely to be met, and vice versa. However, whatever form of 'industrial policy' this takes, it will almost certainly be quite unlike anything implemented in Africa in the 1960s and 1970s if it is to be successful. Many elements of 'palliative', 'institutional' and "Washington Consensus" set of policies will have to be part of the mix of any successful development strategy in Africa. Most notably, the "Washington Consensus" has a key proposition that has gone under-appreciated by both its proponents and opponents alike: whatever else it means, 'greater marketization', must include the 'market for ideas', including policy, theoretical and empirical ideas that might be diametrically opposed to those proposed by the "Washington Consensus". If for nothing else, such competing 'markets for ideas' should help strengthen the rigour and clarity of all 'policy prescriptions'.

Should African policymakers pay attention to Economic Advisors? Absolutely. Should both economic advisors and policymakers be mindful of and work to avoid 'white elephants' and rent seeking in development policy and practice in Africa? Of course. Does this warrant more power to Economic Advisors over Policymakers? Absolutely not. Policymakers are subject to various checks and balances. The Economic Advisory function is just one, albeit relatively informal, part of the overall checks and balances that policymakers are subject to.

What is 'economically feasible' should certainly be a key consideration in the determination of national development ambition. However, this should just be one, among other considerations. Just as important should be the question of whether any development policy being proposed has a demonstrable record of success either in a country's economic history or elsewhere. Policies that work only in theory and not in 'practice' should not be ignored out of hand (see the emphasis on experimentation, learning and innovation above), but they should be subject to 'greater scrutiny', during formulation, and should they be adopted, 'experimentation'. It should not take more than 20 years before a country realizes that a piece of policy is not working.

Africa faces unique development opportunities and challenges. If it maximizes these opportunities it is more likely than not that it will consolidate its recent economic and techno-scientific gains and given material and sustained meaning to the narratives of Africa rising, lion states or silicon savannah. If it does not, the Africa rising narrative will constitute just another false start in African development.

We have assembled some of the world's leading scholars in development to assess how Africa might con-

solidate its recent economic and techno-scientific gains and harness future global megatrends for its sustained economic growth and techno-scientific progress. They focus on different thematic areas:

On the Emerging Africa Middle Class

Prof. Michael Lofchie of University of California, Los Angeles reminds us that entrenched political oligarchies do not willingly surrender power and privilege out of a benevolent concern for the greater good. "African development challenge is not a scarcity of economic resources; nor is it a scarcity of policy options that will distribute those resources more broadly. Nor is it a lack of administrative capacity to implement alternative policies. It is the reluctance of dominant elites to adopt policies that might require them to share their privileges". The role that the emerging African Middle Class plays will to a large extent, determine the nature of development policies that African countries adopt and the resulting social, economic and political outcomes.

On Trade, China and Skills Development in Africa

Prof. Alan Winters of the University of Sussex examines ways through which Africa might harness international trade for its structural transformation and economic development through a strategy focused on 'mobility'. Dr. Sajitha Bashir of the World Bank examines how Africa might benefit from skills or capacity development from a more coherent strategic engagement with China.

On Biotechnology and Bio-Economies

Prof Torbjörn Fagerström (Sweden), Dr. Roy B. Mugiira (Directorate of Research Management and Development, State Department of Science and Technology, Ministry of Education, Science and Technology, Nairobi, Republic of Kenya) and Prof. Lisa Sennerby Forsse (Swedish University of Agricultural Sciences) argue that biotechnology is a tool that Africa cannot afford to ignore. "Research in life sciences will have equal importance for society in the 21st century as research in physics, chemistry and electronics had in the 20th". Prof. Nwadiuto Esiobu, Professor of Microbiology and Biotechnology, Florida Atlantic University; and former Senior Science Advisor, Secretary's Office of Global Food Security, U.S. Department of State, joins them in making the case for bio-based African economies. Dr. Aime Tsinda, Senior Research Fellow, IPAR-Rwanda reviews policies that promote biodiversity informatics in Sub-Saharan Africa.

On information and Communication Technologies

Dr. Pádraig Carmody, Trinity College Dublin and University of Johannesburg and Prof. James T. Murphy, Clark University, assess the opportunities and challenges posed by the 'African Information Revolution'. They argue that whereas "an ICT enabled "Africa Rising" narrative has dominated much of the media discussion over the last decade, financialisation and informationalisation have not been inevitably or universally positive trends for the region". Prof. Mark Graham and Dr. Chris Foster of the Oxford Internet Institute, Oxford University look at the geographies of Information Inequality In Sub-Saharan Africa. Prof. Laura Mann of the LSE examines the 'Good, the Bad and the Ugly' of Big Data in Africa. She cautions that while the mobile phone will bring revolutionary changes in Africa, "we should not be naïve or complacent about whom is being empowered... behind every new trend in international development, there is a business opportunity". Prof. Mark Graham (Oxford) , Prof. Laura Mann (LSE), Dr. Nicolas Friederici (Oxford) Prof. Timothy Waema (University of Nairobi) critically examine the Business Process Outsourcing Sector in Kenya. Dr. Mrinalini Tankha, IMTFI (Institute For Money Technology And Financial Inclusion), University of California, Irvine, highlights lessons from the Mobile Money Experience In Sub-Saharan Africa. Ken Banks, founder of Founder of kiwanja.net and creator of FrontlineSMS, examines the relationship mobile technology social innovations.

On Rethinking African Agriculture

Prof. Joseph Hanlon, LSE and the Open University; Prof. Jeanette Manjengwa, Deputy Director, Institute for Environmental Studies, University of Zimbabwe; and Prof. Teresa Smart, Institute of Education, University College London argue that commercial family farms are more productive than 'plantation' agriculture in Africa. Dr. Ann Waters-Bayer, Chesha Wettasinha & Laurens van Veldhuizen focus on Farmer Governance of Local Agricultural Research and Innovation in Africa.

On Research and Science and Technology Collaboration

Prof. Johanna Crane, School of Interdisciplinary Arts & Sciences University of Washington – Bothell highlights the challenges of global health partnerships in Africa while Prof. Clare N. Muhoro, Jess and Mildred Fisher School of Science and Mathematics, Towson University, and Science Partnerships Advisor, US Global Development Lab, USAID looks at Science and Technology Partnership options that might be beneficial to Africa. Angela Okune (Ihub), Denisse Albornoz, Becky Hillyer, Nanjira Sambuli (Ihub) and Leslie Chan (University of Toronto) tackle inequities in global scientific power structures. Prof. Sekazi Mtingwa, Emeritus Professor, MIT, makes the case for an 'advanced light source' in Africa.

On Natural Resources, Conflicts and National Security

Langdon Morries (InnovationLabs) looks at the future of fossil fuels, Africa and the global economy. Bat-el Ohayon and Frank Charnas both of AfriQue Consulting Group assess the growing threat of terrorism in Africa. Prof. Jon Unruh, McGill University, revisits the concept of Resource Curse and conflicts in Africa while Prof. Ogaba Oche, Nigerian Institute of International Affairs, looks at the role of traditional institutions in conflict in resolution. Prof. Samwel Makinda of Murdoch University reviews security strategies in select African countries.

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AFRICA'S NEW MIDDLE CLASS

A VEHICLE FOR PROGRESSIVE CHANGE OR MORE OF THE SAME?

Prof. Michael Lofchie,
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History offers sobering lessons for those concerned with the prospects of broad based development in Africa. Entrenched political oligarchies do not willingly surrender their power and privilege out of a benevolent concern for the wellbeing of the many because they fear that, if they do, they might erode the basis of their dominance. Africa's incumbent oligarchies share the political anxiety of oligarchs everywhere; if they widen the circle of citizen engagement and distribute wealth more widely, this would empower those who wish to contest their hold on power. Their determination to retain power helps explain the scarcity of development policies that share the benefits of Africa's growing wealth with poorer Africans. Africa' development challenge is not a scarcity of economic resources; nor is it a scarcity of policy options that will distribute those resources more broadly. Nor is it a lack of administrative capacity to implement alternative policies. It is the reluctance of dominant elites to adopt policies that might require them to share their privileges. Political reforms do not come about because governing elites undergo an intellectual epiphany. They emerge because changing economic realities give rise to new social forces with an interest in different policies and the capability to demand change. History's lesson is clear: the adoption of fairer economic strategies in Africa is unlikely to originate from above; it is more likely to originate from below as emergent social groups acquire the resources to insist upon reforms. The question of overriding importance for Africa is not whether its governing elites can be persuaded to adopt policies that improve the conditions of their fellow citizens. It is whether there are new, countervailing social forces with the ability to wrest reforms from those who hold power.

To address this question, it is critically important to move beyond a prevailing imagery of Africa that portrays African societies in binary terms, as consisting of two social strata, the very rich and the very poor. The point here is not to deny the importance of this cleavage. Few would doubt the reality of Africa's entrenched elites or the yawning chasm between them and the mass of the continent's poorer citizens. The oligarchies that preside over many African countries enjoy a level of wealth unimaginable to previous generations. Their affluent lifestyles compare to those of dominant elite groups almost anywhere; their grasp on political power enables them to increase their wealth in virtually unrestrained fashion. Africa's poor are among the world's most desperate, often living at the barest margin of survival. Their poverty constrains their ability to participate on equal terms in the political realm.

This two-part vision of Africa is no longer adequate. Africa is no longer a continent inhabited only by the very rich and the very poor. The process of economic growth has brought into being a growing middle class consisting

of skilled professionals and independent business entrepreneurs. The foundation study of this middle class is the African Development Bank (AfDB) monograph, The Middle of the Pyramid: Dynamics of the Middle Class in Africa. The AfDB study calls attention to the expanding size of this class, its affluence, and its autonomy from state control. Many of the members of the new middle class enjoy a lifestyle similar to that of middle classes in industrial societies in Western Europe, Asia and North America. Their deepening political involvement in their countries' politics has the potential to transform the continent. It could reinforce democratic trends that are already underway; it could result in economic policies that might improve the lives of the majority population, and it could avert the tendencies toward civil disruption that are inherent in polarized societies.

The Old and the New Visions

The older conception of Africa presents extremes of wealth and poverty as the by-product of the neo-liberal economic policies, sometimes termed structural adjustment, that were put in place during 1980s . There is firm basis for that view. To understand the emergence of the new middle class, however, it may be helpful to entertain a mixed appraisal of the neo-liberal reforms, which have brought both benefits and challenges to African countries. The principal benefit was that structural adjustment brought an end to the roughly twenty-year experiment in state-sponsored industrialization, which had lasted in most cases from the early 1960s to the early 1980s.

Following the advice of such prestigious economists as W. Arthur Lewis, Gunnar Myrdal and others, many African countries had sought to transform the basis of their nations' economies from agriculture to industry. The policy pillars of their industrial strategy were central planning, protectionism and taxpayer-provided subsidies that transferred wealth from agriculture to industry. This experiment, which these economists termed import-substituting industrialization (ISI), was perhaps the most important cause of Africa's economic stagnation during the two decades following independence. The ISI approach failed virtually everywhere, not only in Sub-Saharan Africa but also in Latin America and South Asia. In Africa, it not only failed to bring about industrialization, it resulted in faltering agricultural performance as farmers were called upon to bear an unsupportable burden of taxation to help defray the costs of the new industries.

When the planned industrial experiment ended, Africans with entrepreneurial ambitions, whose skills had been smothered during the era of state-centered economies, were free to play a larger economic role. The businesses they built have provided an important impetus to today's economic recovery and to class formation in the middle of the social pyramid. By almost any standard of measure-

ment, the poor economic performance of the 1960s and 1970s has been replaced, in many countries, by a process of multi-sectorial economic expansion. Currency devaluations accompanied by trade liberalization and the end of costly taxes on agriculture have stimulated a broad-based recovery. This recovery began with traditional agricultural exports but quickly embraced a range of other sectors including non-traditional exports, commercial real estate, retail sales, professional services, and housing. Multi-sectorial growth has helped Africa attain rates of economic growth that are presently higher than those in any other developing region. The dramatic reversal of economic fortune has begun to change the world's image of the African continent, from an impoverished region dependent upon donor nations to a scenario of rising prosperity worthy of large-scale investment.

The relationship between the neo-liberal reforms of the 1980s and the democratic reforms that followed during the 1990s is less clear. Africa's democratic transitions had numerous causes, both internal, such as a rising democratic ethos, and external, such as pressures from international donor agencies. The neo-liberal reforms were one factor among many. The best interpretation is that the transition to market-based economies removed an obstacle to democracy since the effort to build planned economies necessitated the suppression of competitive politics. A centrally planned economy is inherently authoritarian: countries that permit opposition groups to derail critical features of the industrial plan risk its failure. Central planning was inimical to democratic politics because it presupposed the planners' strict blueprint for the allocation of resources must be enforced for the life of the plan. With the adoption of more open economies in the 1980s, this deterrent to democratic politics was set aside. Greater economic openness did not bring about democracy but it removed the idea that democratic opposition could not be allowed to challenge the planners' economic blueprint or the burdensome tax policies it required.

Africa's democratic transition has brought disappointment, however. The arrival of competitive, multi-party systems had encouraged those who hoped this might provide an opportunity for poorer Africans to challenge the oligarchic tendency. That hope has, on the whole, been frustrated. The same neo-liberal policies that helped to nurture democratic competition have also insured its greatest deficiency, the tendency for wealth and power to reinforce one another. Throughout the continent, those at the bottom of the social hierarchy face daunting obstacles in challenging their dominant elites. If global political processes hold out any lesson, it is that those with large financial resources enjoy decisive advantages over those who lack them. The social outcome is unmistakable: Twenty-five years of more open politics, conducted in a policy environment dominated by the neo-liberal ethos, has not brought about a better distribution of wealth.

The economic wealth that flows from a political elite's grasp on political power helps insure the status quo by placing opposition groups at a financial disadvantage. The wealth political leaders accumulate and their ability to deploy it in the political arena insulate them from pressures from below. There is a negative cycle: those who hold political power use it to acquire economic resources; those who have those resources then have an infinite variety of techniques they can use to maintain their status. They can create extensive patron – client networks; they can fund supportive organizations; and they can offer tempting incentives for influential political leaders to join them rather than oppose them. The neo-liberal ethos described in Cosmas Ochieng's essay, "kick back, relax and wait for the invisible hand," serves the economic and political interests of the dominant elite; it discourages the idea that government policies can be employed to make things better.

The New Middle Class

Absent effective challenges to the oligarchic system by the poorer strata, the central question of modern African politics repeats itself: where to look for a social class with the resources and skills to extract reforms from a reluctant elite. The most hopeful answer to this question has to do with the rise of the new middle class and the expectation that it will introduce a new set of interests, aspirations and capabilities to the political process. This viewpoint permeates the important volume edited by Mthuli Ncube and Charles Lufumba, The Emerging Middle Class in Africa.

The essays in this volume demonstrate critical differences between the new middle class and the old. Although the earlier vision of African social structures made provision for the presence of a middle class, its conception was more limited. There were valid reasons for this. During the decades following independence, the African middle class consisted principally of government employees or the employees of parastatal corporations that were an integral part of the governmental apparatus. Africa's older middle class consisted largely of the clerical, technocratic, and supervisory personnel in government offices or those employed in businesses that depended on the government. During the era of state-led industrialization, which lasted in most cases through the mid-1980s, most private firms, such as banks, insurance companies and accounting firms conducted the bulk of their business with government agencies. Even the smaller firms such as those that provided office equipment, information technology, or custodial and catering services, did most of their business with governmental entities such as schools, universities or parastatal bodies. The all-pervasive pattern of dependence upon the government meant that their white-collar employees, even those with advanced university degrees, were limited in their ability to operate as an independent political force.

The middle class documented in Ncube and Lufumba does not suffer those constraints. Its members are the employees and owners of private sector firms that do not derive the majority of their business from government agencies; they are members of skilled occupational groups such as doctors, attorneys and academics that have global professional opportunities and

can exit regimes that seek to constrain their freedom. Many are the employees of multi-national businesses that possess great economic leverage over local governments. For this new class, exit and voice are not opposite choices: members of a middle class who have the option to exit are also freer to speak with a more audible voice; they are freer to pursue political and economic interests that conflict with those of the dominant oligarchy. Many have begun to do so.

attention has focused on its three-tier conception of the middle class with an upper tier of those enjoying consumption levels of between $10 and $20 per day; a middle tier of those enjoying consumption levels of between $4 and $10 per day, and a bottom tier, which the AfDB study terms the "floating class," which consists of individuals with a daily per capita consumption of between $2 and $4. Critics have questioned the idea that members of the floating class, who comprise approximately 20 percent

commercial real estate, infrastructure construction, and retail sales.

The AfDB's depiction of Africa as a place where a new middle class is bringing about fundamental changes in the shape of the social structure has gained the support of several of the world's most prestigious and conservative financial institutions. The McKinsey Global Institute, the research arm of the international consulting firm McKinsey & Company, for example, has also called attention to

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Estimates of the size and dynamics of the middle class are intrinsically subject to definitional difficulties and the AfDB's analysis, which divides the African middle class into three separate tiers, has been controversial. The authors of the AfDB study utilize an absolute definition; middle class persons are those with a daily per capita consumption of $2 to $20 in 2005 purchasing power parity (PPP) USD. By that standard of measurement, Africa's middle class has grown by more than 3 percent per year since 1980. The AfDB study estimates that the new middle class may comprise as much as 35 percent of the total population of Sub-Saharan Africa, nearly 350 million people. The tangible indicators of the growing presence of this class are everywhere to be seen and include such diverse factors as cell phone use, automobile ownership and the rise of private services in areas formerly provided by governments including universities and medical facilities.

It would be a gross understatement to suggest that AfDB's optimistic scenario has gone unchallenged. Much

of the continent's population, should be included at all. The AfDB study acknowledges that members of the floating class are barely above the poverty line and, in the event of economic difficulties such as exogenous shocks, would be vulnerable to slipping back into poverty. If the floating class is removed from the definition, Africa's middle class would comprise only about 13.4 percent of African society, not 34 percent.

The debate about absolute numbers, however, misses the major point, which has to do with the dynamic of socio-economic change in Africa. The basic facts are not in dispute. Since the beginning of this millennium, many African countries have enjoyed favorable conditions for both traditional and non-traditional commodity exports. The earnings from these exports have alleviated the foreign exchange scarcities that were such a conspicuous and damaging feature of the pre-reform economic crisis. This has permitted a surge of imports, making it easier to provide for the import requirements of Africa's high growth sectors, especially housing and

economic growth and social change in Africa, publishing a major study Lions on the Move: The Progress and Potential of African Economies. The McKinsey study also portrayed Africa as the locus of a rapidly expanding consumer population.

In 2008, roughly 85 million African households earned $5,000 or more — the level above which they start spending roughly half their incomes on items other than food. The number of households with discretionary income is projected to rise by 50 percent over the next ten years, reaching 128 million.

The international consulting and accounting firm Deloitte has painted a similar portrait. Between 2000 and 2012, Africa's aggregate household final consumption expenditure grew at an average annual rate of 10.7 percent, rising by more than $850 billion and reaching nearly $1.3 trillion… The emerging middle class is more optimistic, brand conscious and connected. In 2013, there were over 375 million middle class people living in Africa. By 2030, over half a billion Af-

ricans are projected to be middle class.

This pattern of social change will be buoyed by a high rate of economic growth, expected to exceed 7 percent per year over the next decade, about double that of the world's industrial countries. Africa is already a major actor in world markets as a source of raw materials and primary commodities. Its importance as a market for goods and services will grow commensurately. Both Mckinsey and Deloitte describe Africa as one of the world's most attractive regions for foreign investment. As this occurs, it will further reinforce the expansion of the new middle class.

These transformations have changed the visual face Africa presents to the world. The historic poster image of Africa was hungry children in food-deficit countries. The new Africa, sometimes termed "Africa Rising," has generated a different imagery, the resplendent shopping mall, populated with a bewildering variety of high-end stores that cater to an increasingly affluent population. Even the most casual visitor to the YouTube web site can gain a glimpse of this prosperity by viewing the luxury shopping malls that have arisen in practically all of the major cities of Africa. The middle class customers who frequent these malls have important socio-economic characteristics: they are urban and do not generally derive their income from farming or other rural activities; they have high levels of university education, often leading to specialized and valuable skills such as medicine, law, accounting, financial services, information technology, or business management; they have fewer children per family than rural residents or poorer urban families; they hold high salary positions in large business enterprises or they own lucrative businesses of their own. The higher levels of income enjoyed by members of this class make it possible for them to own automobiles and other expensive consumer goods; to live in housing that is spacious, comfortable and well built; to afford high quality privately-provided medical services, and to opt for private education for their children. Africa's new middle class enjoys a lifestyle comparable to that of middle classes anywhere.

The political potential of the new middle class contrasts with the lesser influence of Africa's poorer strata, which have generally been unable to use their numerical strengths to gain policy impacts. Smallholder farmers, for example, are among the most numerous of the poor. However, Africa's farmers have rarely been able to translate their large numbers into corresponding political influence. Poor farmers face collective action difficulties long familiar to African observers; they are spread out over vast distances, making it difficult to meet together; they lack the disposable cash income necessary to help defray the expenses of political organization; and existing farmer organizations, such as producer cooperatives, seem especially prone to principal – agent issues. Sectoral differences have also hampered African farmers from acting together; farmers in the export sector, such as those producing cotton, tobacco, cocoa, coffee or tea, do not share policy preferences with those producing food staples for domestic consumption.

Although Africa's rural and urban poor have a common cause in the remediation of their poverty, protest movements that link the two groups in a united worker-peasant alliance have been the rare exception. The common explanation points to the underlying difference in economic interest between the two. Food-producing smallholders have an interest in higher farm gate prices for their crops whereas the urban poor are concerned about the cost of food items, which consume a major part of the family budget. Perhaps more importantly, the policies that might address rural poverty are different than those that might improve the conditions of the urban poor. These differences have made it difficult for Africa's farmers to enlist support from urban-based political organizations.

Africa's urban poor face challenges of their own in creating broadly based political movements, with the result that the political potential of Africa's working classes remains unfulfilled. There are several explanations. One is that there is not necessarily a crosscutting sense of worker economic interest. Workers in the export sector, such as agricultural workers, railroad workers, mine workers, and dock workers, for

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example, have benefitted more from the new atmosphere of openness to trade than industrial workers, whose conditions may have worsened due to the surge in manufactured imports. Workers in the service sector, such as household workers, custodial employees and workers in catering and laundry services are not well organized. Even where unions have begun to gain traction, worker poverty may necessitate a focus on the material necessities of day-to-day life, such as wages and benefits, rather than such distant and seemingly abstract concerns as the unequal distribution of privilege across society.

The cumulative effect of these factors is unmistakable. In contrast to the political limitations of the rural and urban poor, Africa's middle class has great potential to become an influential political force. The members of this class are aspirational, confident and, perhaps most importantly, well situated to express their economic interests in the political realm. The difference between the middle class and the poor is not one of political consciousness. Members of Africa's poorer strata are deeply aware of the extreme inequalities in their societies. Their difficulty lies in translating that consciousness into effective political action. Nor is the critical difference a lack of common interest. The poorer citizens of African countries have a powerful common interest in policies that will ameliorate poverty. The difference between the two strata lies in their differential capacity to bring about meaningful political change. Members of Africa's rising middle class are not only aware of the wealth and power of the governing elites; they are in a strong position to build political organizations that will challenge the status quo.

The new middle class has many political assets. Middle class Africans can well afford the expenses entailed in building modern political parties, which require offices permanently staffed by professional administrators, not to mention the costly equipment required in the digital age. Since the middle class is overwhelmingly urban and is generally concentrated in only one or two major cities in each country, geographical dispersion is not a constraint on forming organizations. Africa's cities are already densely populated with the numerous civil society associations of business and professional groups. These provide the base of the organizational pyramid on which political movements are constructed. Since members of the middle class generally have high levels of university education, and are for the most part already engaged in the management of large bureaucratic organizations, the constitute a reservoir of the administrative and technical skills necessary to build effective political movements. Members of the middle class are also united in a powerful shared cause; their interest in policies that will protect their share of national from invasive behavior by the very powerful.

Africa's democratic challenge is all-too-clear. It is the same as that in countless countries across the globe. Dominant classes use their power to aggrandize their wealth, and in turn, they use their wealth to aggrandize their power. Lower strata seek to use their numerical strengths to pursue changes in the existing order but are all-too-often in a weak position. Throughout too much of the African continent, the political weaknesses of the poorer strata have made it possible for the gap between the wealth of the wealthiest and the poverty of the poorest to go uncorrected.

There is no mystery about how to reverse this; the first step is to strengthen the democratic process. Africa's new middle class holds out the best prospect of bringing this about. Barrington Moore's famous dictum, "no bourgeois, no democracy," holds as true today as it did when first articulated 50 years ago. The extended version of Moore's argument was more cautious, however. He did not believe that the greater inclusiveness brought about as the rising middle class gained traction in the public realm would necessarily benefit strata in a less advantageous socio-economic position. For Moore, the working class did not enter the political equation at all and, in his various case studies, the eventual fate of politically weak peasants was the outcome of conflict between other, more powerful political actors, the rising bourgeoisie and the landed aristocracy.

This viewpoint has utmost relevance for modern Africa. It remains uncertain whether the middle class' pursuit of greater political and economic influence will generate benefits that extend downward to poorer elements in society. There is no simple answer. In several respects – reinforcement of democratic practices, the struggle against corruption and improvement of property rights, middle class political involvement may provide collateral benefits to the very poor. In the supremely important areas of income distribution and poverty alleviation, it may not.

Democracy is not an either – or proposition. Its meaningfulness can be enhanced or degraded depending upon the conduct of the key actors. For now, the principal class dynamic of Africa is conflict of interests between the ris-

ing middle class and the entrenched oligarchy at the very top of the continent's class structure. Members of the middle class are anxious to stabilize their newfound affluence by breathing greater life into the more open political arenas that were created during the 1990s. Those at the top of the class system are more reluctant partners in a political process that could result in loss of incumbency. They prefer to remain in power. There is nothing unfamiliar about this pattern, which resonates with trends in other world regions. The great uncertainty in modern African politics is whether the middle class' challenge to incumbent elites will result in collateral improvements for those at the very bottom of the class pyramid.

There is a basis for optimism and a basis for pessimism. On the optimistic side, members of the new middle class have a vital stake in building a more level political playing field. To protect their interests as entrepreneurs and professionals, the members of this class require a political environment in which opposition parties can organize openly, recruit members, address their supporters, and contest elections. They have an urgent stake in freedom to access the media and to criticize government officials without harassment or intimidation. If African's new middle class can play an instrumental role in bringing about these improvements, members of all social strata would benefit.

A further basis for optimism lies in the middle class' interest in lowering corruption because corruption transfers wealth from the bottom and middle strata of society to the very top. It makes industrial investment more insecure and expensive, slowing the growth of industries that might generate employment growth for workers. To defray the cost of corruption, investors may be tempted to reduce other costs such as workers' wages and benefits. Corruption also diverts a nation's economic resources away from investments that improve general wellbeing, such as education, infrastructure, and educational institutions, toward private consumption by members of the dominant oligarchy. Business entrepreneurs require an economic playing field that is predictable and transparent and in which the courts enforce contracts in a fair manner. Above all else, Africa's fledgling business entrepreneurs need an environment free from monetary extractions by rent-seeking officials, where they can conduct day-to-day business without the burdensome side payments that are so pervasive in many countries.

Africa's new middle class also has a stake in the creation of a more secure property rights environment. The economic benefits of an improvement in this area have been argued by a host of development theorists; it is a policy area in which the neo-liberal ethos presents convincing arguments. Few investors will risk resources in an economic environment where the normal uncertainties of the business cycle are compounded by the absence of secure property rights. Improvements in this area could trickle down to other classes. Increased investment could result in greater demand for workers and hence in improvements in wages and working conditions. More secure property rights could offer important benefits to farmers; it would encourage those farmers able to do so to invest in their farms and offer better protection against dispossession by the large land concessions that have become a growing source of farmer insecurity in some rural regions.

Inequality and Poverty

On the pessimistic side, there are unanswered questions as to whether the political muscularity of the middle class will help address the continent's persistent problems of socio-economic inequality and absolute poverty. The best evidence on these matters is not encouraging. One of the most detailed studies of income distribution across countries is that by the Cambridge University economist, Jose Gabriel Palma. His article, "Homogeneous Middles vs. Heterogeneous Tails, and the End of the 'Inverted-U': It's All about the Share of the Rich" surveys income distribution for 135 of the word's countries for the twenty-year period 1985 to 2005. This time frame is of utmost relevance to Sub-Saharan Africa because it coincides with the economic transition to neo-liberal policies and the democratic transition to more open regimes.

Palma's findings show that the political involvement of Africa's new middle class has not provided spillover benefits to the poor. In the countries he surveyed, the middle class — defined as the middle five income deciles — has been secured its economic position by capturing about 50 percent of national income. Worldwide, middle classes have been able to resist encroachment on that income share from above and prevent policies that share their income with those below. Owing to their higher levels of education, which makes it possible to attain the better-rewarded positions in the division of labor, as well as their ownership of business firms, the middle tiers in each country have been able to carve out and defend a 50 percent share of national income. What varies across the globe is not the share of national wealth going to the middle; it is the way the very rich and the very poor divide the remaining 50 percent. In Africa, the two sides in that struggle are as unequal politically as they are economically. This manifests itself

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in Palma's data and in other research that supports his conclusions. In the majority of African countries, the wealthiest decile of the population may receive as much as 45 percent of national income, leaving only about 5 percent for the bottom 40 percent of the population. This represents extreme inequality. The Economic Commission for Africa sustains this viewpoint, showing that Africa's track record in reducing inequality is poorer than all the world's regions except Latin America.

Advocates of the neo-liberal ethos sometimes question the importance of these comparisons, arguing that inequality is less important than changes in real material conditions of the poor. In the neo-liberal viewpoint, expanding the size of the economic pie could provide improvements for the poorest stratum, even if its share of national income is not increasing. To address this issue, the survey organization Afrobarometer has created an index of poverty called the Lived Poverty Index (LPI), which is an attempt to assess the conditions of poorer social classes in absolute terms, rather than relative to other social strata. The LPI measures whether an African family may have gone without enough food to eat, without clean water for home use, or without needed medical care during the course of a year.

Afrobarometer has been collecting data on this topic for more than a decade. Its major recent study of lived poverty offers telling evidence that economic growth in Africa has not improved economic conditions for the very poor: "we find little evidence for systematic reduction of lived poverty despite average GDP growth rates of 4.8 percent per year." The Afrobarometer data portray a continent in which the conditions of poverty have not been ameliorated by economic growth. [R]oughly one in five Africans still experiences frequent ('many times' or 'always') deprivation with respect to their most basic needs for food (17%), clean water (21%), and medicines and medical care (20%). Approximately half experience at least occasional shortages."

Afrobarometer's findings have found partial corroboration in World Bank research on global poverty. According to the Bank's PovcalNet research project, Africa's economic growth during the twenty-five year period 1990 – 2015 reduced the percentage of the population living on less than $1.25 per day by about 10 percent, from approximately 57% of the population to 47%. However, owing to population growth, Sub-Saharan Africa is the only world region where the number of people living on $1.25 per day or less increased during this period. Although Africans living in countries where there has been civil conflict are especially vulnerable to lived poverty, some of the worst poverty conditions also appear in countries with a reputation for democratic stability, including Lesotho, Togo, and Tanzania.

Afrobarometer's household surveys suggest that economic conditions for the poorest Africans may be worsening. The majority of the African poor are small farmers who engage in semi-subsistence agricultural activity that combines household production with production for the marketplace. A variety of factors have worsened their situation. One is sheer population growth in the countryside, which decreases the amount of arable land per family and forces families to move to less arable districts. Another is urban expansion, which in some areas gobbles up valuable farmland. The variable with the greatest influence on the conditions of small farmers is weather: when rainfall is adequate, conditions improve. During periods of drought, they suffer. Because of global climate change, drought has become more frequent. Those who still have farms to cultivate are not the worst off. Throughout Africa's rural areas, the poorest stratum consists of a growing population of landless persons who support themselves as migratory workers or as squatter-settlers on farms owned by others. The troublesome feature of rural poverty is that so many of the rural poor seem beyond the reach of the most commonly utilized anti-poverty programs.

In Africa's cities, the poorest stratum consists of unemployed, unskilled, and semi-skilled workers, a heterogeneous grouping that includes household workers, custodial workers in offices and hotels, and workers in food services. Africa's industrial workers also face strong downward pressure.

The willingness of Africa's elites to embrace hybrid policy arrangements may have portentous implications for the democratic process.

The booming commodity exports that have yielded such favorable figures on economic growth have been accompanied by trends toward de-industrialization and worker lay-offs as neo-liberal approaches to trade have resulted in a surge in manufactured imports. The figures on youth unemployment in large African cities are especially troubling: they foretell a generation of Africans whose hopes for the future are especially bleak.

Conclusion: Heterodox Economics

The persistence of absolute poverty in Africa is a painful reminder of basic truths. The encouraging figures on economic growth, which may also show increases in GDP per capita, are not an indicator of better conditions for citizens, nor a proxy for the amelioration of socio-economic inequality. African economic statistics show a glaring inconsistency between macroeconomic data, which show impressive growth, and household surveys, such as those conducted by Afrobarometer, which reveal stagnant or declining incomes among the poorest African families. Only one conclusion is possible: Africa's embrace of neo-liberal policies has not improved the share of national income going to the poor; it has probably made their situation worse. Even assuming that the growth data is real — not a universal assumption — its benefits have been concentrated among the more well to do Africans at the top and middle of the social structure. This explains why the emergence of an affluent middle class is consistent with a trend toward more and more Africans living in deep poverty.

There is no mystery about how to reverse these patterns. The countries with the most equitable income distribution, the Nordic countries, Japan, and Netherlands, have tax systems and welfare programs that redistribute income downward. The implication for the development debate is unmistakable. The most productive conversation is not about the abstract merits of market forces versus state interventions; it is about how to combine market forces with state interventions in hybrid arrangements that promote economic growth while, at the same time, improving the welfare of the poor.

In the search for workable hybrid arrangements, there is no single formula. The precise mix of hybrid policies may vary greatly across countries and, indeed, within a single country over time. Adaptation to local conditions is critical, as is the willingness to be flexible as between market forces and policy interventions. Economists refer to this viewpoint as heterodox economics, to distinguish it from the neo-liberal tradition. For those concerned to promote more equitable development in Africa, hybrid policy arrangements merit the most serious consideration.

The willingness of Africa's elites to embrace hybrid policy arrangements may have portentous implications for the democratic process. Although poor Africans continue to participate actively in their countries' democratic institutions, their faith in democracy could easily diminish if they are unable to use their democratic rights to bring about policies that improve their lives.

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HARNESSING TRADE FOR ACCELERATED DEVELOPMENT IN AFRICA

THINK MOBILITY

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Mobility would seem to be the very essence of trade: if things don't move, there is no trade. This is true, and it informs the parts of this article that talk about efforts to reduce the costs of doing international trade, including trade facilitation and aid for trade. But there are three other aspects of mobility that I want to stress: mobility between sectors – notably structural transformation - and mobility between areas – internal migration and urbanization. Third, I shall argue that mobility lies not only at the heart of generating more output and income, but also at the heart of sharing that income in a more equitable and sustainable ways. In a sense the last is about social mobility and I recognize this as one of the most important elements of achieving a sustainable society; however, as an economist I do not have the skills to move beyond the analysis of incomes, so I will concentrate on that.

Facilitating Trade

Trade matters. This is most true within a country – a village that had to be wholly self-sufficient would be grim, or perhaps impossible, to live in. But in the modern economy, it is also true between countries, especially small ones. Trade allows specialization and the reaping of economies of scale, and it generates competition and, via that and by allowing larger markets, incentivizes innovation. All of these dimensions allow us raise efficiency and live better. Thus reducing the costs of international trade has become a major objective of some governments and most donors over the last couple of decades. Achieving such reductions requires both hard and soft infrastructure as well as effective current operations, and is no easy task. However, there are large reductions to be made and the benefits of making them are large.

The seminal contribution on the effects of transportation costs in the modern world is Limao and Venables (2000) who used the quoted prices for transporting a 40-foot container to capture international transportation costs. They found that 50% of the variation in transportation costs between different routes could be explained by differences in infrastructure (a combination of roads, rail and telephones) and only 10% by distance. Raising the quality of a country's infrastructure from the 75th to the 50th percentile was equivalent to taking approximately 3,500 kilometres off the average sea trip or 400 km off the average land trip that its exports and imports had to face!

More recently, Portugal-Perez and Wilson (2012) have examined bilateral trade between a large number of partners and find that infrastructure quality is a key constraint on developing countries' exports, along with 'soft' infrastructure (essentially trade regulations). They use this observation to argue passionately for trade facilitation – which potentially addresses both aspects - as a policy priority for development. Vijil and Wagner (2012) carry this line of reasoning one step further and show that infrastructure constrains developing country exports and that aid for trade devoted to infrastructure has a material effect on the latter's quality. From this they argue that a 10 percent increase in aid for trade flows to a developing country could raise the recipient's (export/GDP) ratio by 2.3 percent, which they calculate is equivalent to a cut of approximately 2.7 percentage points in the tariff and non-tariff barriers that those export face.

It is obvious from this glance at the research literature that trade facilitation and aid for trade could make a great contribution towards higher incomes in Africa. I would, however, offer three cautions. First, aid has to be well spent – both technically and in terms of carefully identifying priority projects – either hard or soft. The latter requires a close engagement with the private sector – they are the people who trade – coupled with rigorous attention to ensure that they do not capture the process merely for private gain. Second, investing in infrastructure reduces the costs of trade but to translate that into reductions in the prices of traded goods and services one needs competition. Teravaninthorn, and Raballand (2009) looked at the likely returns to investment in each of five road corridors in Africa and found that they vary significantly with the institutional situation. In particular, they found that in west and central Africa transportation costs could be significantly reduced by reducing fuel costs, improving road quality and reducing border-crossing-times. However, they argue that the trucking sectors are so cartelised and heavily regulated in these regions that any cost savings so produced will just go into truckers' pockets rather than stimulate trade and enterprise. The moral is that until regulation ensures sufficient competition to ensure that cost savings are passed on, road and border-crossing improvement schemes will tend to be unequalising because they will increase rents. These results refer to the mid-2000s and things are changing fast in Africa, but the moral is general: fixing the kit is one thing, fixing the problem is another and it takes careful analysis to identify exactly what is going wrong.
The third caution is that trade costs also include policy barriers to trade. For sure in most cases the burden that transportation costs impose on imports is greater than the burden imposed by tariffs. However, the critical difference is that transport costs cannot be reduced to zero (ever!) and in fact can usually be reduced only at considerable expense, while tariffs can be reduced to zero at the stroke of a pen: I may have to pay hundreds of dollars to have a critical input delivered to my factory, but that is not as reason to increase its costs even further by taxing it. While we work hard on trade facilitation, let's not forget the (technically) easy and cheap stuff – trade policy.

Structural Transformation

For two hundred years or more economists have understood that opening up to international trade allows specialisation – concentrating on producing what you produce best, selling some (lots) of that to other countries and buying the rest of what you need on the world market. The key insight is that an economy that does not trade is obliged to produce all that it con-

sumes and consume all that it produces. International trade breaks that tyranny and allows producers to break free of the shackles of the domestic market and so to produce far greater quantities of certain goods (the ones the economy is good at) than consumers could possibly absorb. But taking advantage of trade in this way is not necessarily a painless process: it starts by cutting back on some activities in order to concentrate on others; in other words, on inter-sectoral mobility. Anything that hinders this process is likely to delay or even prevent the gains from trade emerging. Some hindrances are natural, like geographical barriers, but many are man-made in terms of regulations and restrictions. While the issue is far from closed among academic economists, there is certainly some evidence that countries that have restrictive labour market regulations, restrictions on firm entry and exit or serious capital market failures benefit less from international trade than more liberal societies – for example, Chang, Kaltani and Loyoaza (2009).

Economic development is similarly seen as hinging around the idea of switching sectors, at least since Nobel Laureate Arthur Lewis's classic work in 1954. Lewis characterised development as the reallocation of factors of production and employment from low productivity "traditional" sectors, such as agriculture, to high productivity "modern" sectors, such as manufacturing. This increases average productivity and hence average incomes. These two processes go together – no country has developed in the modern era without engaging increasingly and eventually heavily in international trade. However, there is a potential disconnect in the medium term: what if international trade encourages countries to specialise in primary products, so that factors of production move towards lower productivity sectors (e.g. agriculture) or sectors in which there are very few jobs (minerals)? While this may generate high income growth while primary prices are high, and indeed can provide a basis for long-run progress (think of the USA, which counts as a primaries exporter on most measures), it is not sufficient for development. For development, one looks also to see movement towards 'modern' sectors, not only manufacturing, but also in terms of services.

The arguments about the need for structural change provide the rationale for the Aid for Trade initiative which was launched at the Hong Kong Ministerial Conference in December 2005. Although its origins owed at least as much to the desire to keep developing countries inside the tent of the Doha Development Agenda as to long-run economic reasoning, it was aimed at addressing whatever governments thought might be preventing developing countries from developing their exports and particularly their export bundles (the goods and services which they actually able to export). This was an obvious first step towards inducing positive structural change.

Last year the Commonwealth Secretariat asked Xavi Cirera and me whether Aid for Trade (AfT) had actually stimulated structural change in Africa – Cirera and Winters (2014). Looking across Sub-Saharan African countries since 1995, we first sought to relate AfT to the costs of conducting international trade and to trade performance and then we looked for traces of the effects of AfT on the structure of the African economies. With the minor exception that maybe

The key insight is that an economy that does not trade is obliged to produce all that it consumes and consume all that it produces.

policy-related AfT reduces the clearance times of goods in customs, we found no relationship between AfT and exports or economic structure at all. One should not necessarily conclude from this that AfT is a waste, however. First, our analysis faced formidable data problems which could easily have clouded the results. For example, it is the donors who label an aid flow 'Aid for Trade', rather than the recipients who could do so in the light of what the money is actually spent on. Second, given the huge differences across countries and the array of forces that influence economic structure (including the primaries price boom), our tests based on relatively small amounts of relatively poor data may just be too weak to find an effect. On the other hand, our results do suggest that recipients should make greater efforts to make sure that AfT is well directed and well spent and then well evaluated. And the argument of this article is that this ought to include thinking seriously about what it is that allows people and resources to move between sectors.

The Mobility of People

Arthur Lewis's model of development depends on moving people between sectors, but this also depends to a large extent on moving them between places. If we consider Britain's economic history as the first industrial nation, rural-urban migration lay at the very heart of the industrialisation process. It contributed an increase of about 1 percent per annum to the urban population every year over a century from around 1776, and reduced the rural population by about 0.8 percent per annum in 1776 rising to about 2 percent in 1866 partly because the numbers of migrants increased but mainly because the rural population actually fell – Williamson (1990). Likewise, the remarkable growth of China has been accompanied by a dramatic increase in urbanisation, and now over half of China's population lives in urban areas.

The role of cities in development is not a surprise. Even a little reflection suggests that the provision of many of the services that characterise development such as health, education and law enforcement are much easier to provide and likely to be of higher quality where population density is higher. Moreover, there are very strong reasons why production is more efficient there too – cities allow for deeper and more frequent interaction, better coordination, a quick spread of ideas and large local markets to encourage economies of scale. Bettancourt and West (2011) summarise the evidence drawing on both developed and developing country experience to suggest that a doubling of city size is associated with an average increase of around 15 percent in measures such as wages and patents produced per capita. Their data also reveal that as city-size doubles, 'its material infrastructure -- anything from the number of gas stations to the total length of its pipes, roads or electrical wires -- does not'. And even better, perhaps, cities in developed countries are greener than other areas because people living closer together require less energy to get about. Of course, cities can be unpleasant – lawless, dirty, crowded – but this is not inevitable if they are suitably planned and governed.

Africa has low population densities on average, which makes industrialization an uphill struggle, and most countries have low rates of urbanization, which suggests that they are not doing the best they can to overcome this. Moreover, in many African countries the prevailing attitude is that rural-urban migration is a problem which needs to be minimized. For sure, the difficulties of managing large inflows of migrants are challenging and there may sometimes be a case for temporarily slowing the flow; however, over the medium run deciding to facilitate and then manage this form of mobility can only be beneficial.

In the University of Sussex we have a Research Consortium (Migrating Out of Poverty Research Program Consortium, http://migratingoutofpoverty.dfid.gov.uk/index) that studies internal (as opposed to international) migration. Work in several African countries has revealed that even if migration to the town or city is uncomfortable and often dangerous for the poor and less skilled (especially for women), a large majority of the people we have interviewed see it

as a way of improving their economic fortunes. Plenty also see it as a way of improving their lives in other, social dimensions, and, again, especially young women who see migration as a route to greater independence than traditional rural societies provide.

Mobility and Sharing the Gains from Trade

My final paean to mobility is to observe that mobility is key to sharing the gains from trade – or, indeed, the pain and thereby mitigating it. If a sector receives a boost in demand from a trade reform, the demand for labour will go up. If the labour force cannot be expanded, the existing workers will experience a strong rise in wages but nobody else will see any benefit: you get a narrow but large impact on welfare. If, on the other hand, the sector can bid workers away from other sectors, more people will benefit but wages will increase by less; the effect will be broader but smaller – i.e. less unequal. Similarly – and this is important – when a sector suffers from a trade reform because import competition causes it to decline, if the workers have no alternative employment they will probably suffer a large wage decline, whereas if there are other sectors they can go to, the wage decline will be mitigated.

International trade typically raises living standards by reducing the prices of the goods that people consume and by stimulating economic growth overall, but nonetheless there are bound to be sectors that have to contract. Hence the fact that mobility reduces the hit on workers in such sectors, is important both in reducing the burden of adjustment (because both theory and experience suggests that halving the size of a shock more than halves the welfare costs of bearing it) and in increasing the likelihood that the net effect of the negative specific shock plus the positive general benefit is positive.

I have spent some time studying the effects of international trade on extreme poverty in developing countries, and have concluded that mobility is a key consideration not only in reaping aggregate benefits from trade reform but in achieving a moderately equitable – and hence politically more sustainable – distribution of those gains. A survey of the recent literature – Winters and Martuscelli (2014) – uncovered several instances in which mobility played a key role in spreading (or otherwise) the benefits of trade reform. For example, in Vietnam (as in most places) unskilled workers are less mobile that skilled ones and so the export benefits that Vietnam reaped from its 2001 trade agreement with the USA, which greatly improved access to the US market, were geographically more concentrated for unskilled than for skilled workers. In Indonesia, workers are not very mobile across firms and so trade liberalisation strongly benefits people in export industries and does little for those in import-competing firms. Similarly, the evidence shows that the impact of India's trade liberalisation in 1991 was most pronounced among the least geographically mobile sections of the population - those at the bottom of the income distribution - and in Indian states where inflexible labour laws impeded the reallocation of factors of production across sectors.

Conclusion

Mobility is by definition the sine qua non of international trade – you have to move goods or services across borders before you see any international trade. Policies that increase such mobility by reducing its costs have a strong effect on trade and, through this, welfare. But mobility is also key within the trading country: the main gains from trade arise from changing your production bundle – you have to be able increase activity in certain sectors and reduce it in others. If this is thwarted, you do not get great gains and may even record losses from a trade liberalisation. But moving sectors often entails moving places, and if such movement results in agglomeration into large groups – cities or large towns – you get not only gains from trade but also gains to productive efficiency, innovation and the effectiveness of services. Moving places means migration and it is important that African governments start to see internal migration in a more favourable light. Finally, mobility helps to share the benefits of trade (and other economic activity) more equitably and so both fosters development and increases its sustainability.

Thus, as the title of this article says: if you are thinking about trade, think also about mobility.

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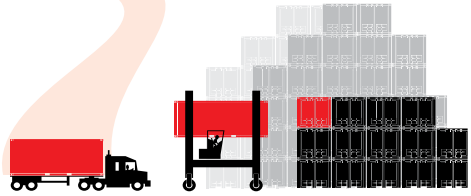

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CHINA'S CONTRIBUTION TO SKILLS DEVELOPMENT IN SUB-SAHARAN AFRICA

Dr. Sajitha Bashir, World Bank

The scale of China's engagement in Sub-Saharan Africa is impressive and is expected to grow substantially if future projections of Chinese investments materialize. By 2013, China accounted for a quarter of all SSA trade. Estimates of the stock of Foreign Direct Investment (FDI) vary from the official estimate of $ 24 billion to $ 61 billion. (The China Global Investment Tracker estimated the stock of FDI to be $ 61 billion in 2013 and the value of Chinese contracts, a proxy for committed investment flows, to be US$82 billion in the same year - Pigato and Tang, 2015).

Introduction

During his visit to Africa in 2014, Premier Li Keqiang predicted that trade volume with Africa would double by 2020 to US $400 billion. Further, Chinese foreign direct investment (FDI) is expected to increase to US$ 100 billion in the same time period. Not only are the levels of investment rising but they are also becoming more diversified and expanding in manufacturing and services, compared to the past when investments focused primarily on infrastructure and energy. Although the recent slowdown in the Chinese economy has repercussions on the demand for commodities and hence for growth in resource dependent SSA economies, the re-balancing of the Chinese economy towards greater domestic demand and rising wages in China offers new opportunities for exports of labor-intensive manufactures. The December 2015 Forum on China-Africa Cooperation (FOCAC) Summit, held in Johannesburg, provided further impetus to these trends, given the new pledges of financing made by China.

Despite China's growing role as a trade and development partner for Africa, little is known about China's current contribution to skills development in SSA countries, whether through the private sector or through the government. In a situation where most traditional bilateral partners focus on aid for basic education in SSA countries, the role of new Partners, including from the South, can be both impactful and catalytic, especially in building up critical higher level technical/scientific skills.

China's investments and growth in foreign trade could contribute significantly to economic diversification in SSA countries, and the creation of better quality jobs in the non-agricultural sectors that could absorb the growing numbers of young people who enter the labor market every year. Many SSA countries are looking to emulate the experience of China and other East Asian countries, which used FDI and integration into regional production networks to embark on a process of sustained structural transformation. The emergence of 'export capable' domestic firms, as key feature of this process was strongly driven by FDI in the initial stages (Yusuf, 2014). However, broad-based economic transformation required other key policy ingredients, including the creation of the appropriate business environment and investment in infrastructure, as well as, quite critically, investment in skills of the labor force.

In East Asian countries, government policy often included provisions for employment and training of local workers as well as encouraging foreign firms to invest in broader training efforts that benefit an industrial sector as a whole, rather than just the individual firm. This reinforced the direct effects of FDI in raising the skill level of the labor force, as foreign firms tend to invest more in training of their own workers and of their suppliers, and these trained and more productive workers start getting employed in domestic firms.

Hence, a central factor in ensuring that China's investments deliver on economic and social returns for both China and Africa depends on complementary investments in the skills of the local labor force. Given the scale of China's investments in African economies, both the direct investment by Chinese firms in skills development as well as Chinese government support for skills development are important. The creation of an appropriate policy framework in SSA countries to leverage increasing Chinese FDI to invest in training of young workers will also be critical.

The Partnership for Skills in Applied Sciences, Engineering and Technology (PASET), a regional initiative launched by several African countries and the World Bank which focuses specifically on building the skilled labor force in sub-Saharan African countries (from technical, vocational to higher education and research), provides a platform to align the investments and efforts of different partners, including with new Partners. Under the PASET framework, Chinese academic institutions have participated in various regional Forums, in analytical work and in sharing the experiences of China in the development of capacity in vocational training and science and technology. This article synthesizes the current role of China in skills development in sub-Saharan Africa, drawing on many of these studies.

Chinese Firms in SSA countries

At present, Chinese firms, like many foreign firms operating in sub-Saharan African (SSA) countries encounter serious skills constraints. Such skills shortages are encountered even in low skilled jobs, where many workers lack basic competencies such as literacy, numeracy and non-cognitive skills required for the work place such as punctuality and discipline. This arises from the low level of education attainment of the domestic labor force and the low quality of basic education. Skills shortages are even more severe at the level of technicians and higher level skills of professionals such as engineers, scientists, accountants, and others.

In the short term, and especially in order to deliver large scale infrastructure projects on time, Chinese firms have often resorted to importing skilled labor, in addition to qualified professionals such as engineers and architects. This reliance on Chinese skilled workers is a distinctive feature of Chinese investment in Africa and has social ramifications for host countries. Chinese firms have sometimes also taken African workers to China for training, but this is not a viable long term strategy, because of the associated high labor costs.

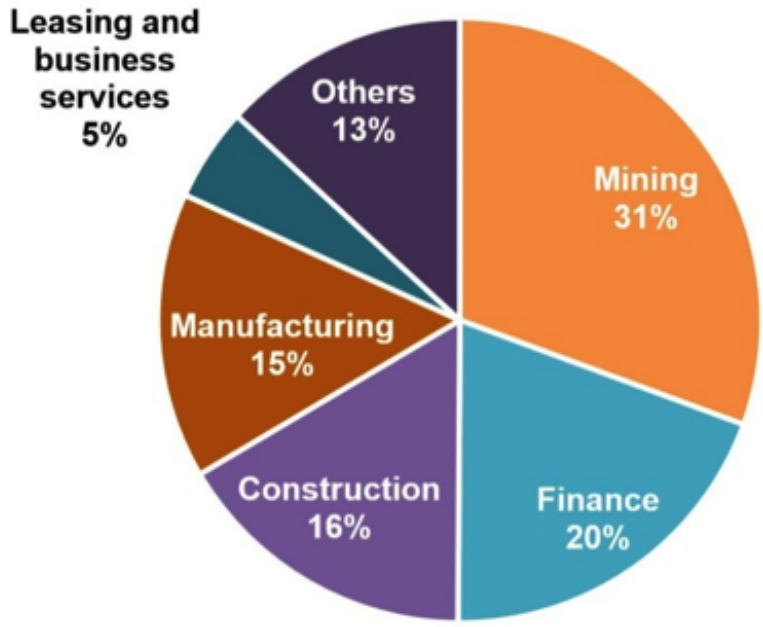
Chinese FDI flows into Sub Saharan African countries are channeled through four main types of firms (Kaplinsky and Morris, 2009). The differences between these firms, which is an essential feature of Chinese FDI, also has implications for what the Chinese

government can do to encourage Chinese firms to invest in skills development. The four broad categories are (i) Central government State Owned Enterprises (SOEs); (ii) Provincial government SOEs; (iii) private owned enterprises, incorporated in China and Sub Saharan African countries; and (iv) small firms, incorporated in Sub Saharan African countries, often started by Chinese individuals living in the countries. Investment by the latter is probably not captured at all in official FDI statistics.

This proliferation of investor types also accounts for the broad sectorial distribution and segmentation of Chinese FDI and its distinctive impact on local economies. The large SOEs invest primarily in natural resources, infrastructure and construction, receiving financing from China Development Bank, China's EXIM Bank and other Chinese banks, and often supported by government to government agreements. The private owned enterprises are largely self-financed and invest in manufacturing and services (such as telecommunications). The share of private firms in Chinese FDI in Africa has increased from negligible amounts in the early 2000s to about 45 percent. The fourth category consists of very small Chinese investors who operate in small scale manufacturing and retail trade, who are likely to have come to Africa to work on FDI projects.

The total number of Chinese firms operating in Sub Saharan African countries is not accurately known but is estimated to be about 2,200 (UNCTAD, 2014). These firms operate in a range of sectors, as mentioned above. Figure 1 provides an estimate.

Figure 1: China's FDI stock in Africa by end of 2011



Source:
http://www.wri.org/blog/2014/05/where-are-chinese-investments-africa-headed.

Very little is known about the employment impact of Chinese FDI or the employment profile of Chinese firms operating in Sub Saharan African countries. A recent review, based on the estimate of jobs created by greenfield projects, suggests that the employment impact is larger for manufacturing and construction, as might be expected, and for government-led projects compared to private projects, largely due to the size of the former (Pigato and Tang, 2015). There is even less data about the ratio of Chinese to domestic workers in these firms. One estimate indicates that in 2013, approximately 215,000 Chinese workers came to Africa to work, which was 18 percent higher than in 2011.An early study on China's role in infrastructure development in Africa, which drew on field work with construction companies in Angola, Sierra Leone, Tanzania, Zambia and China, noted that: "Labour has been an extremely contentious issue in all the countries surveyed" (Corkin et al, 2008). The study found that the general perception that Chinese firms bring in their own labor instead of using local labor is not necessarily true. However, local workers tended to be "predominantly employed as unskilled, casual workers".

Ethiopia: How Chinese Firms Meet Labor and Skills needs

A recent World Bank study of labor and skills issues in Chinese firms in Ethiopia sheds some light on the impact of Chinese firms on job creation and skills development. Ethiopia has been very proactive in attracting Chinese investors to promote labor-intensive industries as a part of a strategy to diversify its economy. Together with heavy investments in infrastructure, the government has also sought to leverage its inexpensive labor force to attract FDI, especially from China, into manufacturing and other sectors. While the overall educational attainment of the labor force is low, due to the low base from which Ethiopia started, the country has made targeted investments in technical/ vocation-

al education and training, as well as in higher education, with a special focus on science and technology.

The study draws on a survey of the universe of Chinese firms known to the Chinese Embassy to be in operation in Ethiopia in 2012 and compares this to a sub-sample of domestic firms in the World Bank Enterprise survey for 2011 to highlight differences between Chinese and domestic firms. Despite the fact that Chinese FDI has likely changed in its volume and possibly in its composition since 2011, this study still provides some important insights.

The Chinese firms in the sample were overwhelmingly privately owned (the third category of the four categories described earlier) with only 14 percent being government-owned. Government owned firms operated in construction and transportation sectors. The privately owned firms were in manufacturing as well as services. There were relatively few joint ventures with Ethiopians.

This relatively small number of Chinese firms are, however, significant employers in Ethiopia. Chinese firms accounted for 18,368 full-time (FT) jobs equivalent to 6.5 percent of the total FT permanent jobs (282,306) in the formal non-agricultural sector in Ethiopia. Of these full-time jobs, 86 percent are held by Ethiopians as are 99 percent of the temporary jobs created in these firms. Median wages in Chinese firms (US$ 2296) are higher than in domestic firms (US$1380).

Despite this significant creation of better quality jobs, relatively few of the skilled and professional positions are held by Ethiopians. Table 1 presents the occupational and skill profile of Chinese firms that responded to these questions. 93 percent of all professional positions and 67 percent of skilled production workers in these firms are Chinese. Among all Chinese employees, 46 percent are professional workers while 20 percent are skilled production workers.

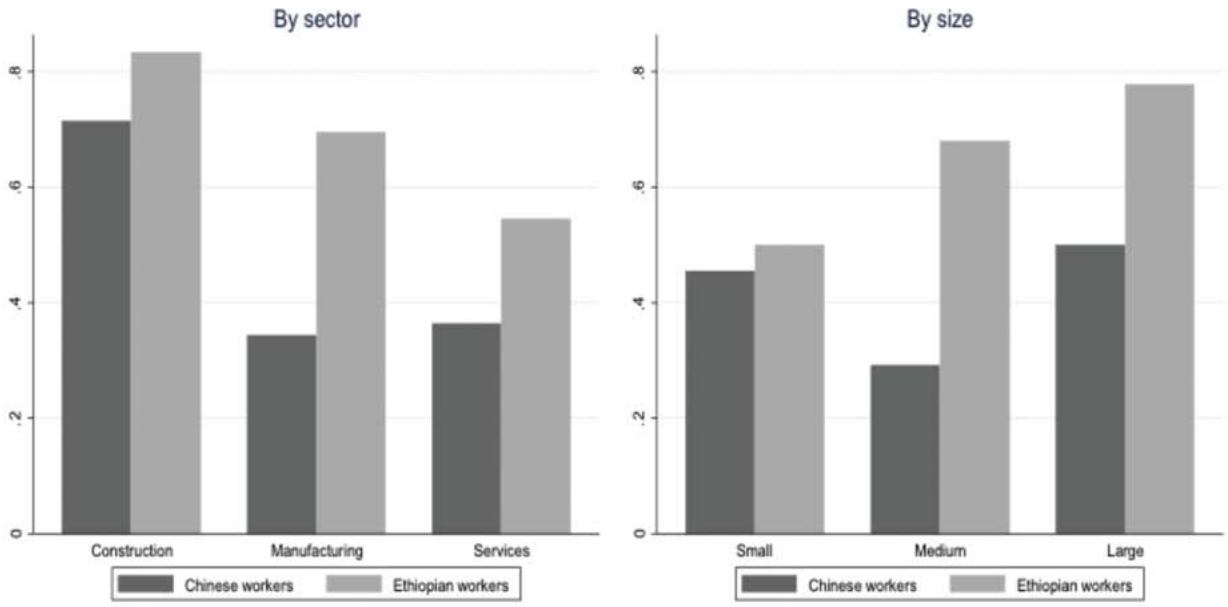
Table 1: Occupation and Skill Profile in Chinese Firms in Ethiopia.

Variable	Obs	Mean	Sd	Min	Max
Percentage professional employees	30	44.0	26.7	4.3	100
Percentage skilled production workers	31	23.1	27.1	0.0	100
Percentage of professionals among Chinese employees	59	46.2	28.8	0.0	100
Percentage of skilled production workers among Chinese employees	58	19.7	27.2	0.0	100
Percentage professionals staffed by Chinese employees	30	92.9	17.4	40.0	100
Percentage skilled production workers staffed by Chinese employees	18	66.9	48.2	0.0	100

This may indicate the preference of Chinese firms for home workers, but another explanation is that there is an insufficient supply of skilled Ethiopian workers for the types of jobs that are required. There are some indications that Chinese firms experience such shortages. More than 50 percent of Chinese firms indicated that an inadequately educated workforce is a major or severe constraint to their operations. Only 4 percent of domestic firms indicated that this was a serious constraint. This perception is stronger among Chinese firms in the manufacturing and construction sectors. This may indicate the fact that Chinese firms operate in different markets and operate on a large scale, and hence demand a different type and quality of skills. Overall, as stated earlier, the Ethiopian government's investments in basic education, TVET and higher education is sufficient for the domestic sector, given Ethiopia's relatively small manufacturing basis. However, these investments may not be providing the kind of quality that is required for foreign firms that are competing globally.

What is equally interesting is that even those Chinese firms that have operated in Ethiopia for a long time—and for whom, hence information about securing better quality workers is presumably not a problem—indicate that the quality of skills is a constraint. A significantly greater proportion of Chinese firms (75 percent) invest in training of workers compared to domestic firms (27 percent) (see Figure 2). Furthermore, a greater percentage of Ethiopian workers (69 percent) benefit from training, compared to Chinese workers (40 percent). Larger firms tend to offer more training, and training is also positively correlated with several measures of education—both findings are consistent with findings from the broader literature, sug-

Figure 2: Incidence of training by worker nationality in Chinese FDI firms (sector and size)



gesting that Chinese firms operate according to similar parameters.

The study's findings, although based on a small sample, throw some light on commonly held perceptions about the operations of Chinese firms. In Ethiopia, indeed, there has been a high level of dependence by Chinese firms on skilled Chinese labor, whether due to preference or lack of local supply. This can limit the "spillover" benefits from Chinese FDI to domestic industry. On the other hand, the significant employment creation effects as well as firm level investment in training contradict general perceptions about low domestic impact.

Firm-based training is useful for firm-specific skills, but if Chinese firms are also investing in training of local workers in generic skills or broader occupational skills, there is an argument for policy intervention to encourage more of such training. Further, transferring the training in such skills to local institutions (rather than taking workers to China) could both lower the costs of training to firms and help local training institutions upgrade and adjust their training programs to meet employer needs. Such interventions could benefit a broader group of firms in the sector, both foreign and domestic, and thus contribute to improving productivity across the board.

China's Contribution to Skill Development in Africa

China's involvement in providing assistance to education, training, and research, particularly in science and technology, in Sub Saharan African countries has long historical roots. Traditionally, it has been provided by the Chinese government through bilateral agreements. Since 2000, this assistance has been undertaken within the framework of the Forum on China-Africa Cooperation (FOCAC). As stated earlier, a new set of actors comprises the Chinese SOEs and private firms who are investing in the continent. Figure 3 provides a schematic overview of the channels for assistance/investment in education and training.

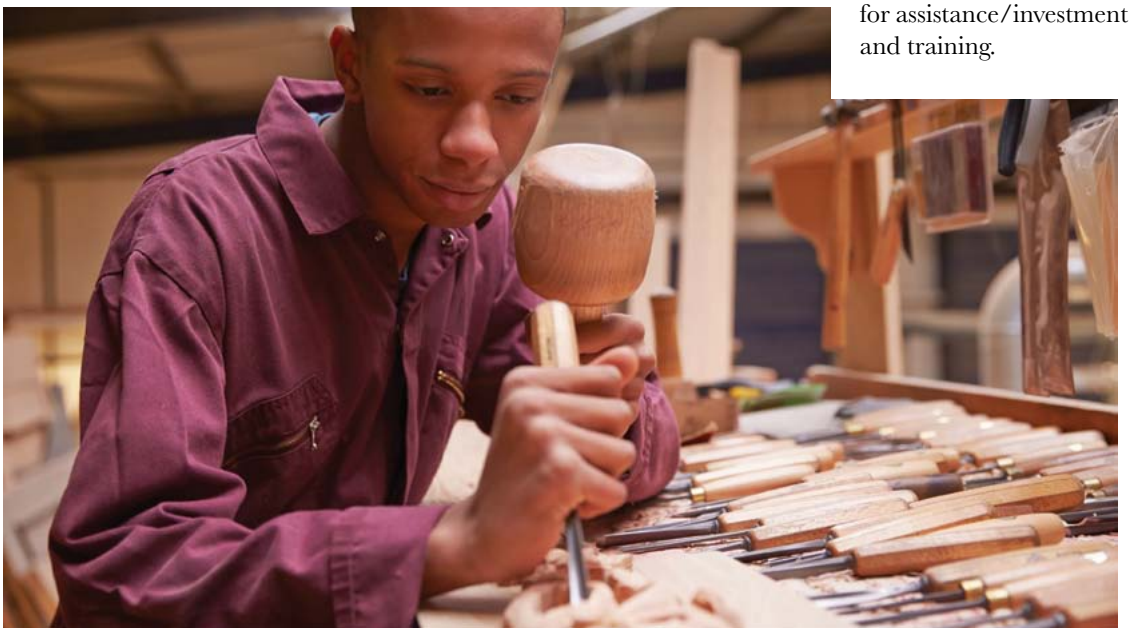
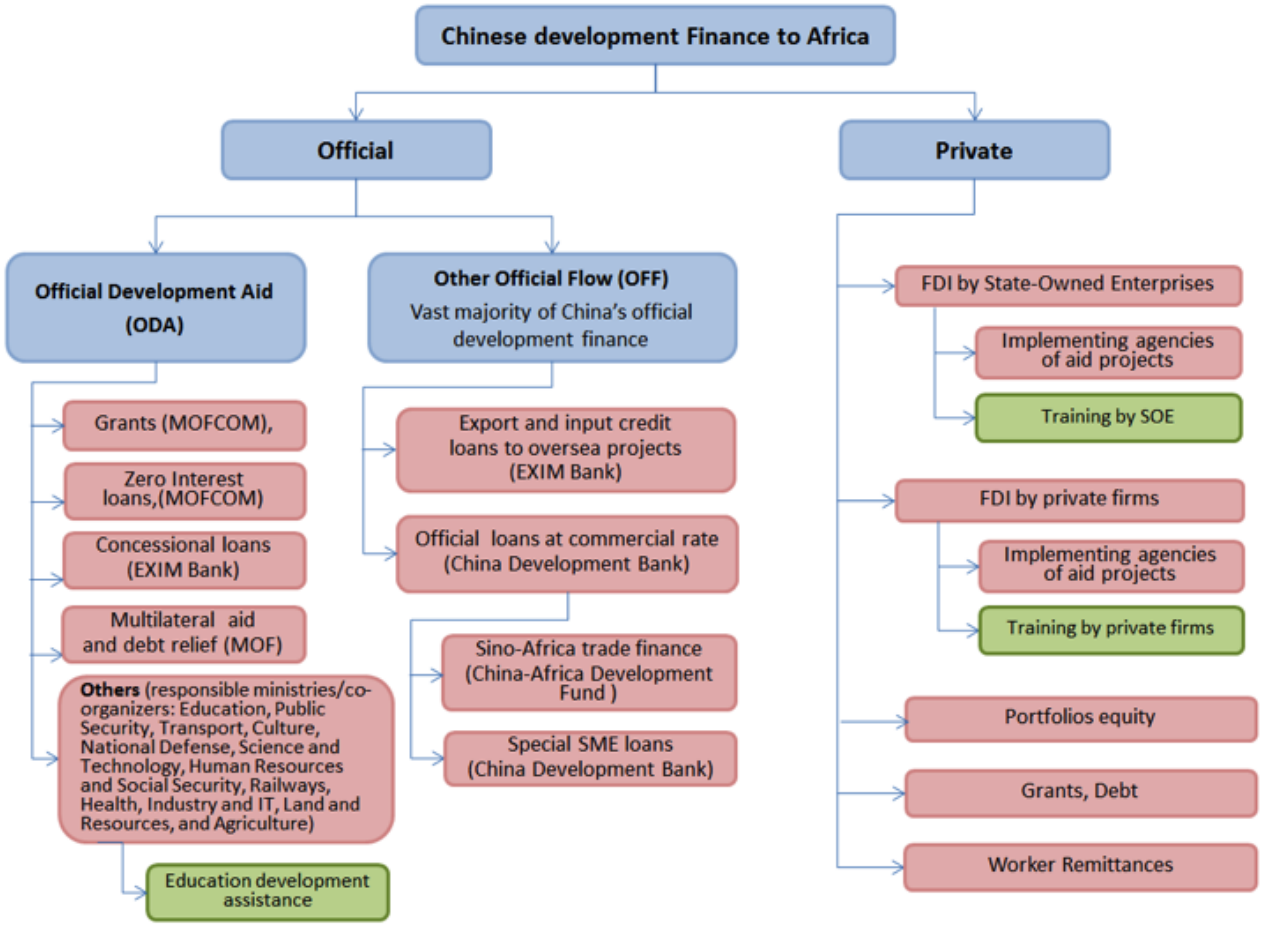


Figure 3: China – Assistance for Education and Technical/Vocational Training



Note: *Author's representation based on China's Foreign Aid White Paper, various years; Brautigam (2011); King (2011); websites of various Chinese Ministries and agencies.*

Chinese Government Assistance for Education and Training

Focusing on the government's direct aid (ODA), education and training, broadly defined, is estimated to have received between US$ 432-850 million in the period 2010-2012, based on the latest White Paper on China's foreign assistance (State Council of China, 2013). There is no separate demarcation for education sector, which is included under the ambit of Human Resource Development (HRD). The figure of US$ 432 million relates directly to the human development cooperation element of the foreign aid appropriation for 2010-12 and represents about 5.6 percent of total official foreign during this period. In addition to this, a significant amount of training is provided under the programs for agriculture and industry (for instance, programs under agriculture support technical/vocational centers and agriculture technology centers). The larger figure of US$ 850 million includes aid given for agriculture and industry.

The contribution to education and training is therefore not insignificant. A striking feature of the various aid programs in education and training which have burgeoned since the launch of FOCAC, is the increase in the number of Ministries that are involved. The main ministry coordinating foreign assistance is the Ministry of Commerce; however, sectorial Ministries are involved in designing implementing the specific programs. A rising trend of cooperation in education and training by the Chinese government can be seen since the launch of Forum on China-Africa Cooperation (FOCAC) in 2002, which is the main institutional mechanism for determining aid to African countries. This is in addition to bilateral agreements between China and various African countries.

Five key modalities are used by the Chinese Government:

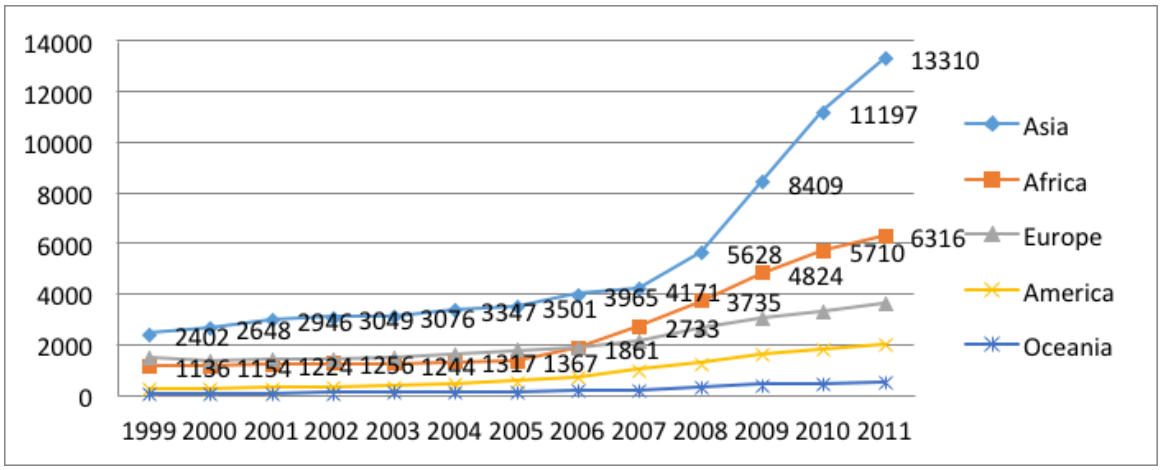
- Chinese governmental scholarships for Sub Saharan African students and providing places in Chinese universities for self-financed students from African countries;
- Providing training for Sub Saharan African officials and professionals technicians in a range of fields;
- Sending professional experts to Sub Saharan African countries to undertake specialized training;
- Building education infrastructure and providing equipment;
- Partnership programs implemented by various governmental ministries such as the Ministry of Education, Ministry of Science and Technology, Ministry of Foreign Affairs etc.

Scholarships:

The number of scholarships has grown rapidly since 2006, especially for Africa. (Figure 4). The annual increase in scholarships has averaged 835 and in 2011, a total of 6316 scholarships were given to Africans. About 40 percent of these scholarships are in the applied sciences, engineering or technology fields, reflecting the demands from the African countries to build up skills in this areas. The remaining scholarships continue to be in humanities, social studies and Chinese language. In addition to the Central government, provincial governments and some enterprises also provide scholarships but the numbers are not available.

Equally striking is the rapid growth in self-financing students, which increased from almost zero in 1989 to over 26,000 in 2013. Cumulatively, close to 95,000 African students have studied in China in this period, constituting 78 percent of all students.

Figure 4: Chinese Government Scholarships for International Students, by Region (1999-2011)



Professional training:

This segment has also seen a significant rise, with 27,000 people (mainly administrators and others) being trained in China through short-term courses. The training covers economics, foreign affairs, energy, industry, agricultures, forestry, animal husbandry and fishing, medicine and health care, inspection and quarantine, climate change, security and other subject areas. However, the majority of training is for African government officials; only about 20 percent of trainees are technicians or professionals.

Professional experts:

China has also dispatched professional experts to African countries, especially in the areas of agriculture, vocational and technical education, and health. A particular striking case is the close cooperation with Ethiopia in technical and vocational education. Over 400 teachers were sent to Ethiopia to train local teachers working in agricultural, vocational and technical education during 2010 to 2012. Further, China has established the Ethiopia-China Polytechnic College at a cost of $14 million to train TVET students, which has since 2011 become an institute to train TVET teachers. Tianjin University of Technology and Education is the partner Chinese institution.

Education infrastructure and equipment:

Chinese investment in building schools, technical institutes and universities has also been undertaken. While the number of primary and secondary schools is relatively small (about 150 during 2010-2013), there have been significant investments at the post-secondary level. The details of total funding and distribution of this aid, which is mostly concentrated on infrastructure and equipment, is not available. Examples of new universities are those which are being built in Senegal and Malawi. In Malawi, the Export-Import (EXIM) Bank of China provided a loan of $70 million in 2010 to establish the Malawi University of Science and Technology. Several countries have obtained aid for scientific and technical equipment in universities and research institutes as well as building of technical/vocational centers.

New partnership programs:

The most significant partnership programs for education and training are those related to higher education under the Ministry of Education (the 20+20 university partnership program), the China-Africa Science and Technology Partnership Plan (CASTEP) under the Ministry of Science and Technology (which promotes joint research), the Agricultural Technology Demonstration Centers under the Ministry of Agriculture and the China-Africa Joint Research and Exchange Program under the Ministry of Foreign Affairs .

China Development Bank's Assistance for Skills Development in Africa

In addition to assistance provided by the Chinese government, China Development Bank (CDB), which is China's leading cross-border financier, has invested mainly in short-term

training through different modalities. These included (i) CDB Training sessions for management-level staff from various government departments, financial institutions, and corporate partners in Africa. (ii) Joint Training Sessions covering China's experience with economic reform and development as well as on the financial sector (iii) Corporate Leadership Program under which CDB funded an Executive MBA program for African entrepreneurs (particularly women entrepreneurs) at the China Europe International Business School (CEIBS) and (iv) CDB Scholarships for African students to study MA and PhD courses in Chinese, economics, finance, and management. Between 2007 and 2014, CDB organized a total of 57 such programs for beneficiaries from 52 countries.

Investment by Chinese firms in TVET and higher education

There is some evidence that Chinese firms are starting to invest in these areas, in addition to firm-specific training; however, comprehensive information is lacking. Two such examples are ZTE and Huawei, both telecommunications firms. ZTE University has set up training centers in a number of countries and a telecom college in Equatorial Guinea. Huawei has built seven training centers and one research and development center in South Africa. An especially interesting example is the agreement between the government of the Democratic Republic of Congo (DRC) and Chinese enterprises in 2007-8 relating to investment in the mining sector, which included agreements on local content so that no more than 20 percent of the workforce is Chinese; at least 0.5 percent of the investment is allocated to training, and 12 percent of the work is sub-contracted to local firms. China also agreed to build 2 universities along with hospitals and health centers, and other social infrastructure (Kaplinksy and Morris, 2009).

The Magnitude of Skill Shortage in Africa: Current Status and Priorities

The educational and skill challenges in Sub Saharan Africa continue to be significant despite important improvements in access to basic education in the past decade. The new challenge is expanding the provision and quality of post-basic education, especially secondary, technical and vocational, and tertiary, education. Success here will be a critical to ensuring that the continent continues to undergo structural transformation.

Sub-Saharan Africa lags behind other regions in the average skill level of its population. Although this has been increasing in recent years, the pace of growth is relatively slow, and certainly does not match the rapid increase in investment in physical infrastructure in recent years.

One measure of the stock of human capital is the average years of education of the population, aged 25 years and more (that is, when most people have completed their education). One estimate, based on a world-wide dataset, projected that the average years of education for SSA as a whole would be about 3 years in 2010. Using more recent household surveys for selected SSA countries, the average educational attainment may have increased to as much as 5.4 years. This dramatic improvement is largely due to the rapid expansion of access to primary education. Nevertheless, SSA countries lag behind other regions such as East Asia and Latin America (8 years) and Middle East and North Africa (about 10 years).

The overall average education attainment hides significant variations across SSA countries. In general, many countries show a slow improvement, in particular middle income countries such as South Africa and Mauritius, which have an average of 8-9 years of education, and Kenya and Ghana, which are in the range of 5-6 years. Some have commendably accelerated their education attainment, albeit starting from a low base, such as Uganda, Tanzania and Rwanda. Their average years of education ranges between 4-5 years. At the other extreme, the average education level in Mozambique is still only about 3 years, while in conflict affected countries, of which there are several in SSA, the pace of increase would have been seriously disrupted if not reversed.

Providing quality basic education (8-9 years) to all African children will, therefore, continue to be a priority for African governments, as most new employment opportunities during the next decade will require relatively low skills (basic literacy and numeracy and non-cognitive traits will suffice). The increase in years of education attainment mask the effect of poor quality of education, which has deteriorated in many SSA countries. Poor learning

outcomes at the basic education level also limit the number and quality of students who can access post-basic education and tertiary education.

However, over the next 10 years, several of the larger SSA countries, which could potentially diversify into more sophisticated higher technology activities, will be in need of more advanced skills beyond basic education, and especially in the applied sciences, engineering and technology (ASET). Moreover, even in the near term, a "critical level" of these skills will be needed to initiate the process of technological absorption and prepare the groundwork for a broadening of the industrial base. This requires training of workers in tertiary level and technical/ vocational institutions.

Currently, the proportion of the population with post-secondary education is extremely small, even in the middle-income SSA countries, as well as in aspiring middle income countries, compared to comparator countries. For instance, 20 percent of the population in Malaysia has achieved more than secondary education. In South Africa, this proportion was 14 percent and in Zambia, just 5 percent. Both countries are significantly behind Malaysia in the proportion that has attained secondary education (24 percent and 12 percent, respectively, compared to 33 percent in Malaysia). In Botswana, the proportion of the population with secondary education and above was 19 percent, compared to 54 percent in Malaysia (Figure 5a). Figure 5 (b) compares the educational pyramid of Vietnam, a lower middle income country, with SSA countries that have recently attained that status (Ghana) and Tanzania and Mozambique, which are aspiring middle income countries. Clearly, the differences are stark, not only at the base of the pyramid, where significant proportions in SSA countries are illiterate, but also at the secondary education and post-secondary levels. Tanzania and Mozambique have roughly 4 % and 1 % of the population with more than secondary education compared to 8 percent in Vietnam.

Figure 5a:
Malaysia and Selected SSA countries - Proportion of Population Aged 25 years or more with different levels of education

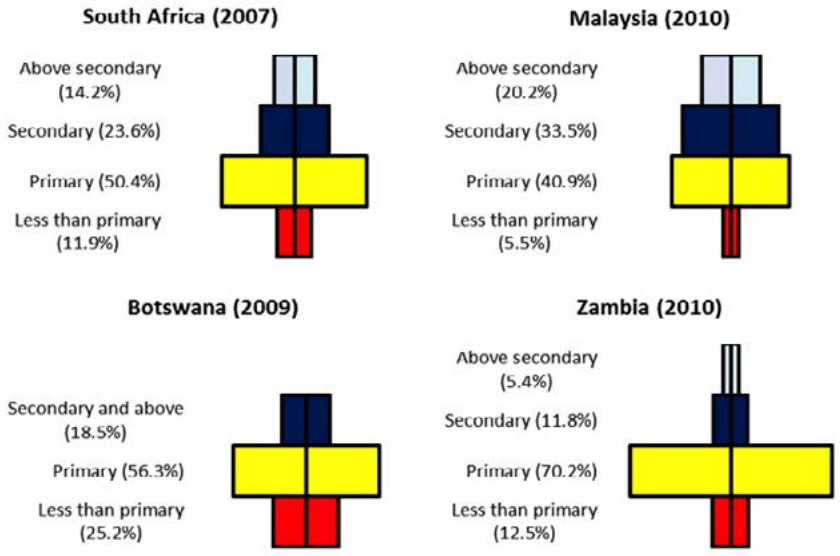
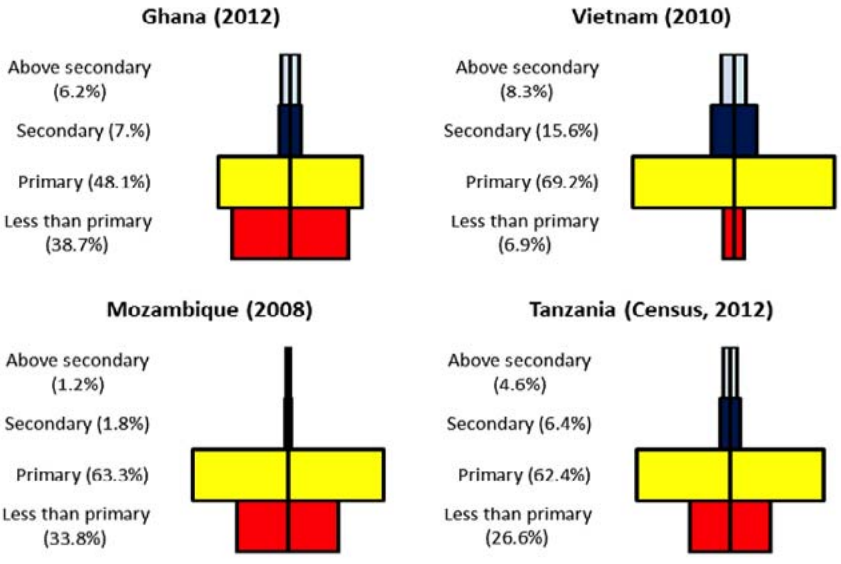


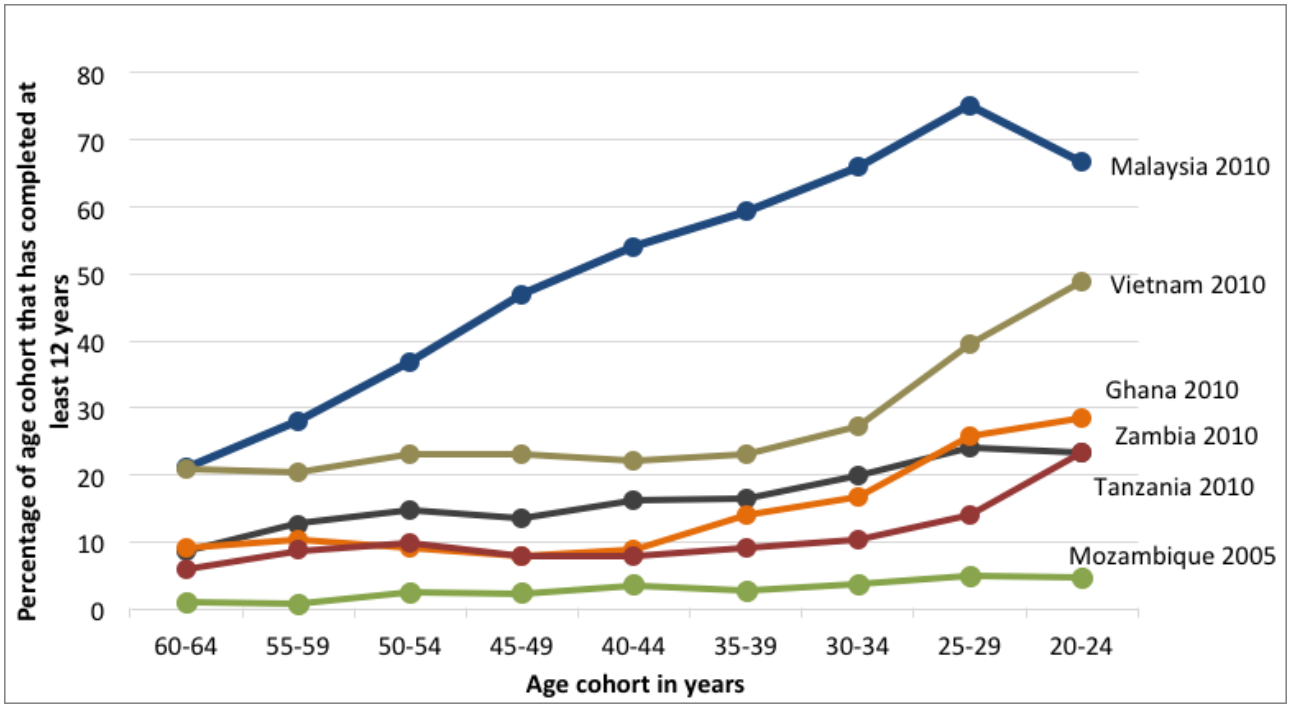
Figure 5b:
Vietnam and Selected SSA countries - Proportion of Population Aged 25 years or more with different levels of education



Note to Table 5a and 5b: *The proportion of the Population Aged 25 years and over with different levels of education in each country is based on author's calculations using harmonized micro data from the International Income Distribution Database-I2D2 version 6 (World Bank 2013). South Africa estimates are calculated using and older version of I2D2 (December 2011). Tanzania attainment by levels is estimated using aggregated data by age and school attendance (never attended, currently attended, completed) from the 2012 Tanzania National Census. Malaysia levels of attainment are estimated using micro data from the 2010 Malaysia Labor Force Survey.*

Using data from the most recent household surveys, we can also look at the rate at which SSA countries are upgrading their higher level skills. Figure 6 shows the proportion of different age cohorts that have at least 12 years of education for various countries in the SSA region compared to Malaysia and Vietnam. In Mozambique, one sees no appreciable increase in investment at higher education levels over the last 20 years. Tanzania, Zambia and Ghana have slowly increased the proportion of the population with at least 12 years of education in the same period, after a period of stagnation. Nevertheless, the gap with countries such as Vietnam and Malaysia has widened, as these countries have accelerated their accumulation of skilled labor.

Figure 6:
Percentage of different age cohorts with at least Grade 12, Selected SSA and comparator countries



Note: *Except where indicated the Percentage of Attainment of at least Grade 12 (secondary complete and over) for different age cohorts is based on author's calculations using harmonized micro data from the International Income Distribution Database-I2D2 version 6 (World Bank 2013). Survey year is rounded to the closest year multiple of five. For Malaysia the percentages are estimated using micro data from the 2010 Malaysia Labor Force Survey*

Further disaggregation shows that the proportion of secondary students enrolled in technical- vocational courses is significantly below that in other regions, although consistent data are not available for many countries. Among those who reach higher education, the proportion who enroll in science and engineering courses is less than 25 percent; those enrolled in engineering constitute about 8 percent of the total (Saint, 2014). At the postgraduate level, except in very large countries such as Ethiopia and Nigeria, most Sub Saharan African countries have only a few hundred students enrolled in science courses. Further, enrollment in the science and engineering courses is not aligned to the sectors of growth, with students taking general science courses that have limited employment potential.

The poor quality of the training of technical/ scientific personnel is as much of a constraint as the limited numbers of professional and technical labor. Many Sub-Saharan scientists and engineers are unemployed because they lack the specialized competencies and skills required by firms. The poor quality of their training relates to the fact that curricula are outdated, most faculty lack Ph. D training, and students gain little practical experience during their courses.

Faced with the enormity of the challenges in basic education, it is easy to overlook the critical needs of higher levels skills in the process of economic transformation and structural transformation.

THE POOR QUALITY OF THE TRAINING OF TECHNICAL/ SCIENTIFIC PERSONNEL IS AS MUCH OF A CONSTRAINT AS THE LIMITED NUMBERS OF PROFESSIONAL AND TECHNICAL LABOR.

The lack of technological capability of African firms as a constraint in improving productivity was highlighted two decades ago in a synthesis study of the World Bank's Regional Program on Enterprise Development (Biggs and Srivastava, 1997). The availability of technically skilled manpower is critical not only for individual enterprises but also for the emergence of competitively viable industries, as the diffusion of productivity enhancing technological know-how is often through movement of individuals across firms and through sub-contracting of firms that can meet quality standards for inputs. A recent study noted that the lack of adequately trained engineers is affecting development in every field, from rural sanitation to reduction of poverty (Royal Academy of Engineering (2012).

Conclusion

Economy wide skills constraints take about 10-15 years to emerge after periods of sustained growth. If Sub Saharan African countries are to continue on their sustained growth path, the time to address the skills constraints is now. Targeted investments in better quality technical/vocational education and training, higher education, and research are required for creating

skills for the emerging growth sectors across the continent. Sub-Saharan Africa could benefit from better coordination with development partners to ensure that investments in these areas are well targeted and well-coordinated.

Although China's assistance in this domain has increased, and is indeed substantial, it is still small relative to Chinese FDI and trade with Sub Saharan African countries. Further, at present, China's approach to foreign assistance to Sub Saharan Africa involves many government bodies and is channeled through various modalities. Although the Ministry of Commerce is the leading coordinating body for foreign aid and assistance, human resource development projects are implemented across a number of ministries, higher education intuitions, enterprises and other agencies. While the involvement of a range of entities allows for specific areas of expertise to be drawn upon, greater coordination is required to avoid fragmentation and impact on outcomes.

This also requires efforts on the part of SSA countries to align the contributions of different partners, as has been done in the case of basic education. African governments can take the lead in ensuring coordination and complementarity of development partner investments. At the same time, greater sharing of information among partners themselves could also lead to greater synergy among investments and enhanced results on the ground. ■

Sajitha Bashir is Practice Manager in the Education Global Practice, World Bank. *This article draws upon a background paper prepared by Sajitha Bashir and Reehana Raza for the "Investing in Africa Forum – Partnering to Accelerate Investment, Industrialization and Results in Africa" organized in Addis Ababa (June30 - July1, 2014). The Forum was organized by the Government of the People's Republic of China, the World Bank Group (WBG), China Development Bank (CDB), the China-Africa Development Fund (CAD-Fund), the Government of Ethiopia (GoE) and United Nations Industrial Development Organization (UNIDO). The author wishes to thank reviewers from the China Development Bank, Shuilin Wang (World Bank), Aileen Marshall (World Bank) and Peter Materu (World Bank) for comments provided on the background paper. The findings, interpretations, and conclusions expressed in this paper are entirely those of the author. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.*

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BIOTECHNOLOGY

THE TOOL AFRICA CANNOT AFFORD TO IGNORE

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Our vision

Research in life sciences will have equal importance for society in the 21st century as research in physics, chemistry and electronics had in the 20th. We will introduce biological production systems, which are ultimately driven by the sun. These will give us not only fuel and food, but also a multitude of novel products including a sustainable flow of raw materials to many industrial processes. This will be achieved by putting science and technology in its rightful place, in order to reach its full potential. We share this vision with the US President Barak Obama, who in his inauguration speech said "We'll restore science to its rightful place ... We will harness the sun and the winds and the soil to fuel our cars and run our factories".

Introduction

Developments in cellular and molecular biology give us greater possibilities to control processes of the photosynthesis-driven chemical factory and to select which end products it will deliver. Knowledge of the genes and proteins that control different biosynthesis pathways opens opportunities to create plants that produce entirely new products through genetic engineering. This technological leap is an excellent example of how basic research, often conducted on non-commercial model organisms, relatively quickly can be converted into new innovations of high societal relevance.

The breeding objectives are not entirely new, many have been central to plant breeding throughout history and are continued in today's breeding programs. These include improving the plant's qualitative characteristics, productivity and resource efficiency, which combine to strengthen agriculture and forestry production. The use of technology gives us the possibility to apply these breeding objectives to plant growth, including interactions with the surrounding abiotic and biotic environment.

Plant breeding and biotechnology

The development of plant breeding has largely been made possible by the advancement of methodology within the field of experimental biology. Applications of biotechnology in plant breeding thus follow well-trodden paths in which different techniques come together to form the tools available to the breeder. The first modernization of plant breeding took place in the early 1900s, marked by Darwin's theories and the rediscovery of Mendelian genetics. The majority of technological breakthroughs in genetics and cell and molecular biology have come during the latter part of the 1900s, which has affected the breeding methods used. Examples of techniques are cell and tissue cultures for virus-free propagation, chromosomal-doubling to enable polyploidisation, crosses of closely related species, somatic hybridization to enable hybrid seed production, and mutational breeding using ionizing radiation and mutagenic substances.

During the past decade, advances in DNA sequencing technology, combined with the ability to handle large amounts of data, set the stage for large-scale methods to identify particular genes carried by an organism, and determine when and under what conditions the different characteristics are expressed. This technology is only in its infancy, and further development will likely provide increased opportunities to both understand and control various biological processes, and to use molecular markers to select for increasingly complex characteristics. Through genetic engineering, it is possible to determine which genes should be carried over to the plant. Other technologies that are expected to have great impact in the next 5-10-year period are different techniques for mutagenesis of individual genes.

Sustainability and Productivity

Too often the term "sustainability" in an agriculture context is decoupled from discussions about productivity. This is unfortunate as it is obviously not a problem to create production systems that are sustainable - in an ecological sense - if you do not have any requirements for them to be productive. If, for example, an acceptable return of a cereal crop were 500 kg per hectare, there would be no need to cultivate the soil, add nutrients or employ pest and weed control measures. Such a system would obviously not be sustainable in the other important dimensions of sustainability, namely, socially and economically. The challenge for the future is to create production systems that are socially, economically and ecologically sustainable, while simultaneously both environmentally friendly and productive. One of the central tasks in plant biotechnology is to meet that challenge.

Photosynthesis

The total energy reaching the earth from the sun is about 10 000 times greater than the total energy sup-

plied to all human societies in the form of oil, coal, gas, hydropower, nuclear power and biofuels. When this energy is transferred to biomass more than 90 % is lost, with slight variation between C3 and C4 plants. It has long been understood that if you could increase this efficiency there would be tremendous gains in terms of productivity, in all forms of photosynthesis-driven production. It has, however, proved very difficult to achieve any substantial improvements using traditional breeding methods. With biotechnology's advanced and more accurate methods the situation is now different. There are possibilities to alter certain parts of the photosynthetic machinery. One example is a well-established project supported by the Bill and Melinda Gates Foundation and a major initiative by the International Rice Research Institute IRRI. The project aims to transform rice from being a C3 plant into a C4 plant, which is expected to raise the yield of this important staple crop by 50%.

Abiotic stress

In practice, agriculture and forestry can miss out on as much as 60-65% of the potential biological returns due to abiotic stress factors. These factors include high or low temperature, insufficient water supply, improper pH, elevated salinity or insufficient nutrients available in the soil. Results from studies on eight of the most important agricultural crops in the United States show that it should be possible to increase the yield considerably by increasing the plants' tolerance to one or more of the major abiotic stress factors. In many important farming systems, access to water has decreased sharply, which requires both better management of water resources and development of crop varieties with improved tolerance to drought. The Water Efficient Maize for Africa (WEMA) project is designed to deliver a maize variety that is tolerant to drought.

Recently, several breeding companies have introduced transgenic drought-tolerant varieties of maize. Other crops that have been designed to be grown with less water are soybean, cotton, rice, sugarcane and wheat. Furthermore, there are varieties developed that are capable of growing in soils with salinity levels too high for the "regular" varieties, or that can handle increased fluctuations in temperature, as well as average temperatures that are higher or lower than those normally preferred. All these properties are of course also important when it comes to adapting our farming systems to future climate change.

C3 plants
Plants using the most common form of photosynthesis in which atmospheric CO2 is used to build 3-phosphoglycerate; a sugar molecule with three carbon atoms.

C4 plants
Plants using a form of photosynthesis in which atmospheric CO2 is fixed into a sugar molecule comprised of four carbon atoms instead of 3-phosphoglycerate; increasing the photosynthetic efficiency in hot and dry environments. Several companies have introduced transgenic, drought-tolerant varieties of corn. Corn is an example of a C4 plant that generally has an advantage over C3 plants in hot and dry climates.

Biotic stress

Globally, the losses from disease, pests and weed competition, termed biotic stress, are significant. On-going research against a broad range of biotic stress factors may confer resistance against several diseases that affect important crops and trees.

Viruses and bacteria

It is often difficult to achieve satisfactory resistance to viruses with traditional plant breeding methods, and resistance is often controlled by several genes. The most common ways to prevent the spread and damage of viruses in crops include the use of insecticides to combat the insects that spread the virus, weed control, since weeds can serve as host plants, and the use of certified, virus-free planting materials. With modern plant biotechnology techniques, however, acceptable results can be achieved to produce resistant varieties. Currently, resistance against over 20 different viral diseases has been induced in a large number of plant species including tobacco, melon, squash, rice, papaya, potatoes and sugar beet. The Virus Resistant Cassava for Africa Project seeks to develop and deliver cassava varieties that are resistant to the main virus diseases that affect the crop.

A bacterial disease – Yellow Dragon Disease – causes oranges to remain green and fail to become sweet in the commercial plantations in Asia, Africa and recently also in the US. The bacteria are spread by leaf hoppers, and oranges made resistant to these leaf hoppers avoid the disease.

Another bacterial disease has almost wiped out the American chestnut tree, which previously dominated the forests of the eastern United States. The bacteria secrete oxalic acid (the acidic substance found in rhubarb) that damages plants and allows the bacteria to spread. Many plants have the enzyme oxalate oxidase that degrades oxalic acid, but this is lacking in the chestnuts. Through inserting a gene from wheat, chestnut trees have been created that are able to degrade oxalic acid, rendering them resistant to the bacteria.

Fungal diseases

Virtually all crops are attacked by one or more severe fungal diseases, which are usually controlled chemically using fungicides. It is important to combat fungal infections, as many fungi produce toxic substances called mycotoxins, which we do not want in our food.

A plant disease that has long attracted particular interest is late blight (*Phytophthora infestans)* in potatoes. The pathogen, which according to the taxonomy belongs to the group Oomycete and thus is not closely related to the true fungi that cause many other fungal diseases, attacks the leaves first and then moves into the tubers where it induces brown rot. Almost all current varieties of potato are sensitive and must be sprayed extensively during the entire growing season to keep the fungus away and secure the harvest. It has long been known that many wild potato species in the Andes of South America are resistant to late blight. The first field trials of the variety Fortuna, developed by Swedish researchers, containing two resistance genes from *Solanum bulbocastaneum,* were carried out in 2006. The variety was planned to be marketed in 2013-2014, but was withdrawn prior to commercialization in large due to the politically slanted approval process for GM crops in Europe. This conferred a great loss to both farmers and the environment.

Insects

Insecticides are globally the most widely used group of agricultural chemicals. Despite the fact that the chemical control of insects in agriculture has been very successful, crop losses caused by insects in the field and during storage account for almost 25% of total world agricultural production. Many insecticides are highly toxic and major health and environmental benefits are obvious if these could be replaced by a strategy that is based on insect resistant plants instead of chemical spraying. Identification, isolation and transfer of genes conferring resistance is a central focus within plant biotechnology.

Plants that produce their own insecticides is another direction which has proved very successful, but biotechnology is also open to other, perhaps even more elegant methods.

To date, most development work is focused on *Bacillus thuringiensis (Bt)*, a soil bacterium that produces a crystalline protein that when broken down in the digestive tract of susceptible insects forms a toxic substance. The majority of Bt strains produce toxins that are specific to a group of related insect species. There are, for example, Bt strains only affecting butterflies and moths. Similarly, there are Bt strains that are specific to the beetles, meaning they are effective against every pests like the Colorado beetle and cotton weevil. Other strains produce toxins that are specific to species within the order of flies and mosquitoes.

Genes encoding a number of Bt proteins have been cloned and introduced in, for example, tobacco, cotton, maize and potato. Since 1996 maize with Bt resistance to European corn borer *(Ostrinia nubilalis)* has been available and in 2003 varieties with resistance to the beetle Western corn root worm *(Diabrotica v. virgifera)* were introduced. Bt maize was grown in 2012 on 75 million hectares globally. The cultivation of Bt cotton with resistance to cotton weevil *(Anthonomus grandis)* has also been grown extensively. The global total acreage in 2012 was almost 19 million hectares, mainly in India, China and Pakistan.

Another way to provide insect resistance in plants is based on the introduction of genes that control the production of specific plant proteins that disrupt insect digestion. Examples are "Cowpea trypsin inhibitor" which stems from the legume black-eyed bean *(Vigna unguiculata)* grown in West Africa and South America, and a lectin from snow drop *(Galanthus nivalis)* that confers resistance to sucking insects.

A third way is based on influencing insect behavior through pheromones. Synthetic pheromones are already used successfully for species-specific and environmentally friendly pest control, and are a viable alternative

to conventional insecticides. The cost of synthetic pheromones is very high– from 600 to 4,000 Euros per kg. This limits the use of insect pheromones in pest control to crops with high value. Researchers in Sweden have shown that it is possible to develop oil crops where the seed produces pheromone components in the oil.

Using simple chemistry these can be converted to active pheromones at less than 20 percent of the cost of current cheapest synthesized pheromone. Many insect pheromones are based on substances that can also be synthesized by plants. The same research group has successfully introduced the synthetic pathways for insect pheromones in plant leaves with a combination of plant and insect genes. They have further shown that the pheromones produced in the plant are as, or almost as, effective as synthetic pheromones when it comes to capturing the actual pests in pheromone traps. In addition, an even more elegant method is within reach, where plants emit pheromones that confuse male insects so they are prevented from finding and mating with females. This means no eggs are laid and no caterpillars develop that can damage the plants.

Nutritional fortification

It is often argued that the use of genetic engineering in plants so far only has resulted in improvements in the interest of the farmers and major plant breeding companies. According to this view, there would be a greater acceptance of the technology if the modifications were of direct interest to the consumer and society. The reality, however, is quite different. One obvious example of a GM crop impeded, despite obvious consumer and societal benefits, is "Golden Rice". This rice has the ability to synthesize β-carotene (provitamin A) in the grain when it is usually only found in the green parts of the plant. The idea behind Golden Rice is that by making it a vitamin A source it can combat the deficiency of vitamin A that leads to blindness in children in countries where rice is staple food.

Despite the fact it is ten years since the introduction of Golden Rice, and new varieties with more than 10 times as much β-carotene have been developed, cultivation has been modest, mainly due to extensive propaganda from anti-GMO activists. Many other projects are underway aiming to increase the nutritional value of various crops. Examples include sweet potatoes with a higher content of β-carotene, "multivitamin-maize", carrots with doubled calcium, tomatoes with 20% more antioxidants, and cassava with higher content of iron, protein and vitamins. A global project with cassava began in 2005 aimed at developing varieties with both higher levels of vitamins and minerals and to provide resistance to major diseases.

Where is Africa in the Modern Agricultural Biotechnology Development?

Africa's development narrative is characterized by a rising population with its commensurate demand for more food; deficiencies of vital dietary nutrients in the continent's population; the continent's vulnerability to the negative impacts of climate change such as droughts; the reducing area of arable land due to rapid urbanization; the declining soil fertility in the continent's hither-to bread baskets; and the tropical biotic constraints to agricultural productivity. In view of this narrative, the adoption of modern agricultural biotechnology to mitigate against these impediments to human wellbeing and development cannot wait any longer.

Agriculture is one of the major users of modern biotechnology and worldwide adoption of the technology in commercial planting of genetically modified (GM) crops continues to be rapid. However, despite the tremendous outputs of the various Pan African programs in form of institutional capacity building for research, training, product development, policy and regulation, as well as practical recommendations by expert groups, the adoption of modern biotechnology in Africa remains low, resulting in minimal participation of Africa in the global biotechnology enterprise.

Modern agricultural biotechnology is viewed as an additional tool in the breeder´s tool box, which presents an opportunity for increased agricultural productivity through mitigation of biotic and abiotic stresses that constrain production. Further, the technology has found application in enhancing or unleashing the full nutritional value of food crops through bio-fortification and silencing of genes responsible for the synthesis of anti-nutritional compounds. In recognition of this opportunity and potential, African political, business and civil society leadership have invested in deliberate efforts to harness science and technology generally, and modern biotechnology in agriculture specifically through dedicated programs that address specific needs in the application of the technology, including stewardship to ensure its proper deployment.

Agricultural biotechnology has been billed as the single technology that has witnessed phenomenal growth in adoption within a very short time. This is testament to biotechnology's great potential in delivering real benefits to humankind. Besides direct benefits derived from tangible products of modern biotechnology in commercial production systems, there are many other benefits from its application as a tool in various processes such as plant breeding and study of gene function. In this ever expanding agricultural biotechnology enterprise, Africa has however remained largely hesitant to adopt the technology.

To support the development of the nascent biotechnology enterprise in the continent, African governments will need to partner with private sector and civil society actors who are working to deliver agricultural biotechnology benefits to the people of Africa. Examples of such potential partners include the African Agricultural Technology Foundation (AATF) which was established to negotiate royalty free agricultural technology (including biotechnology) and the Golden Rice project, which is working towards delivering the Vitamin A bio-fortified rice to Africa.

Governance of Modern Biotechnology Development and Biosafety Regulation in Africa

The governance of modern biotechnology stems from the Cartagena Protocol on Biosafety to the Convention on Biological Diversity (CBD), a protocol that was globally negotiated and adopted in Cartagena, Colombia in 2000. The core objective of the Protocol is to ensure the safe handling, transport and use of GMOs resulting from modern biotechnology that may have adverse effects on biological diversity, taking also into account potential risks to human health. To reinforce the legal liability provisions of the Protocol, a supplementary protocol on liability and redress was negotiated and adopted in Nagoya, Japan in 2010.

The majority of African countries are parties to the Cartagena Protocol on Biosafety and a number have ratified its Supplementary Protocol on Liability and Redress. Taking cue from the Protocol, the African Model Law and drawing from the European approach to modern biotechnology, the governance of modern biotechnology in Africa is characterized by an extreme precautionary approach. This has become a major hindrance to the development and application of modern biotechnology in the continent.

The idea behind golden rice is that by making it a vitamin a source it can combat the deficiency of Vitamin A that leads to blindness in children in countries where rice is staple food.

In compliance with the provisions of the Protocol, individual party states embarked on the development of their domestic policy, legal and regulatory frameworks to govern modern biotechnology. African states are at various stages of developing their biotechnology policy and biosafety regulatory frameworks, having benefited from the United Nations Environment Program – Global Environment Facility (UN-GEF). Most of their regulatory frameworks however, have leaned heavily on the extreme precautionary approach of the Protocol as guided by the African Model Law and drawing from the European approach.

But while Africa continues to hold on to the extreme precautionary approach, ostensibly taking cue from Europe, the European Union (EU) has moved on to re-invent its approach to modern biotechnology development and biosafety regulation to facilitate importation of Genetically Modified (GM) soybeans for processing animal feeds from Brazil and Argentina. It is therefore unwise for Africa to keep shunning modern agricultural biotechnology assuming that it is in line with the EU approach.

Africa should therefore adopt the co-evolutionary approach where consumer and biodiversity safety goes hand in hand with the development of the technology. This calls for the review and adjustment of national and regional policies together with their related legislation to provide a condu-

cive environment for the development and application of agricultural biotechnology. In conducting the review, African governments are encouraged to lay emphasis on maximizing the benefits associated with modern biotechnology and science based risk assessment to inform decision making.

At the regional level, the Common Market for Eastern and Southern Africa (COMESA), the West African Economic Community (ECOWAS) and the East African Community (EAC) have initiated harmonization of biotechnology policy and biosafety regulation. Harmonized approaches are cost effective, uniform in approach to risk assessment, assure seamless intra-regional trade and help address the unique informal exchange of commodities across national boundaries. African governments need to facilitate and actively participate in the process of regional biotechnology policies and biosafety regulation harmonization initiatives to reduce the cost of regulation, leverage on synergies and support the growth of regional biotechnology businesses.

Africa should pursue a dynamic 21st century, home grown biotechnology policy and biosafety regulatory regime that assures the maximum benefits from modern biotechnology and takes advantage of the continent's youthful, well-educated population to support the deployment of the technology and its associated stewardship. Africa's biosafety regulatory institutions need high quality scientific capacity to be able to regulate quickly, safely and effectively. This will ensure that Africa does not miss out on the Gene Revolution in the same way she missed out on the Green Revolution.

A positive political will and drive is critical to the adoption of agricultural biotechnology in Africa. The enthusiasm with which African governments ratified the Cartagena Protocol on Biosafety and the commitment to the development of their national policies and regulatory frameworks testifies to their positive will and drive to ensure that Africa is fully integrated into the global biotechnology enterprise. In spoken and written policy statements, the current generation of African government leaders have acknowledged the benefits of agricultural biotechnology and expressed positive sentiments in support of its adoption. However, despite these positive policy pronouncements, biosafety regulatory regimes of most African states remain extremely restrictive to the development and adoption of modern biotechnology.

Concerns and Perceptions

The most frequently expressed concern over modern biotechnology, and which informed the negotiation and adoption of the Cartagena Protocol on Biosafety, is the environmental and health safety of the technology. The precautionary principle portends that modern biotechnology is inherently risky to human and animal health and the conservation of biodiversity. Experience over the past two decades with modern biotechnology in agriculture, environment and health applications, with over 180 million hectares cultivated with GM crops, has demonstrated beyond any reasonable doubt that modern biotechnology does not present any health or en-

Finally, and most dear to the african socio-cultural setting,is the ethical question in which genetic engineering has been equated to playing God by altering the original creation or even creating new organisms.

vironmental risk. To the contrary, it has been demonstrated that the technology presents real health and environmental benefits. As early as 1999, the Nuffield Council on Bioethics concluded that "There is a compelling moral imperative to make genetically modified crops readily available to developing countries who want them, to help combat world hunger and poverty" and that "…genetic modification of plants does not differ to such an extent from conventional plant breeding that it is in itself morally objectionable".

Opinion expressed by the European Commission Research Area – Food, Agriculture and Fisheries and Biotechnology has put the issue of safety of modern biotechnology to rest, stating thus: "The main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research, and involving more than 500 independent research groups, is that biotechnology, and in particular GMOs, are not per se more risky than conventional plant breeding technologies". Further advice given to the European Union by the European Academies Science Advisory Council (EASAC) goes to reinforce the previous one, stating thus: "There is no validated evidence that GM crops have greater adverse impact on health and the environment than any other technology used in plant breeding. There is compelling evidence that GM crops can contribute to sustainable development goals with benefits to farmers, consumers, the environment and the economy".

The other issue of concern is socio-economic in nature, with the argument that modern biotechnology is a frontage of multinational agribusiness companies with the intention of dominating the global seed system thereby impoverishing the masses. The argument goes further to posit that modern biotechnology is not beneficial to small scale resource poor farmers. To reinforce these arguments cases have been cited of increases in farmer suicides in India following the introduction of GM crops due to frustrations resulting from their inability to afford GM crop seeds. Formal case studies conducted in India and other parts of the world have however dispelled these arguments.

Finally, and most dear to the African socio-cultural setting, is the ethical question in which genetic engineering has been equated to playing God by altering the original creation or even creating new organisms. Although this argument is difficult to conceptualize from a scientific point of view, it stems from the technology's ability to overcome species barriers in exchange of genetic material. It makes sense to a religious adherent for example whose religious beliefs forbid using some organisms as food and may therefore consider trans-genes from such organisms to have transferred the taboo. The question is whether transferring a DNA fragment amounts to transferring the whole organism's traits. This fixed mind set can only be overcome by effective public education programs to debunk myths and counter deliberate distortion of facts by anti-biotechnology crusaders.

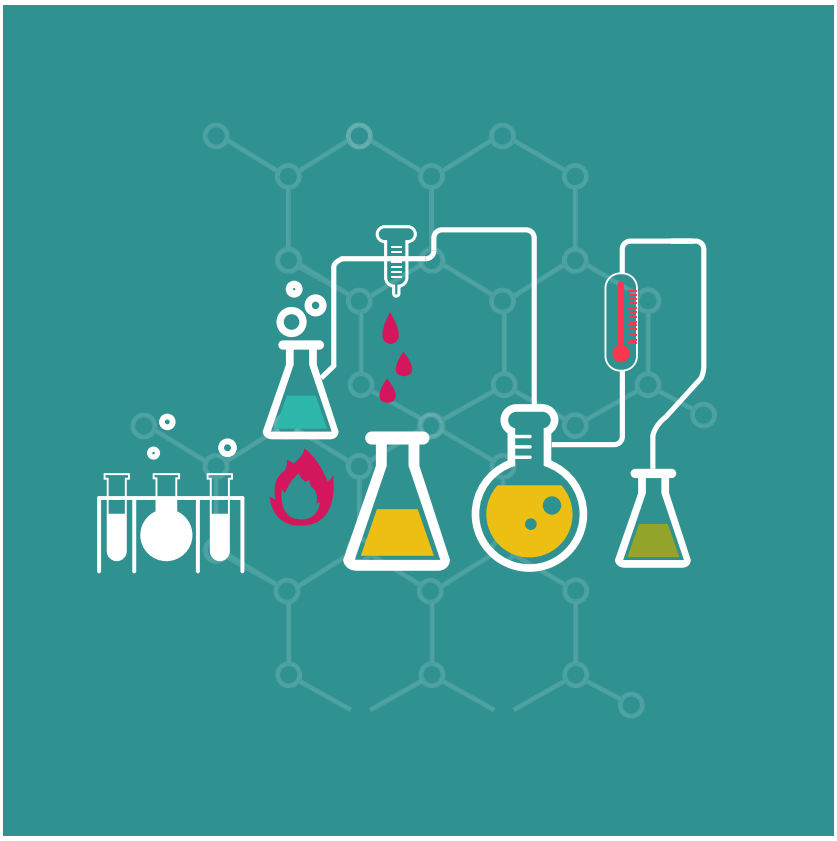
The Global Agricultural Biotechnology Enterprise

The global hectarage of GM crops has increased more than 100-fold from 1.7 million hectares in 1996 to over 180 million hectares in 2014, making GM crops the fastest adopted crop technology in recent history. This adoption rate is a clear testimony of the technology's resilience and the benefits it delivers to farmers and consumers. Africa continues to make progress with Burkina Faso and Sudan increasing their GM insect resistant Bt. Cotton hectarage substantially. What should be of great concern to African government and business leaders is the fact that in international trade, Europe imports GM products from South Africa, Brazil and Argentina and a lot of food imports into Africa including emergency food aid are sourced from countries growing GM crops. This demonstrates that the commonly held fear of losing the EU as an export market if Africa adopts modern biotechnology is unfounded.

Several African countries (Uganda, Kenya, Ghana, and Nigeria) have been conducting confined field trials on various GM crops for far too long without moving to the commercialization stage. They have therefore remained at the periphery of the global biotechnology enterprise. There is an urgent need and farmer demands to move these crops to commercialization since the trials have demonstrated their potential to positively impact on the continent's macro- and micro-economics. The potential for enhanced cotton production through the use of GM insect resistant Bt. cotton will position Africa to reap maximum benefits from the provisions of the Africa Growth Opportunity Act (AGOA) of the United States of America.

AFRICAN COUNTRIES LEADING IN BIOTECHNOLOGY RESEARCH

South Africa
Sudan
Burkina Faso
Uganda
Kenya
Ghana
Egypt
Nigeria
Malawi



The first generation GM crops targeted herbicide tolerance, which was not seen as beneficial to Africa. The situation has since changed with a focus on crops and traits of great relevance to Africa including nutrient bio-fortification, drought and insect tolerance and overcoming the aflatoxin problems in storage. In this emerging sector, China has become a key player in the provision of seeds in partnership with local seed associations and public institutions. This kind of partnership is important in addressing Intellectual Property Rights (IPR) and demands of other international trade standards such as the CODEX alimentarius.

Despite the demonstrated safety and potential for agricultural biotechnology, Egypt has since 2012 suspended the cultivation of GM maize after health concerns were raised in response to the controversial publication by a group of French scientists led by Séralini. Kenya also responded to the publication by banning importation of GM foods.

Capacity for Biotechnology Research, Product Development and Deployment

African governments have developed robust science and technology policies that are geared towards the transformation of their economies into knowledge driven economies. Collectively African governments, under the AU have launched specific initiatives to position the continent in the global knowledge economy through science, technology and innovation generally and biotechnology specifically. As a result, Africa's contribution to the global knowledge index through innovations and patents has seen a steady increase.

Inadequate infrastructure, human and institutional capacity for agricultural biotechnology research and product development is a major obstacle to Africa's desire of becoming a key participant in the global biotechnology enterprise. The ability of African countries to effectively use existing and emerging biotechnologies depends largely on the level of investment in building physical, human and institutional capacities. More specifically, Africa needs to focus on creating and reforming existing knowledge-based institutions, especially universities and national science academies, to serve as centers of new technology diffusion into the economy and to develop a comprehensive continental biotechnology curriculum for all lev-

els of education, focusing on specific areas that offer high economic returns for the continent. This can be achieved through effective partnerships and collaborations for Research and Development (R&D) in Biotechnology product development.

Article 20 and 23 of the Cartagena Protocol on Biosafety provide for a global information sharing mechanism through the Biosafety Clearing House (BCH) and public awareness and participation respectively. Public awareness and engagement in matters of biotechnology is needed at all levels in Africa to be able to roll-out the technology for application in commercial and subsistence production systems in Africa.

Final remark

Without exaggeration, one could argue that the technological developments in experimental biology and its applications in medicine, agriculture and forestry are comparable to developments in computer science. It is impossible to predict which specific techniques that will dominate in the future, but the aim of the proposed agenda is to point out the possibilities and the importance of supporting a continued technical development of plant breeding based on the scientific discoveries of the1900s and 2000s. If we are to meet the challenges to feed an increased population and at the same time achieve the goal of a bio-based economy we need the best knowledge available and cannot afford to rule out modern science but instead let it work for us.

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THE CASE FOR BIO-BASED ECONOMIES IN AFRICA

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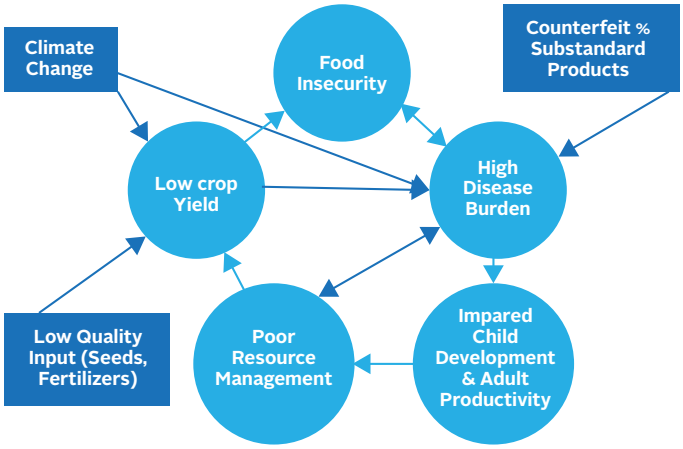
At their historic summit in September, 2015, the member states of the United Nations unanimously adopted the new Sustainable Development Agenda (SDA) to end poverty by 2030 and pursue a sustainable future. The SDA is composed of seventeen Sustainable Development Goals (SDGs) with specific targets and indicators; all of which underscore the critical role of science, technology and innovation (STI).

This unprecedented pledge for partnership and action by the 193 member states replaces the largely successful Millennium Development Goals (MDGs) and commits every country to addressing the root causes of poverty and meeting people's health, education and social needs while protecting the environment.

Alas, the future has caught up with Africa and the need to radically revamp education and systematically build capacity of Africa's workforce in emerging technologies such as biotechnology cannot be over-emphasized. Having been closely involved in efforts on workforce training, capacity building and consultancy in biotechnology and biosafety on the continent, I describe in this article the potential and promise of biotechnology. I identify key areas for improvement, and make the case for country-specific, localized bio-economy strategy beyond agricultural biotechnology, emphasizing the need to increase capacity building and regional research and development centers. Each country should embrace, own and implement its own biotech policies for a sustainable development agenda.

Bio-economy refers to all economic activity that encompasses the use and production of renewable biological resources and their conversion into food, feed, chemicals, energy and healthcare products and environmental sustenance via innovative and efficient technologies. As the world

approaches the third decade of the 21st Century -- a century which has been marked by quantum leaps in scientific and technological advances, renewable energy debates, financial crises and globalization -- it is generally agreed that innovation and technology will remain the key engines for the sort of multi-faceted economies that will survive global competition and remain viably resilient in the face of daunting challenges that will arise from climate change and demographic transitions. For many countries and regional blocks including the United States of America, China, and the European Union, there has been a new emphasis on bio-based economies. Between 2007 and 2012, more than ten countries and regional blocks including Canada, China, USA, European Union, Australia and Switzerland established strategic bio-economy initiatives. The Organization for Economic Cooperation and Development (OECD) estimated in 2009 that bio-economy's global contribution will climb to 2.7% of global GDP by 2030.



The future belongs to nations that recognize their natural / bio resources, and invest heavily in building institutional infrastructure and the human capacity to mine and manage them effectively and sustainably. In his treatise on the drivers of the future, Al Gore aptly identified six major forces that will reshape our world:

1) Ever-increasing economic globalization-"Earth Inc."—an integrated holistic entity with a new and different relationship to capital, labor, consumer markets, and national governments than in the past.
2) Genomics, biotechnology, neuroscience, and life sciences revolutions are radically transforming the fields of medicine, agriculture, and molecular science—and are putting control of evolution in human hands.
3) The worldwide digital communications. Internet, and computer revolutions have led to the emergence of "the Global Mind," which links the thoughts and feelings of billions of people and connects intelligent machines, robots, ubiquitous sensors, and databases.
4) The balance of global political, economic, and military power is shifting more profoundly than at any time in the last five hundred years—from a U.S.-centered system to one with multiple emerging centers of power, from nation-states to private actors, and from political systems to markets.
5) A deeply flawed economic compass is leading us to unsustainable growth in consumption, pollution flows, and depletion of the planet's strategic resources of topsoil, freshwater, and living species
6) Radical disruption of the relationship between human beings and the earth's ecosystems, along with the beginning of a revolutionary transformation of energy systems, agriculture, transportation, and construction worldwide.

It is clear that genes and genomes will mean to this century what oil and gas meant to the last. The multi-disciplinary science of biotechnology and the life science revolution in bioinformatics will undoubtedly remain part of the core of sustainability for both developed and developing countries.

Africa and Biotechnology: Current realities and opportunities

From striving to achieve Millennium Development Goals (MDGs) to advocating Sustainable Development Goals (SDGs) - all of which are laudable in themselves - many African countries have jumped into many 'development paradigms' without the enabling environment, strategic direction and human capacity to drive these visions of development into reality or material outcomes. The result is that ambitious transformative agenda declared by various African countries wind up in the cyclic loop of underdevelopment or non-sustainable growth. Although Africa ranks second to none in the vastness and size of its bio-diversity, minerals and natural resources, it is still plagued by widespread poverty, rising inequality, food and nutrition insecurity, and environmental degradation.

Biotechnology can be harnessed to effectively address many of these challenges:

1

Agricultural biotechnology holds the key to increasing and sustaining production of more nutritious food, while reducing environmental pollution by herbicides and pesticides. Selectable marker-assisted plant breeding is used to identify specific genes that code for desirable crop traits for a quicker and precise production of new genetically modified (GM) varieties. For example, maize has been engineered with high quality protein, and the introduction of the yellow cassava which is rich in vitamin A is helping to alleviate nutritional deficiencies among African children. Agricultural biotechnology has been harnessed to breed stress tolerant and disease resistant crop varieties, which when fully embraced by African countries would allow crop production all year round - eliminating the current, inadequate single cropping practice, available to resource-limited farmers. Micro-propagation and tissue culture are bio-techniques used to rapidly select and clone copies of desired plant material, such as disease resistant and high yielding varieties without genetic manipulation. In East Africa, tissue culture was used to rescue banana production from the deadly Black Sigatoka fungus which plagued farmers before 1995. More importantly, these

simple techniques could be used to conserve and save numerous medicinal herbs and rare food crops indigenous to Africa, which are on the brink of extinction.

Furthermore, forestry, livestock production and aquaculture are improved dramatically in an environmentally friendly way using biotechnology. Exploiting nitrogen fixing abilities of microbial symbionts of woody shrubs can improve soil fertility and agroforestry yields, while reducing nitrogen fertilizer use. These are just a few proven technologies that Africa might harness to tackling current and future threats to food and nutrition security. Biotechnology and related genomics is perhaps the only conceivable science that will allow for rapid and precise modification of crop plants to simultaneously address potential impact of climate change, protect the environment and feed the burgeoning African population. The likelihood that close to half of the world population of children will be African by the end of the 21st century makes proper sustainability planning a moral obligation for African leaders.

This is not to underappreciate the laudable milestones that have been achieved through numerous partnerships and programs on agriculture and food and nutrition security on the continent. At least 10 African countries have passed Biosafety laws authorizing the commercial use of genetically modified organisms. But there are few ambitious or strategic plans for the future. Increasing nutritious food production is as important as thinking through the entire value chain, including post-harvest technologies. It is critically important that each country takes ownership of the development of their technology policies and invest heavily in capacity building. The science of biotechnology is not amenable to imprecision, short-cuts, guesswork or myths. Technology adoption should co-evolve with knowledge-guided regulatory practices based on science conducted indigenously to protect environment and human safety.

2

Environmental biotechnology is a multi-disciplinary science that aims for optimal use of plants, animals and micro-organisms to produce beneficial goods, renewable energy and other useful products in an integrated process that preserves environmental health and the biosphere.

Techniques spanning chemical / industrial engineering, microbiology, genomics and bio-techniques are used to harness biological resources and processes for commercial uses and exploitation in such areas as environmental remediation and restoration of impacted habitats. Innovations of environmental biotechnology also power sustainable agriculture through plant growth promoting soil microbes which replenish soils during intensive cultivation. Majestic tropical forests of Iroko trees, Khaya spp. and diverse flora and fauna need to be barcoded and protected as their contents are harvested. In addition to terrestrial treasures, the African continent boasts of a coastline length of 26,000 Km (7.3% of global coastline) with free access to marine resources whose organisms have been rarely explored.

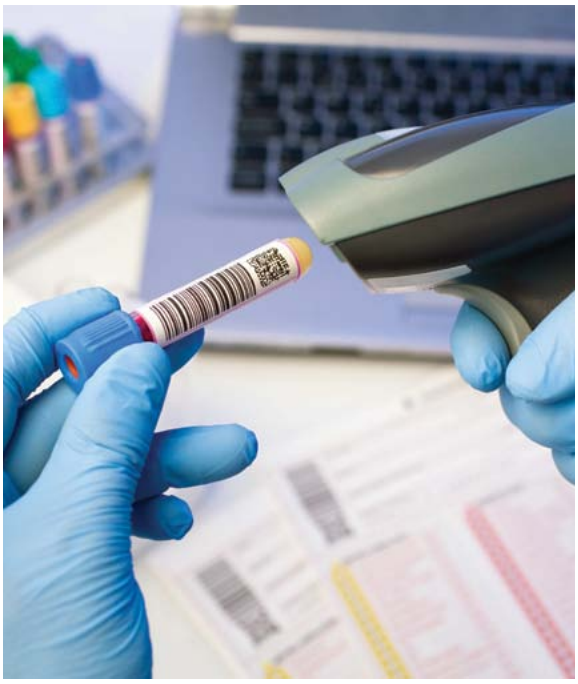
The mangrove ecosystems around Nigeria for example are vanishing at alarming rates due to pollution. Restorative projects will benefit from cutting edge environmental DNA (eDNA) technologies which could provide faster rapid impact assessment indices than flora and fauna diversity, allowing for prompt adjustment of remediation protocols. Also, fresh water rivers – Nile, Niger, Senegal, Congo, Zambezi, hot springs and Lake Tanganyika contain unique aquatic animals and microbes from which potentially useful genes and products such as enzymes can be derived. A casual perusal shows that less than 10 % of literature on biotechnology in Africa addresses environmental biotechnology (other than 'characterization' exercises). Yet therein lies some of Africa's strategic economic and ecosystem advantages. The genetic resources in Africa's tropical forests, deserts and unique terrestrial habitats have yet to be studied and mined.

The need for capacity in environmental biotechnology is much more acute now that genetically modified products are being introduced into many African countries. Despite the widespread use of Round-up resistant GM crops, there are limited studies on their effects on the environment. Reports of increasing resistance of weeds to glyphosphate (the active ingredient in round-up) in corn, cotton and soybean fields could mean higher agro-

production costs for weed control for poor African farmers, if similar effects occur in African farms. Similarly, Cotton, corn and other crops containing an insect-specific toxin gene from Bacillus thuringensis (Bt) have improved yields exponentially but the threat of Bt resistant pests is a challenge.

New genetic hybrids must be introduced frequently. This raises the question of whether Africa is prepared for the science and stringent monitoring and surveillance necessary to protect its environment and people in the age of biotechnology. Training indigenous scientists for environmental biotechnology / biosafety regulations and management has to become a top priority for the increasing number of African countries embracing GMOs.

3



Medical and Pharmaceutical Biotechnology is one of the fastest growing and revolutionizing arms of biotechnology, spanning disease diagnostics, vaccine development, and treatment of diseases to drug discovery. The advances in medical biotechnology in a developing country like India illustrate how biotechnology can be harnessed to improve health and economic outcomes. India is ranked among the top 12 biotechnology destinations worldwide and the third largest in the Asia-Pacific region with bio-enterprises that produce and export vaccines, blood products, antibodies, restriction endonucleases, oligonucleotides, culture media, plastic wares, and micro pipettes. There are more than 300 college level educational and training institutes across the country which offer degrees and diplomas in biotechnology, bio-informatics and the life sciences, producing nearly 500,000 graduates on an annual basis. Innovative products and services draw on renewable resources and bring greater efficiency into industrial processes, check environmental degradation and deliver a more bio-based economy. In terms of job creation, biotechnology employs more than 10,000 people and contributes significantly to the country's GDP.

The revenue of the Indian biotechnology sector grew 33% in 2011 and is projected to reach US$ 10 billion by 2015 from US$ 3 billion. The Indian Association for Biotechnology Led Enterprises (ABLE) seeks to make biotech a US$ 100 billion industry by 2025 (see: Indian Biotechnology: The Roadmap to the Next Decade and Beyond).India's success could be attributed to many factors, including:

- A strategic plan for integrated biotechnology development
- Government investment in training a strong scientific work-force and creation of institutes for research and development,
- Deliberate focus on importation of knowledge in genomics, bioinformatics, genetic engineering, nanotechnology, diagnostics, prophylaxis and commercialization, and
- Effective use of its Diaspora and private sector.

Opportunities for growth in Africa abound. The new UN SDG 3 on health provides a concrete action plan for healthy lives and well-being for all by 2030; including ending the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases. It targets hepatitis, water-borne diseases and other communicable diseases in developing countries. For Africa, the curve is steeper and rugged. Many indigenous diseases like sickle cell anemia (SCD) did not make it to the listed targets, yet it is perhaps one of most subtle threats to Nigeria's blooming economy where 55% of the population either carry the genetic sickle cell trait or are sick. Indeed 90% of this deadly genetic hematologic disorder occurs in Africa, affecting its labor productivity.

Sub-Saharan African countries should invest in point-of-care (POC) devices for accurate and affordable genotype diagnosis to stop sickle cell (SCD) propagation; and implement new treatment technologies. The noble efforts of emerging regional R & D initiatives such as the African Network for Drug Discovery and Innovation (ANDI), whose focus is the neglected diseases of Africa, should be supported.

4

Industrial Biotechnology (IB) is the least known and exploited in Africa and the need to radically reverse this situation is urgent. In IB, living systems like microorganisms, animal and plant tissue culture and other living systems or their components are used to manufacture useful products like enzymes, paper, detergents, animal feed and biofuel needed in medicine, food and agriculture and other human activities. Industrial biotechnology promotes the use of renewable raw materials for a sustainable planet. The SDG 9 aims at building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation. Industrial biotechnology can be harnessed to achieve this goal in Africa.

In the state of Wisconsin in the United States of America, one bacterium - Lactococcus lactis for example, is used in several aspects of biotechnology – as cheese starter culture, in food preservation, production of lantobiotics and development of vaccines or probionts. Cheese-making with this bacterium yields almost 20 billion US dollars annually to the state's revenue. The opportunities for manufacturing and exporting new bio-products from Africa are enormous. Highly nutritious indigenous fermented foods like Nunu and Kindormo, and Ugba would be revolutionized when starter cultures are identified and packaged. To-date, almost all enzyme raw materials in many African industrial processes like brewing, bread-making

and ethanol production are imported. Maintenance of typed culture collections to drive industrial processes has been erratic at best.

Governments should create incentives for partnerships with private companies to help mine the many bio-resource treasures of the continent. These sorts of bio-based economic activities are cost-effective and sustainable. Microbial Inoculant industries helps Brazilian agriculture to remain productive while minimizing impacts to natural ecosystems by controlling plant root pathogens without the need for pesticides. Acetobacter (Glucanoacetobacter) spp - a nitrogen fixing bio inoculant was isolated from the rhizosphere of sugarcanes by indigenous scientists. Its use rapidly transformed Brazil into one of the world's largest sugarcane producer which fueled its success as the world's leading bio-ethanol manufacturer. There are niches for every country to engage in bio-innovation and bio-enterprises. Strategic investment in human capacity is key to finding and valorizing those niches.

5

Genomics and bio-informatics are rapidly growing disciplines in the life sciences that employ recent advances in recombinant DNA and DNA sequencing techniques to sequence, annotate and analyze function and structure of whole cell DNA information (the genome). It includes metagenomics, functional genomics, epigenomics and computational genomics. These sub-disciplines are applied to all aspects of biotechnology for a deeper understanding of life processes and for precise management of genes, cells, organisms and even ecosystems. Research and development employing these tools to solve problems in Africa are extremely rare because the subject is alien to its scientific community. Meanwhile, it was genomics that turned the Brazilian citrus industry around in 2000, when Brazilian Diaspora working with many other indigenous scientists published the first complete DNA sequence of Xylella fastidiosa, a bacterium responsible for significant damage to the region's citrus crops. Food security in Africa is under constant threat of poorly defined plant pathogens and adequate mitigation can only be made when the organisms are well understood. For example, Cocoyam yield in West and Central Africa (the world's largest producers of these nutritious crops) has declined sharply in the past 7 years due to Cocoyam root rot disease (CRRD) and more recently, a leaf blight whose etiology is poorly defined. Applications of genomics might identify the pathogens, their mode of pathogenesis and help to treat and predict their evolution.

Scientific innovation is indispensable for sustainable development in Africa. Any sustainable development agenda in Africa should be anchored in harnessing applications of science, technology and innovation. Consider this. China manages 7% of the world's surface area to feed 20% of the global population using biotechnology. India produces 66% of children's vaccines and dominates the market of enzymes. Agro-biotechnology catapulted Brazil into a leading producer of citrus, sugar and bio-ethanol. And of course, the United States leads the world in all dimensions of science, technology and innovation.

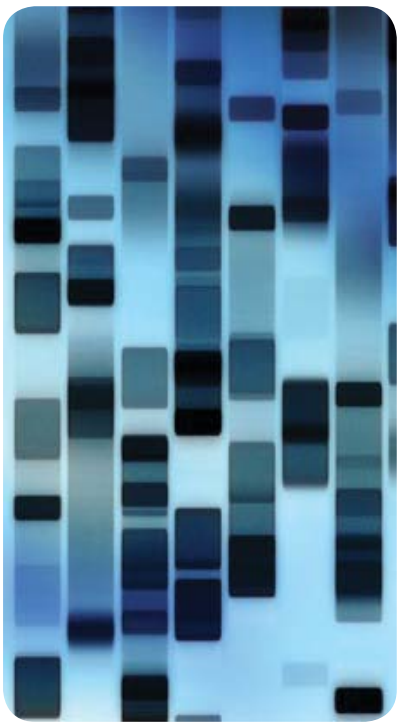
What Africa needs to do now that the future is here

African leaders have long recognized (at least in theory) the need for science and innovation as drivers of sustainable development. What Africa lacks is the vision, human capital and infrastructure to plan, promote, and implement science for development. At the first African Congress of Scientists and Policymakers (CASP) in Alexandria Egypt (8), heads of state and their science ministers re-iterated their commitment to advancing science, technology and innovation in their countries. It was remarkable that the 2006 Congress ended with the same conclusions as other meetings held 15 years prior. So, rather than repeat the litany of reasons and proposed interventions, I will devote this section to key recommendations based on lessons from my active involvement in CASP, technology training workshops and consultancy in science and technology applications to development in Africa. Governments at the level of the Presidency and Ministers should:

- Reset the button and try to understand the strategic importance of biotechnology in sustainable de-

velopment. I learned that there is a huge gap in understanding modern STI among the leadership. A critical first step is to invite a credible team of scientists who will make personalized presentations in an altruistic spirit.

- Identify a non-political champion with full government support to lead the crafting of a national vision for bio-based economy. Such a candidate must be able to foster technical cooperation and collaborate with indigenous and international experts to provide a strong leadership and direction for biotech with local context. Xeroxing the plans written by consultants for other countries will perpetuate mediocrity.
- Radically transform the life science curriculum in tertiary institutions to reflect contemporary science. Many African graduates are obsolete before they graduate, having been taught by teachers who themselves are rusty.
- Invest heavily in human capital development on a continuous basis, building capacity of the workforce – technicians, professors and lecturers in the life sciences, engineering agriculture and medicine at all levels – vocational and University. Because knowledge is abounding at incredibly fast rates in the 21st century, these otherwise brilliant workers will naturally get outdated without continuous retraining.
- Overhaul education from primary, through secondary to tertiary levels. Most of the students and indeed their teachers lack proper foundation in science. Build knowledge-based societies.
- Develop R & D Infrastructure
- Partner with the talented African Diaspora across the globe. They are transnational actors who understand two worlds, capable of shaping development relationships across regions and continents
- Engage the youth broadly, invest in their future and tap from their talent, energy and zeal. They represent Africa's greatest hope for development.
- Aggressively pursue importation of knowledge and de-emphasize product importation
- Institutionalize strategic transformation agenda for the bio-based economy with minimal strings to the government bureaucracies. This does not require proliferation of ministries or agencies, rather an enabling institutional environment (i.e. intellectual property protection policies) will work.
- Measure performance by cultivating a strong sense of impact assessment of biotech programs under a transparent monitoring and evaluation scheme. This will help track progress and challenges with the goal of maximizing return on investment.
- Promote and facilitate private sector involvement in research and development, service and manufacturing sectors of the bio-economy. The private sector is a major catalyst in sustainable development and Africa needs to create the rule of law and technology transfer framework for it to thrive. Encourage multi-national research collaborations and partnerships in order not to re-invent the wheels.
- Embrace the promise of biotechnology and take ownership of the effort.



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BIODIVERSITY INFORMATICS IN EASTERN AFRICA

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Introduction

This article reviews policy and institutional frameworks that constrain biodiversity informatics in Eastern Africa, with a particular focus on Ethiopia, Kenya, Rwanda and Tanzania. Conservation and utilization of biodiversity directly depend upon access to information. The Eastern Africa region is known to harbor rich and diverse biotic resources. However, data and information regarding these resources remains scattered among several organizations and individual scientists, making it difficult to easily and efficiently access adequate and accurate biodiversity information. Efficient access to data and information about these natural resources and processes is essential for their effective conservation and sustainable use (Tandon and Bhattacharjee, 2010, Pettorelli et al., 2014). Although biodiversity information is critical to a wide range of scientific, educational and governmental uses, it is often shaped by the existence of adequate policy and institutional frameworks (Canhos et al., 2004b, Guralnick and Hill, 2009, Nativi et al., 2009, Paton, 2009).

Biodiversity informatics is defined as the computerized handling of information on biodiversity and its management. This may include both processes and technology for data capture, curation, storage, analysis and visualization. Biodiversity informatics has come about as a result of the implementation of international agreements, availability of information in text, images, maps, videos and the technology to record, link and archive such diverse types of information, combined with the ever-increasing power of computers and the internet to facilitate access and retrieval (Agrawal et al., 2012). The status of biodiversity informatics can be assessed by looking at four key areas: (1) mobilization of biodiversity data, (2) standards, protocols, and tools development, (3) informatics Infrastructure development and (4) capacity building, outreach and open access initiatives. This article reviews the policy and institutional frameworks in Eastern Africa that either promote or hinder initiatives in each of these areas.

There have been a number of initiatives undertaken in different regions of the world to mobilize biodiversity data, as this forms the basic constituents of all biodiversity informatics related activities (Hobern, 2013). However, most of the initiatives often focus on developed countries and relatively little is known about biodiversity in developing countries, including Eastern Africa. Secondly, several initiatives have been directed towards the development of standards and protocols, collection management tools, geo-referencing and mapping tools, data cleaning tools, modeling tools, as well as web services and computational frameworks. Again, much of this work has tended to sidestep many African countries.

Thirdly, many countries have already built or are seeking to build informatics infrastructure with exponential technological capacities, computational power, storage capacity and analytical capabilities. East Africa and more generally Sub-Saharan Africa lags behind in this field. Last but not least, open access to primary biodiversity data is essential both for enabling effective decision making and for empowering stakeholders involved with and affected by the conservation of biodiversity (Chavan and Ingwersen, 2009, Reichman et al., 2011). Efficient exchange of information has been recognized as one of the necessary preconditions for improvement of global biodiversity conservation (Laihonen et al., 2014). However, many existing primary biodiversity data are neither accessible nor discoverable (Chavan et al., 2004, Moritz et al., 2011). Furthermore, there is scarce knowledge of legal, policies and technical factors that inhibit or promote human and institutional capacity in this domain.

Methodology

This study focuses on Eastern Africa and the countries were purposively selected. Ethiopia, Kenya and Tanzania because of their biological or ecological richness. Kenya was also selected because of the availability of technical infrastructure among institutions such as the Kenya Wildlife Service (KWS), National Museums of Kenya (NMK) and Jomo Kenyatta University of Science and Technology. Rwanda was selected because of its high scores for control of corruption and government effectiveness and also because it is one of the fastest growing African countries in terms of the use of technology, particularly, information and communication technologies.

The study employed content analysis to identify policies that impact the field of biodiversity informatics in Eastern Africa. Content analysis looks for the presence of concepts in a text, condensing many potential concepts into fewer broad categories, as a means of discovering patterns in the analyzed media, and thus better understanding the underlying phenomena (Matthews and Ross, 2010).

The starting point for this study was to identify existing policies and strategic documents that impact the collection of biodiversity information. In the second stage, policies and other strategic documents were reviewed with a view to identify the degree to which they were either drivers of, or barriers to: 1) mobilizing biodiversity data; 2) standards, protocols, and tools development; 3) informatics infrastructure development; 4) capacity building, outreach and open access initiatives. The effectiveness of these policies was also analyzed through a review of available peer-reviewed articles, policy briefs, and working papers. References of key peer-reviewed articles were scanned to identify other

literature that could provide relevant information. The titles and abstracts (if available) of this second set of articles/documents were critically scanned to identify those that could provide some relevant information, for inclusion in the review.

Findings

The study identified a number of drivers and barriers to the mobilization of biodiversity data, development of tools, standards and protocols, informatics infrastructure development and capacity building, outreach and open access.

The first key driver is the commitment by all countries studied to several international conventions that emphasize the protection and conservation of biodiversity, particularly the UN Convention on Biological Diversity (CBD). The CBD's '2010 targets' highlighted the importance of technology in biodiversity management and triggered the creation of national and global biodiversity monitoring systems to monitor and measure progress towards the various targets. The establishment a Biodiversity Information Database as a central repository of data generated by inventories and surveys in Kenya is a direct response to the country's UN CBD commitments.

The second key driver in all countries is prevailing policy and legislative frameworks related to biodiversity, environment and natural resources. These include in:

- Ethiopia: National Biodiversity Strategy and Action Plan (2005) and Environmental Policy (1997)
- Kenya: Forest policy (2006), Wildlife Policy, National Biodiversity Strategy and Action (2007-2012), Biodiversity Strategic Plan (2013-2018); National Environment Action Plan framework (2009-2013);
- Rwanda: National Constitution (2003); Biodiversity Policy (2011), Wildlife Policy (2013), Organic Law No. 04/2005 on protection, conservation and preservation of the environment in Rwanda;
- Tanzania: National Environmental Policy (1997), National forest program (2001-2010), the National Biodiversity Strategy and Action Plan (2001-2006), the Forestry and Beekeeping Divisional Program (2001- 2010).

Some biodiversity informatics related programs were initiated based on the above policies, strategies and plans. For example, in Ethiopia, the Institute of Biodiversity Conservation Germplasm Database Management System (IBC DMS) grew out of the requirements of the Environmental Policy. In Rwanda, the Rwanda Environment Information Network operating under Rwanda Environment Management Authority (REMA) has been established. However, there is currently no national biodiversity data management system in place although a few sporadic and isolated efforts have been made in the recent past. In Tanzania, the Forest Policy (2008) places an emphasis on biodiversity research and information dissemination and the importance of access to biodiversity data.

The study also found 'gaps' or barriers to the development of biodiversity informatics in these countries in the same policy and institutional frameworks examined. While a few policies and laws have some elements of biodiversity informatics, there is a general lack of clarity and specificity with regard to biodiversity informatics. In Ethiopia for example, sectorial laws dealing with biological resources tend to address biodiversity and not biodiversity informatics per se. The Forestry Law (Proc. No.94/94) has provisions for ensuring the conservation of forests (Federal Democratic Republic of Ethiopia, 1994) but fails to address the issue of biodiversity data management. In Kenya, the National Biodiversity Strategy and Action Plan (2005-2010) highlights the need to develop indicators for and subsequently monitor biodiversity. Specific ways of achieving this are, however, not highlighted. In Rwanda, biodiversity informatics is not mentioned in any policy document. As a result, it is not surprising to note that out of nineteen national targets for biodiversity conservation which were defined in line with the Aichi Targets of the Strategic Plan for Biodiversity 2011-2020, there was no single target focusing on biodiversity data management. It should also be noted here that even though some policies and regulations make specific reference to the biodiversity informatics framework, this reference is very brief and general, suggesting limited usability of the policy.

Secondly, the extent to which existing policies and legislation have fulfilled expectations in practice in the area of biodiversity data management is mixed. In Tanzania, there is a robust evidence that many programs (al-

though not specifically related to biodiversity informatics) did not achieve the expected results (United Republic of Tanzania, 2006, United Republic of Tanzania, 2007, Jacqueline and Stacey, 2014). One of the reasons for this is the lack of effective monitoring and evaluation (Jacqueline and Stacey, 2014). In all countries, different institutions are involved in biodiversity and environmental information management and conservation. These include ministries, and institutions of higher learning and a number of national and international Non-Government Organizations (NGOs).

In Ethiopia, the constitution mandates the Prime Minister to exercise management of the environment including biodiversity throughout the country (Negarit Gazeta of the Federal Democratic Republic of Ethiopia, 1995b). Proclamation No 9/1995 (EPA Establishment Proclamation) prescribes a range of environmental management (including biodiversity) tasks (Negarit Gazeta of the Federal Democratic Republic of Ethiopia, 1995a) while Proclamation No 120/1998 Institute of Biodiversity Conservation and Research Establishment Proclamation establishes the biodiversity protection responsibilities (Negarit Gazeta of the Federal Democratic Republic of Ethiopia, 1998). In applying the general term of biodiversity protection to each institution, there is a lack of clarity of language used, which results in confusion in identifying and demarcating institutional mandates. Recently, Ethiopia recently addressed this problem by restructuring and establishing institutions at federal and regional levels. These include the establishment of Regional Biodiversity Units, Biodiversity Centers and the Ministry of Environment and Forest (Government of the Federal Democratic Republic of Ethiopia, 2014).

In Kenya, many government agencies that are in charge of environment and biodiversity. These include ministries of Environment and Mineral Resources, Forestry, Lands, Finance, Special Programs in the Office of the President, and the National Environmental Management Authority (NEMA). In spite of this, the coordination of environmental matters, and in this instance biodiversity conservation, remains elusive. There are few linkages or even awareness of what each ministry is or should be doing. Whereas the Ministry of the Environment has primary mandate for biodiversity conservation, the National Museums of Kenya holds the legacy biodiversity data and emergent informatics capacity but is housed under the Ministry of Culture and Heritage. Similarly, in Rwanda, the responsibilities of Rwanda Environment Management Authority (REMA) and the Department of Tourism in Rwanda Development Board (RDB) are not entirely clear. REMA is responsible for the governance of environment management (including biodiversity), but it is not clear whether it has powers over the management of wildlife in parks which is under the Department of Tourism and the Rwanda Development Board (RDB).

In Tanzania, the major institutions include the Vice President's Office through its Division of En¬vironment, Ministry of Natural Resources and Tourism, National Environment Management Council. However, responsibilities of Vice President's Office through its Division of En¬vironment and the National Environment Management Council (NEMC) are somehow conflicting. The NEMC sits in the Vice President's Office where its main role is to provide advice on all matters pertaining to environmental conservation and management. In order to improve and strengthen forest management, the Government has established a stand-alone agency, the Tanzania Forest Services Agency (TFS), newly established under the Ministry of Natural Resources and Tourism (MNRT) (United Republic of Tanzania, 2014). However, the relationship in terms of coordination between TFS and NEMC is wanting (Jacqueline and Stacey, 2014).

Conclusion

The review found that all countries in the region are committed to international and regional conventions that emphasize the protection and conservation of biodiversity. However, the existing policies are deficient in terms of biodiversity data management. Measures that can be taken to ensure the success of biodiversity informatics in Eastern Africa include the following:

Identify and avoid overlaps but promote complementarities within and/or between the different institutions and/or stakeholders that are involved in biodiversity. The roles of various stakeholders should be clearly described and formalized. Considering that, NEMA (in Kenya), REMA (in Rwanda) are in charge of coordinat-

The existence of sensitive data cannot serve as an excuse for a broad withholding of data. Vast amounts of biodiversity information are not sensitive, and can be shared to the benefit of all.

ing the exercise; these institutions should be strengthened to offer guidance on biodiversity data management (i.e. the National Biodiversity Monitoring Unit and an operational Clearing House Mechanism to guide access and utilization of data). In Rwanda, there is an urgent need for developing a web based interoperable and collaborative framework for interconnecting the distributed and heterogeneous databases by establishing resource discovery and access control mechanism.

Put in place clear, complete and user-friendly policy documents. In all countries, the policy and legal frameworks relative to biodiversity informatics need to be further developed by specific regulations for implementing, executing and monitoring each step of the management process. Furthermore, regulations on biodiversity informatics should be complemented by a policy document, and technical guidelines developed for its implementation. Accordingly, the policy documents should outline the rationale of the legislation, plus national goals and the key steps essential for the achievement of these goals. The technical guidelines associated with the legislation should be practical and directly applicable. This review reveals that sufficient skills and tools are important requirements to adequately implement biodiversity informatics. There is need for capacity building in various components of biodiversity informatics.

Document the benefits of sharing data to scientists and to institutional administrators and policymakers. There is resistance to share both spatial data as well as spatial data products such as shape files. The existence of sensitive data cannot serve as an excuse for a broad withholding of data. Vast amounts of biodiversity information are not sensitive, and can be shared to the benefit of all. ■

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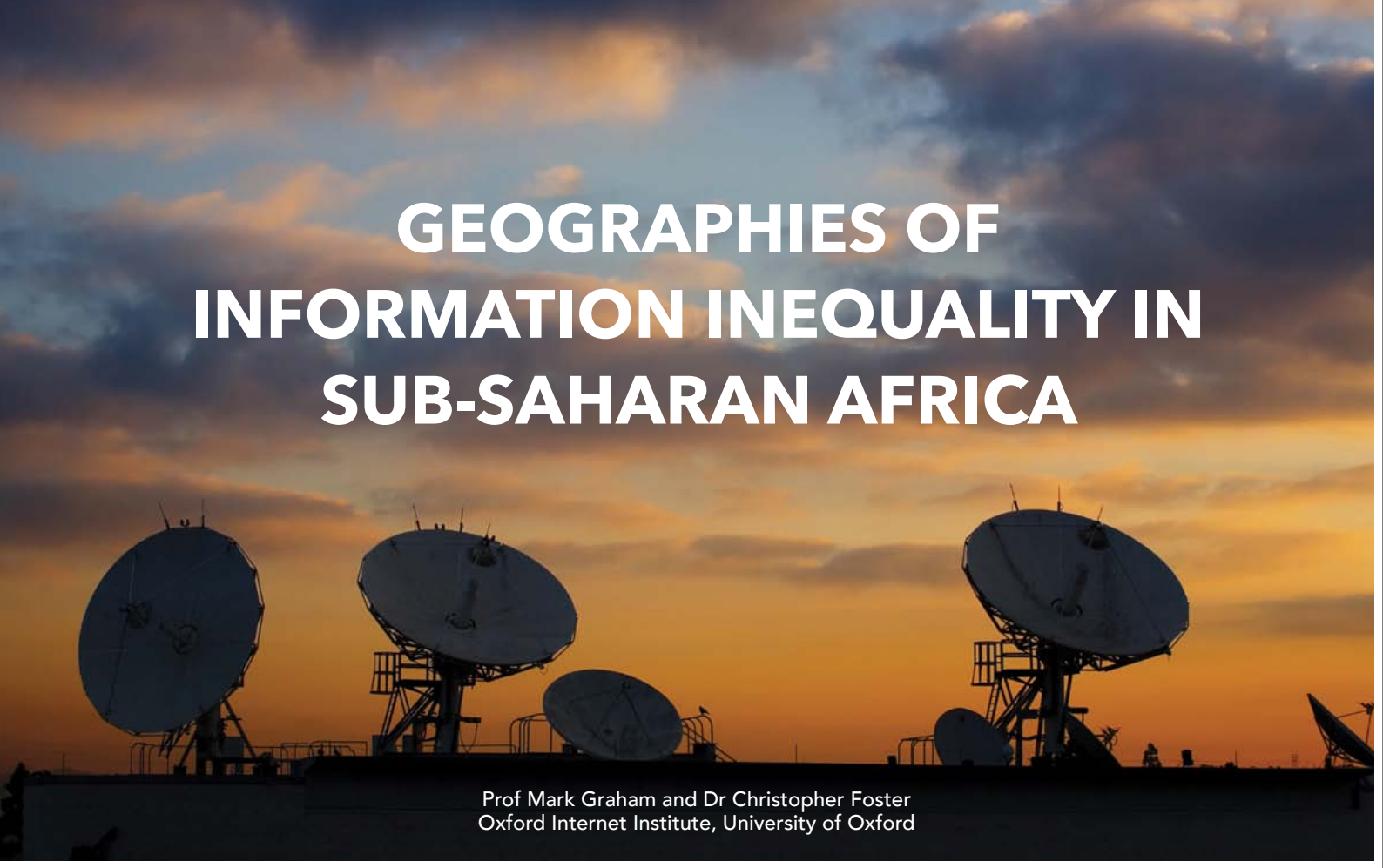

GEOGRAPHIES OF INFORMATION INEQUALITY IN SUB-SAHARAN AFRICA

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Introduction:

Sub-Saharan Africa has traditionally been characterised by stark barriers to telecommunication and flows of information. Rates for long distance phone calls throughout Sub-Saharan Africa (SSA) used to be some of the highest in the world, and Internet costs and speeds similarly were out of the reach of all but the most privileged citizens. However, in the last few years, there have been radical changes to SSA's international connectivity. Fibre-optic cables have been laid throughout the continent and there are now over one hundred and fifty million Internet users and over seven hundred million mobile users in the region.

This rapid transformation in the region's connectivity has encouraged politicians, journalists, academics, and citizens to speak of an ICT-fuelled revolution happening on the continent. Individuals and firms would increasingly be linked into global networks - interacting, selling and using knowledge through this connectivity (Graham & Mann 2013).

This has also been reflected in new ambitions and policy in SSA. For example, in Rwanda (a strong advocate of upgrading connectivity to drive development) the stated policy goal has been to: "transform her subsistence agriculture dominated economy into a service-sector driven high value-added information and knowledge economy that can compete on the global market" (GoR 2001 p.7).

Changing connectivity thus is articulated as a core driver of wider economic change in SSA (Graham et. al. 2015; Graham 2015). It is seen as providing a path for the region to move away from reliance on agriculture and extractive industries and towards a focus on the quaternary and quinary sectors (in other words, the knowledge-based parts of the economy).
However, while much research has been conducted into the impacts of ICTs on older economic processes and practices, there remains surprisingly little research into the emergence of the new informationalized economy in Africa. As such, it is precisely now that we urgently need research to understand what impacts are observable, who benefits, who doesn't, and how these changes match up to our expectations for change. We need to ask if we are seeing a new era of development on the continent fuelled by ICTs, or whether Sub- Saharan Africa's engagement with the global knowledge economy continues to be on terms that reinforce dependence, inequality, underdevelopment, and economic extraversion.

We begin to address this issue by synthesising the outputs of two multi-year research projects that we have carried out which provide in-depth analysis of SSA connectivity use. The first one addresses the effects of changing connectivities on global geographies of voice, representation, and partici-

pation, particularly through exploring the dynamics online platforms, tools and databases. The second project is grounded in in-depth qualitative research, examining the effects of changing connectivity on firms in core sectors of the economy (tea, tourism, and Business Process Outsourcing) in Kenya and Rwanda (see Foster and Graham 2015a, 2015b, Mann et. al. 2015 for full details).

BARRIERS AND EXCLUSIONS

The suggestion that changing connectivity as a result of the laying of fibre-optic cables would lead to an improvement in internet availability and a reduction in costs in SSA is well supported. Changes in physical connectivity have, in part, led to upwards growth in subscription numbers, as highlighted in Figure 1. However, the degree of catch-up in SSA appears limited, Internet use is still limited and well behind the rest of the world.

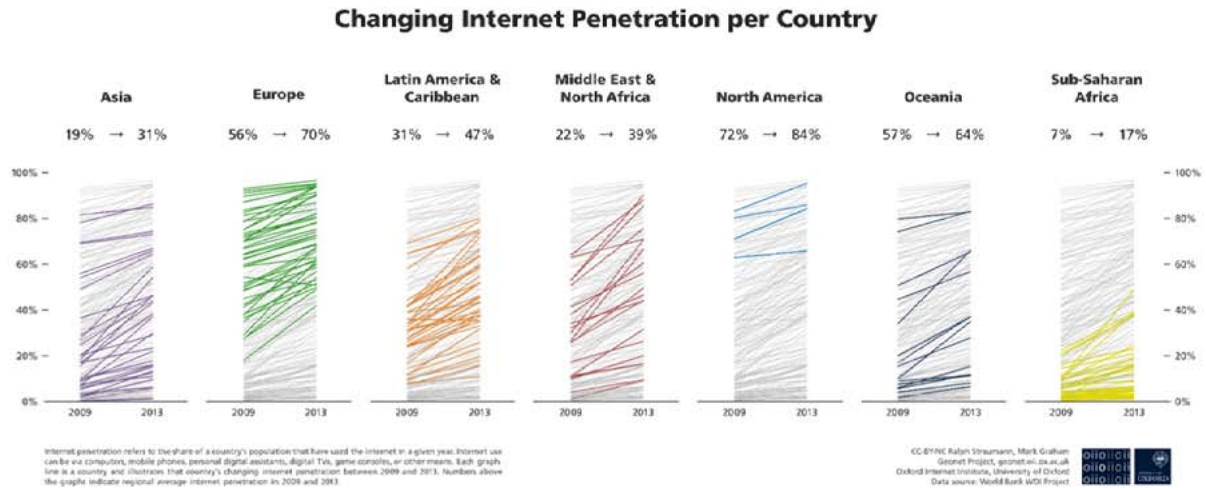


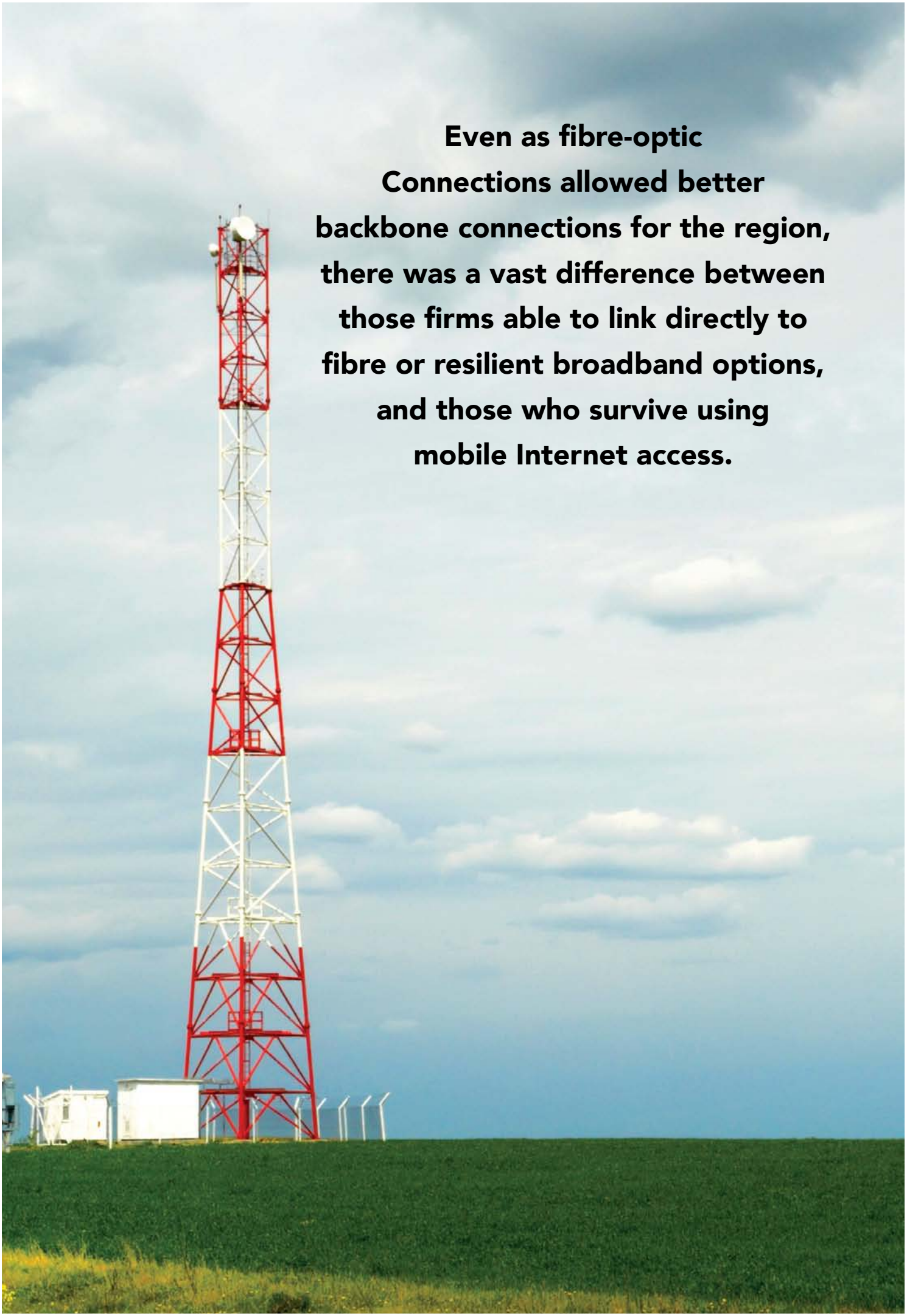
Figure 1: Changing Internet Penetration per Country
Source: Straumann& Graham (2015) Changing Internet Penetration per Country. Geonet: Investigating the Changing Connectivities and Potentials of Sub-Saharan Africa's Knowledge Economy
http://geonet.oii.ox.ac.uk/blog/regional-perspectives-on-internet-penetration/

This jump in internet access and use, however, does not appear to have been as impactful as many had hoped. In our qualitative work in SSA, existing sectors such as export-orientated commodities and tourism, growing internet use has not fundamentally transformed relationships of production and the distribution of value. Meanwhile, new knowledge sectors articulated as the cornerstone of economic 'leap-frogging' appear to comprise of a small number of often struggling firms. Similar outcomes were found in examinations of the geography of coverage and contributions to online platforms. Research on presence of SSA locations within Google searches and Twitter contributions represented minuscule proportions, even allowing for the low penetration.

Our work, in significantly different domains, highlighted barriers that limited the effectiveness of connectivity reducing information inequality. We outline five core categories that conceptualise these barriers: Representation, Contribution, Access-to-information, Connectivity and Non-neutral networks/technologies. Each of these is detailed below:

Representations

We found not only stark inequalities in the amount of information produced from and about different parts of the world, but we also discovered indications that older patterns of informational inclusion and exclusion were being reinforced. The issue is not just that much of SSA left out of the representation on online platforms, tools, and databases. It is also that internet users from SSA often focus their attention on the global informational cores (North America and Western Europe): resulting in patterns of increasing informational poverty and richness (Graham et. al. 2014).



Even as fibre-optic Connections allowed better backbone connections for the region, there was a vast difference between those firms able to link directly to fibre or resilient broadband options, and those who survive using mobile Internet access.

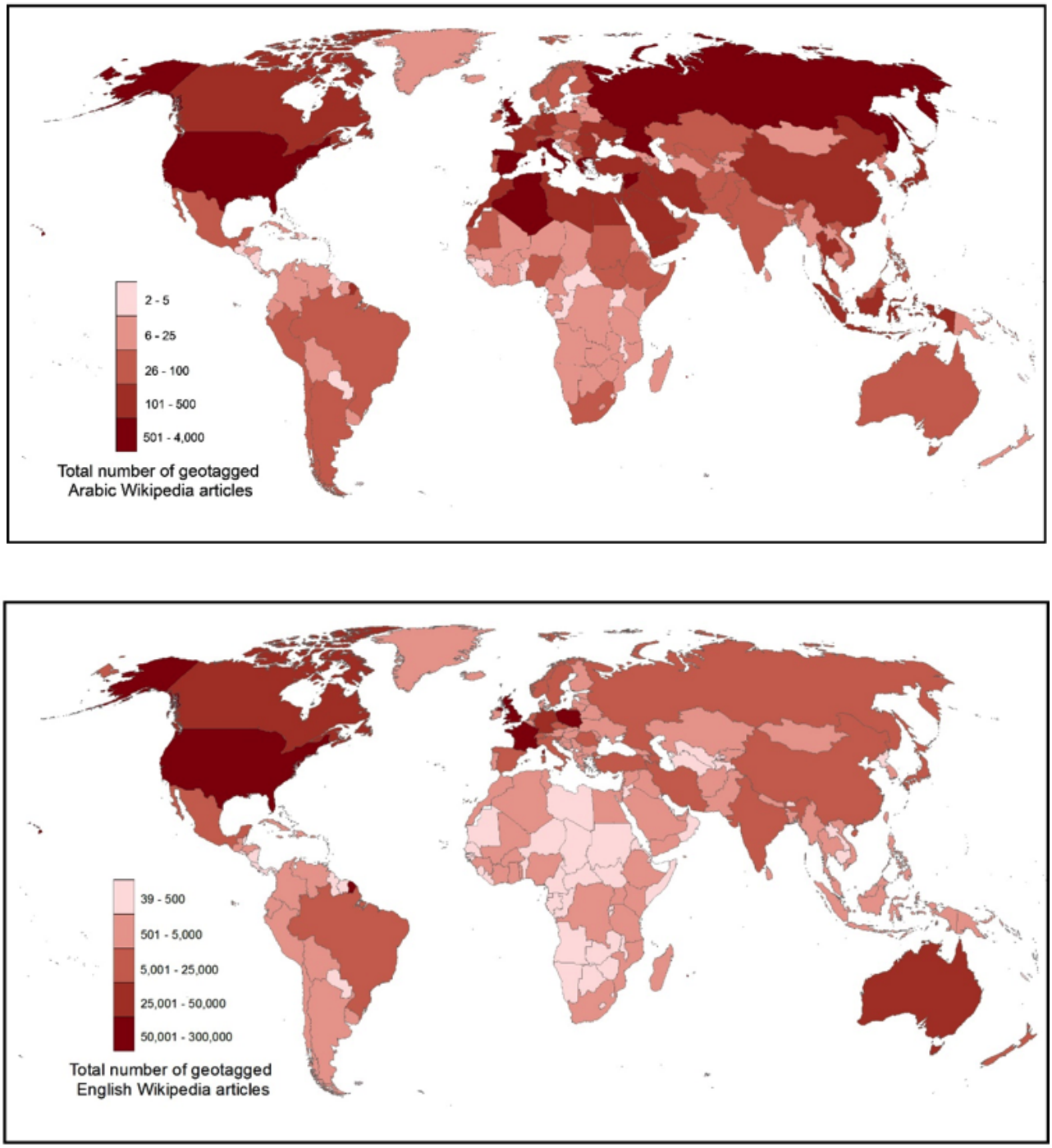


Figure 2: Maps of Articles in Arabic (top) and English (bottom) Wikipedia
Source: Graham et. al. (2014). Note there are more Arabic articles about many European countries than many predominantly Arabic-speaking countries.

Work in the Rwandan tea sector also revealed uneven online representation of processes and products at a more local level. At the level of tea processing and logistics, extensive automation and connection has rendered many parameters of tea production (weight, grade, location of batches) visible online and thus compliant to be analysed, compared and managed. Yet, this was less true for farmer activities. Rural actors involved in tea production are often left relying on guesswork, norms or downward edicts to orientate their growing activities (Foster and Graham 2015a).

At the broadest level, uneven representation is without a doubt one outcome of the uneven global distribution digital connectivity. At the same time, it can also be brought into being by subtle balances of power and choices as highlighted in the tea sector. Representation of knowledge can determine the extent to which information can be employed, applied, put into practice, and integrated into processes. People, places, and practices absent from representations not just lose voice, but also potentially become invisible.

Contributions

We explored a range of platforms and information repositories and found that only a relatively tiny amount of content hosted in online repositories comes from Sub-Saharan Africa (many of our results and maps can be found at geography.oii.ox.ac.uk). Much of this imbalance can't simply be explained away by uneven levels of online access. For instance, if looking at the registration of domain names, there is a domain for every two internet users; whereas the average in the Middle East and Africa is one domain for every fifty internet users (see map below). Similar patterns are evident on every platform that we looked at (e.g. on Wikipedia there are more contributions that come from Hong Kong than all of Africa combined). Furthermore, this small amount of participation from Sub-Saharan Africa has meant that much of the content created about Sub-Saharan Africa comes from the global informational cores.

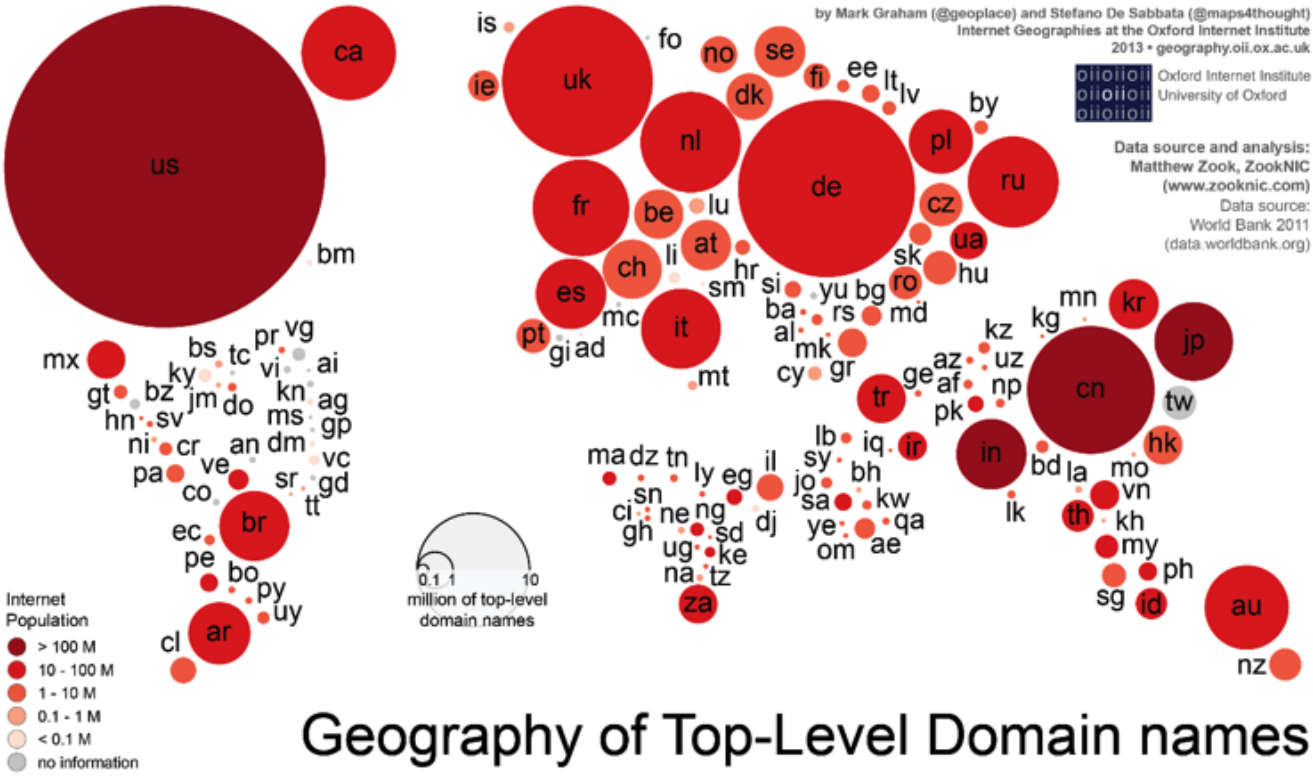


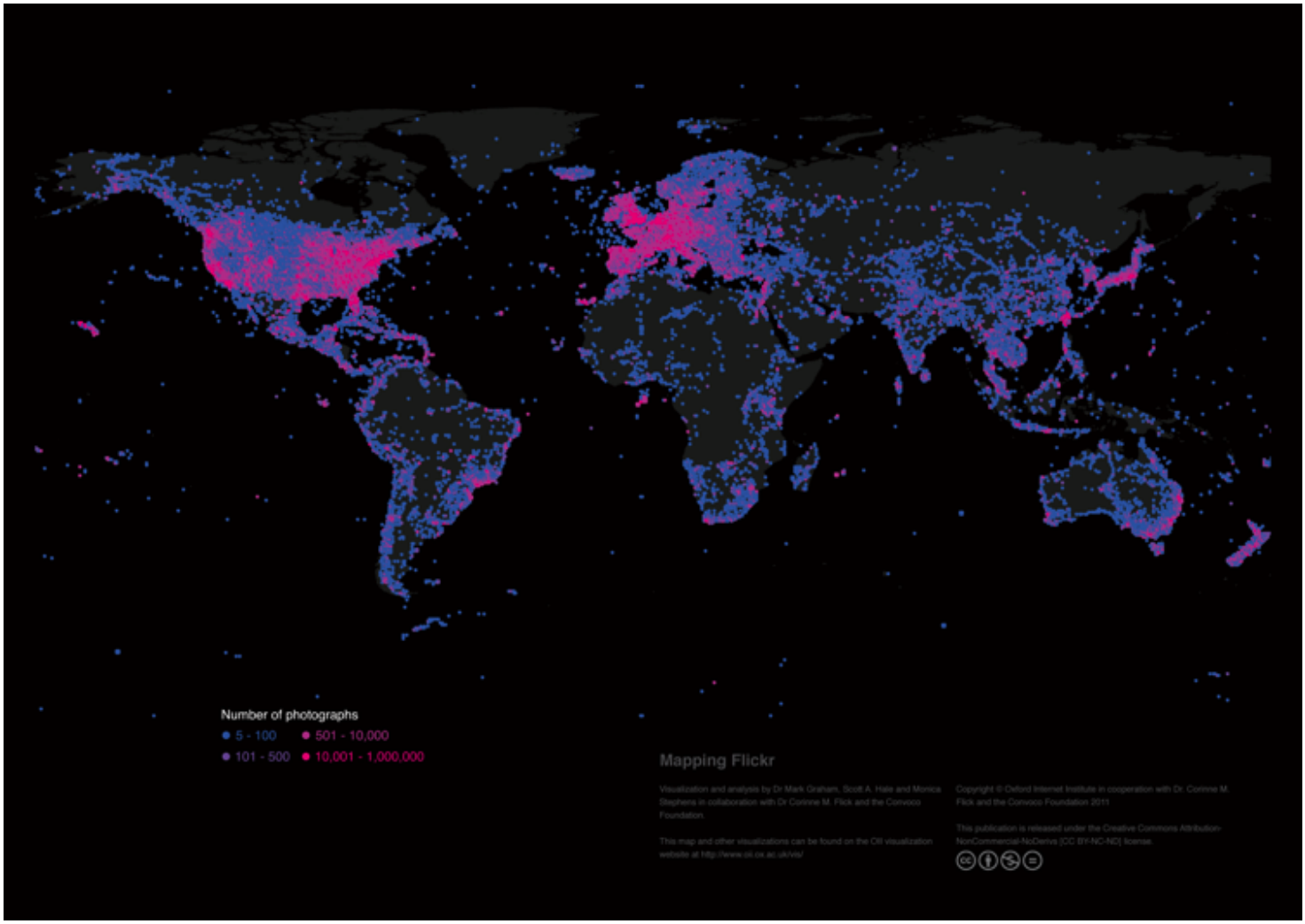
Figure 3: Geography of top level domain names
Source: Graham &Sabatta (2013) drawing on World Bank data

These findings were also mirrored in research on use of the Internet in agriculture in East Africa related to farming processes and information. Whilst some farmers and intermediary representatives (i.e. Co-operatives, NGOs) were aware of the Internet as a source of new information, a lack of locally created knowledge often skewed the types of advice and solutions available online. Information about planting and quality control available online often came from generic, global resources with less relevance to the specificities and context of the region.

These findings not only point to a lack of representation, but also authorship, voice, contributions, and participation; and highlight the need to pay attention to a more subtle politics of knowledge.

Access to information

Being able to access ICTs does not imply that relevant information is suddenly available. In the economic sectors that we looked at, we found cases where certain groups were intentionally excluded from information. More often though, lack of access related to issues where suitable information was difficult to access or inappropriate to the context. For example, in the East African tourism sector, Rwandan tour firms are increasingly connected online, but they have been slow in directly linking to tourists. For tour firms, one limit is lack of access to information on customers and activities to allow them to build compelling products. Sometimes information is hidden behind paywalls not accessible to these firms but there were also cases where useful information (e.g. sources of tourist to the region) were hidden within complex statistics and difficult to understand.



Source: Graham, Hale & Stephens (2013) drawing on flickr data

Connectivity

Even though much infrastructure to support digital connectivity has been built, the ability to digitally connect has distinct geographies. This is especially true if you compare average broadband prices with average yearly income (as we do in the figure below). Doing so reveals stark remaining barriers to connectivity that are particularly experienced in Sub-Saharan Africa.

In East Africa, for instance, even as fibre-optic connections allowed better backbone connections for the region, there was a vast difference between those firms able to link directly to fibre or resilient broadband options, and those who survive using mobile internet access. The latter experienced inconsistent and often saturated connections. These were prone to dropouts and problems related to mobile coverage, service provider issues and liable to be affected by weather conditions.

This was particularly problematic for smaller firms and entrepreneurs who are looking to interact more directly with customers internationally. Network dropouts and saturation can be detrimental to clear consumer interactions and trust. As some of the barriers to accessing backbone connectivity barriers are reduced, what we are therefore seeing is a move from global to new local inequalities around digital access.

Non-neutral networks/technologies

Barriers to effective use of information also exist in the way that ICTs or networks are 'non-neutral'. That is, they may privilege generation or use of certain forms of information over others. For instance, the lower user contributions to Wikipedia from SSA might be linked to the very governance of Wikipedia: which allows only certain kinds of sources and neglects others (e.g. oral sources).

In similar way, digital systems often work within structured templates (e.g. the design of systems and databases) in order for data to be standardised and relatable. Such templates often poorly fitting to the needs of users in SSA. One instance of this is in the Rwanda tourism sector. Rwandan firms were frequently unable to effectively digitally link up with global travel agents because of their inability to digitally codify their complex activities (Foster and Graham 2015b).

TOWARDS DEEPER INTERROGATION OF POWER

In sum, changing connectivity has not fully unleashed the effects that many expected it to. These outcomes will come as no surprise for those familiar with some of the critical literature on the 'digital divide' (Norris 2001, Selwyn 2004, Warschauer 2003, Graham 2011). As Warschauer outlined over a decade ago, for digital inclusion, it is necessary to centralise the wider contexts of development, "an overemphasis on the mere presence of computers or Internet connections, without a corresponding emphasis on social mobilization and transformation, can squander resources while

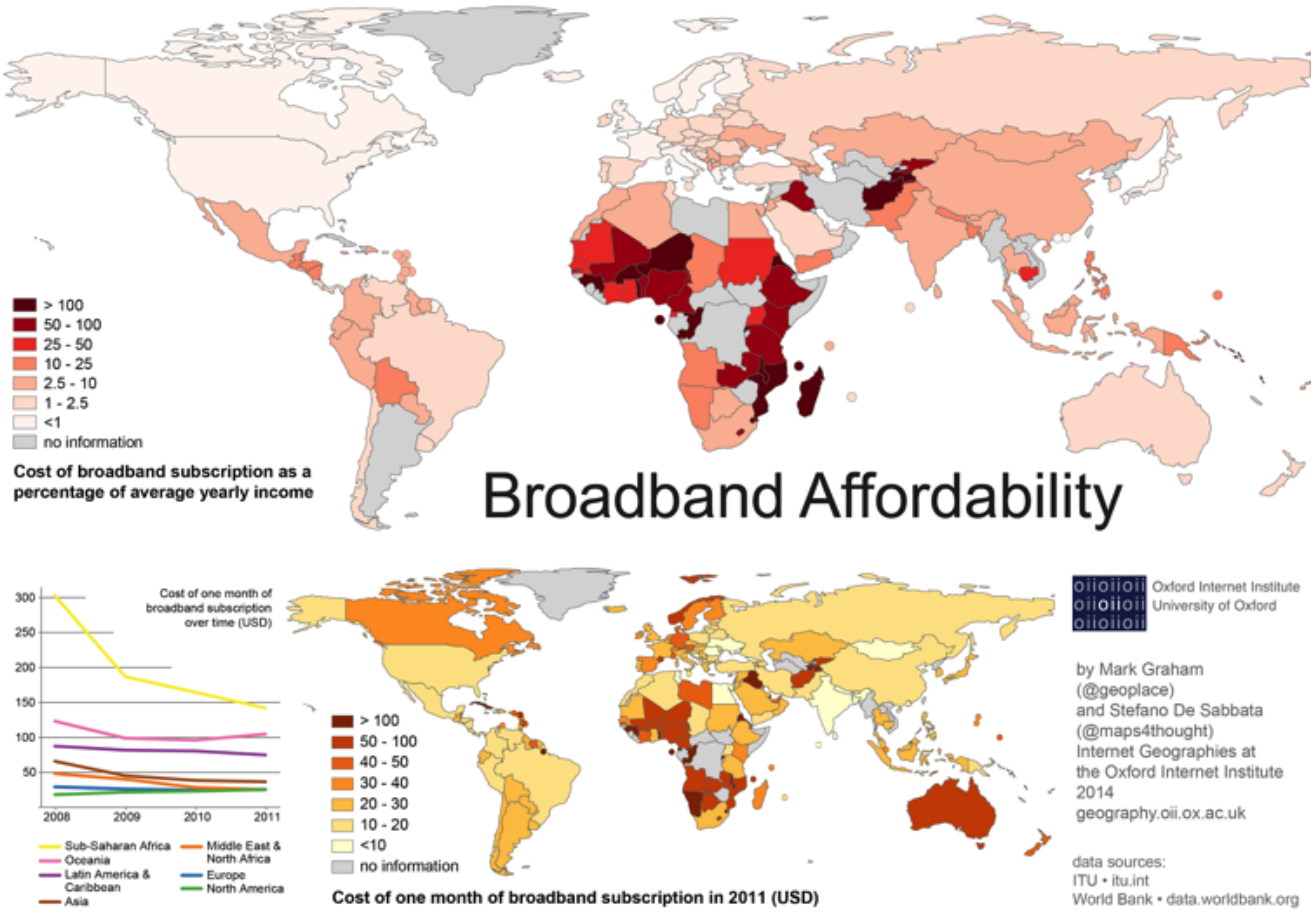


Figure 5: Broadband Affordability. Source: Graham &S De Sabatta (2013) drawing on ITU/World Bank data

leaving inequity intact processes that underlie social development and inclusion" (Warschauer 2003. p.303)

These critiques form the foundation of our understanding of inclusion in network societies. We need to think about connectivity as not just a technical challenge (i.e. concerns about 'penetration'), but a socio-technical one (i.e. skills, costs, culture, etc.).

Our work highlights a further step needed, that goes beyond these rather functional and instrumental approaches to connectivity, towards more dynamic perspectives on power within the network society (Prey 2012). Put differently, the focus should not necessarily be on simple measure of inclusion or exclusion - but rather on power in networks.

Our very understanding of 'connectivity' could therefore be broadened to incorporate both the ways that links/connections/connectivities consolidate or distribute power, and the ways that that power in manifested in voice, representation, and the capture and creation of value.

From such a perspective, many of the barriers in online representation, contribution, access and connectivity that we have observed appear to represent a shift in power away from Sub-Saharan African firms and individuals.

CONCLUSION

Ultimately, this work is a beginning to think about what connectivity means to inclusion in the 'network society.' Connectivity certainly isn't a sufficient condition for inclusion and equity, and we need to ask whether it is a necessary one.

Connectivity, rather, tends to be an amplifier: one that often reinforces rather than reduces inequality. We therefore need to move towards deeper critical socio-economic interrogations of the barriers or structures that limit activity and reproduce digital inequality. The categorisations developed here offer an empirically-driven and systematic way to understand these barriers in more detail.

As the next generation of connectivity projects (e.g. 4G, Facebook's drones, Google's balloons etc.) again draw on the same skewed expectations and goals, we need to loudly call for a more critical approach to understanding such projects. Rhetoric about connectivity needs to be accompanied by a wider debate about how changing connectivities might actually facilitate change in the world, and who changing connectivities might ultimately benefit.

Acknowledgements

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AFRICA'S INFORMATION "REVOLUTION"
POSSIBILITIES AND LIMITATIONS

Dr. Pádraig Carmody, Trinity College Dublin and University of Johannesburg, Prof. James T. Murphy, Clark University

The world economy is characterised by a number of trends; foremost amongst which are financialization and informationalization. Financial services have become highly significant drivers of economic globalization, transnationalizing investor/investment relations and extending the reach of finance capital far beyond traditional centres such as New York, London, and Tokyo. Informationalisation – the increasing ability to access, manage, and process information at a distance – has enabled firms to fragment and/or coordinate their production, exchange, and service-delivery activities across space such that offshoring and outsourcing have become common in most economic sectors.

These two trends are linked as new information and communication technologies (ICTs) – mobile phones, computers, and the internet - have greatly facilitated financial trading and, of course, the informationalization of business activities. In the case of Africa, the rapid and widespread diffusion of mobile phones and, increasingly, smart phones have signalled to some that the region is ready and able to "plug in" effectively to the global networks of capital and information, and to thus empower itself in the world system. ICTs offer particular hope as tools to support development interventions in education, health, and governance, and as means to help integrate African firms into global value chains and international markets. For many in the ICT for development (ICT4D) community, the diffusion of mobile phones, computers, and internet access is a game changer, one that will dramatically increase the quality and accessibility of social services, facilitate growth and innovation, and help to transform African economies such that convergence with the West/North is possible.

While an ICT enabled "Africa Rising" narrative has dominated much of the media discussion over the last decade, financialization and informationalization have not been inevitably or universally positive trends for the region. Capital flows into Africa have increased but to date multi-national investment on the continent has been heavily concentrated in extractive industries such as mining and petroleum. Also recent reports have shown the extent of illicit and legal capital flows out of the continent. The mining and oil sectors are capital, rather than labour-intensive, and are often associated with significant environmental and social problems. Moreover, financial services and investment markets are on the rise throughout the region but speculative trading can have highly negative impacts, particularly when it is accompanied by dramatic swings in commodity prices. The Zambian kwacha lost 44% of its value in 2014-2015 so far on foot of the decline of the copper price, which accounts for about three quarters of Zambian exports. Financialization has occurred in lock-step with informationalization, as trading and investment activities depend heavily on the ability to manage information and communications through the use of ICTs.

As finance and information reshape the pace and direction of globalisation, it is not clear that real, progressive economic transformations are

occurring in conjunction with recent growth spurts throughout Africa. ICTs have become commonplace and the region's connectivity to the World Wide Web has increased dramatically through the installation of new undersea cables. For many commentators in the ICT4D community, the time is thus right or fast approaching for Africa to become a more equal partner in, and beneficiary from, economic globalisation. But how might this progressive, ICT-driven, development dynamic play out in reality and what are the signs that economic and industrialization transformations are taking hold? Our recent book, *Africa's Information Revolution: Technical Regimes and Production Networks in South Africa and Tanzania*, takes on these questions with an emphasis on African-owned enterprises in one manufacturing and one service sector.

In the book our focus is on small, micro, and medium-sized enterprises as many argue that the continent's economic transformation is likely to be driven by upgrading in, and innovation by, these firms. ICTs are thought to serve as levelling technologies and some research has sought to highlight the benefits they bring in relation to marketing, finance, production management, and service provisioning. We examined this issue in detail in order to see what the actual impacts of ICTs have been on small-business development on the continent. Are mobile phones and growing internet access allowing small businesses to transcend geographic constraints and to produce cheaper, better quality products and services and market them overseas? We and our field assistants interviewed more than 200 small, micro, and medium-sized enterprises in South Africa and Tanzania to answer this question. We looked at firms in the wood products sub-sector, primarily in furniture production, and then one of the biggest service industries in both countries – tourism.

There is now a huge literature on the applications of information and communication technology for development (ICT4D), ranging from health care to farming. While not often conceived of in these terms, ICT4D is fundamentally a social movement that is partly funded by large corporations, such as Microsoft, seeking to open up new market opportunities in the Global South. Likewise, European, Asian, and American states are also keen to open up new markets for their companies' products in the "developing" world and have been supportive of initiatives to diffuse mobile phones and other new ICTs in Africa and elsewhere. The academics, entrepreneurs, corporations, and non-governmental organisations (NGOs) that constitute the ICT4D community have developed numerous technologies and applications that are making important, innovative and scalable contributions to improving people's lives and standards of living in Africa. However, it is unclear whether ICT diffusion is resulting in economic diversification and transformations to the structural conditions that have governed the region's (largely extractive) relationships with the global economy for centuries. As we describe, Africa has and does play an important role in the global information economy, but its present economic structure raises questions about the prospects for ICTs to help transform its economies. Specifically, there are three principal roles that the continent plays in the economic changes associated with globalized informationalization. First, it is an essential provider of the raw materials (e.g., coltan – an electrical capacitator) needed in the manufacture of ICTs. Second, African consumers generate significant demand for ICTs, driving manufacturing-led growth in Asia, in particular. Third, Africa serves as a way-station in the life-cycle of ICTs through the importation and processing of second-hand equipment and e-waste that is generated within and outside. Although there are a few "informationalized" niches in the region, e.g., the i-Hub in Nairobi, the digital media industry in Cape Town, these remain marginally positioned in global innovation networks and unable to generate technological spill overs that might help to transform their national economies.

Technology diffusion and adoption alone cannot be expected to ensure economic and industrial transformation, absent structural (political, institutional) changes and the development of other capabilities in production, marketing and other infrastructure, for example. What basic ICT diffusion does do, in part, is make Africans consumers of these technologies and consequently dependent upon foreign producers, particularly China. Moreover, many of the largest mobile phone service providers in Africa are multinational corporations who repatriate profits to their home and other advanced countries, to the detriment of the balance of payments of the countries where the services are provided. For example, Safaricom, which pioneered the iconic M-Pesa mobile money system in Kenya, is largely owned by Vodafone, UK.

What this means is that Africa is primarily integrated into the global information economy as a consumer rather than a producer of these products and services, thereby replicating technological and other forms of dependence. While there are time and other savings and efficiencies from the ability to transfer money from one place to another, this by itself does not necessarily promote investment or substantial local business development. The most fundamental developmental need on the continent is economic diversification, industrial deepening and job creation. This requires African businesses and workers to improve their positions in the world economy – one increasingly driven by ICT-driven information access, flow, and distribution. ICT diffusion then is a potentially promising development for the continent but, as yet, is not substantially changing Africa's place in the world system, a circumstance that looks unlikely to change anytime soon, particularly with the end of the commodity boom.

The challenge for Africa is to construct economic bases which can fund social services and public and other institutions that are supportive of their further deepening and development. If ICTs are quintessentially disruptive technologies in an age of informational capitalism they should be contributing to significant improvements in the scope, scale, and quality of social services. Social services must be paid for, either through tax revenues or aid, and economic re-

structuring and transformation are a prerequisite to their sustainable funding. For example, one study a number of years ago found that those with a secondary education in Ethiopia were more likely to be unemployed, largely because the economy was not creating the types of jobs for which they were qualified and there is an acute shortage of paid jobs more generally. ICTs can contribute to economic diversification by creating effective synergies and complementarities between social service provisioning and economic development, with other appropriate economic and industrial policies. Without these it is likely that Africa's ICT-driven information and communications revolution will remain, at best, a partial effort.

Our research found that the adoption of mobile phones, in particular and perhaps not surprisingly, has been widespread across the businesses we surveyed, and that there were examples, mostly in South Africa, of innovative uses of ICTs. For example, some firms tracked the progress of their inputs from Asia using global positioning systems and another firm emailed furniture designs to another which cut the components using computer numerically controlled machinery. Many firms source ideas for new designs over the internet or use mobile phones to keep in contact with customers. However, in general the applications of new ICTs to production and management are limited. That is to say that although the adoption of these technologies is widespread, their integration has often been relatively shallow or thin. Firms often "tack them on" to their existing ways of doing business rather than using them to fundamentally transform their design, marketing or production capabilities to such an extent that they can increase value creation, enhancement, and capture, through exports for example, although there were some example of firms that were able to do this on a small-scale. This thin form of integration (thintegration) into the global informational economy reproduces rather than transforms pre-existing, and often exploitative, economic relationships within Africa and with international markets.

One of the main benefits of new ICTs are meant to be that they facilitate disintermediation, or the cutting out of "middle (wo) men". However, what we found in the tourism sector is that new intermediaries, which are often foreign-based, are arising, cutting out local tour operators for example. Some of the big booking websites, such as Expedia, booking.com, Trip Advisor or Viator often take substantial commissions, of in some cases, up to 25%. However overseas customers often prefer to use them rather than release their credit card details to small hotels in Africa. Even if they wanted to, many of the companies we spoke to did not have the facilities in place to process credit cards, in any case – a kind of chicken and egg conundrum. This neo-intermediation then creates new forms of monopolisation and surplus extraction, to the benefit of foreign firms, which are difficult to contest. One hotel owner in South Africa told us "you can't negotiate with Expedia. You just do as you are told". Beyond tourism, ICTs also facilitate increased imports of furniture into African economies through intermediaries based locally and abroad. This is driving, in particular, a dramatic increase in Chinese imports which puts intense competitive pressure on local manufacturers who are unable to match China's manufacturing productivity, export subsidies, and favourable exchange rate policies.

Despite the tendency toward thintegration and neo-intermediation, many/most businesses are understandably positive about the impacts of new ICTS and unable to imagine being in business without them. As one South African micro-entrepreneur noted with respect to the importance of ICTs for communication with customers, "without mobile phones we would be starving". Whilst this might seem like an unequivocal benefit for the economy, we argue that there is what some economists call a fallacy of composition at play. Although new ICTs make communications easier and, in some cases, help businesses to create value and grow, most business owners we interviewed were struggling except in cases where they were able to serve higher-value, niche markets (e.g., boutique tourism, high-quality/custom furnishings) protected from the onslaught of imported goods and tourism investments by foreign interests. The ability to differentiate in these ways is determined initially not by ICT use and access but by cultivating relationships with high-value clients and the creation of a favourable reputation within niche markets. Face-to-face interactions and shared experiences are critical for the development of these social and reputational assets, and ICT based communications and productivity improvements marginally contribute to their initial creation.

For most firms, which is to say those competing in mainstream or mass-consumer markets for goods and services, ICTs – especially mobile phones – have become widely used technologies that do little to differentiate enterprises from one another. Such firms use ICTs primarily for communications with customers, workers, and suppliers and there is little evidence of their use in information storage, processing, and management; the kinds of activities associated with knowledge creation, innovation, and industrial upgrading. Without such uses, ICTs cannot be expected to contribute significantly to industrial and economic transformation, but instead serve as basic technologies that allow firms to essentially tread water in highly competitive markets. Even where ICT-enabled communications provide competitive advantages for individual enterprises, the structure of mass markets means that success stories can often yield

contradictory outcomes. They help some new small businesses to establish, but often it is bigger more established firms which can use or leverage them most effectively.

All told, the impacts of ICTs on productivity and quality appear, beyond some time savings, to be relatively marginal for firms struggling to survive in domestic markets, while doing little to expand exports or access to international markets. Producing competitive manufactured goods or internationally traded services requires a much broader range of capabilities, access to finance, social capital, infrastructure, support policies, etc. rather than just access to ICTs.

As the literature indicates, many ICT4D projects fail to create the benefits promised (e.g., one-laptop-per-child) and yet such failures are all too rarely the focus of careful scrutiny. Worse still, some failed projects or approaches continue to be promoted because the coalition of powerful transnational firms and post-industrial countries support them, largely for their own ends, to promote market opening. Acknowledging this reality is not to ignore the fact that new information and communication technologies have made important contributions to African development but to argue that ICT4D initiatives have yet to demonstrate much in the way of structural change with respect to livelihood possibilities, economic diversification, and/or more progressive engagements between African industries and the world economy.

Instead, as in the case of e-development applications in health and other social sectors, ICTs help to ameliorate some of the costs and challenges that Africans face on an everyday basis, serving as palliative tools to improve socioeconomic conditions. These are important contributions, no doubt, but the promise of Africa's information revolution – if there is such a thing – is that it might lead to a transformation of the structural conditions that create the need for palliation in the first place.

Africans, like people elsewhere on the planet value the functionality, services and opportunities, both social and economic, that new ICTs can bring. This is one of the reasons they have been so rapidly adopted on the continent. However, there are also other drivers, including sophisticated marketing campaigns by transnational corporations, social pressures to own these devices and the implicit penalties which arise from exclusion from employment and other economic and social networks which non-adoption results in.

Studies have documented the ways in which people sometimes prefer to put credit on their mobile phones rather than pay their children's school fees, for example. This can be seen as a form of negative adoption, where people feel compelled to spend money on their mobile phones in order to be able to access work as casual labourers for example. In this case adoption is the result of market compulsion, rather than freedom and choice, often to the benefit of foreign investors.

Whilst many technologically deterministic accounts emphasise the overwhelming benefits that new ICTs can bring, we need to temper such narratives with recognition that, as Kransberg put it, "technology is neither good nor bad; nor is it neutral". It depends on the uses to which it is put. Technological adoption is embedded in pre-existing social practices, routines and structures which it in turn helps re-shape. Moreover, technologies have embedded in them valencis or tendencies toward particular outcomes (e.g., guns tend toward violence).

Our research in Africa demonstrates how ICTs, while providing support for pre-existing social, family, and business networks, simultaneously tend to reproduce economic relations that lead to extraversion (i.e., the offshoring of value and profits) and the continued peripheralisation of African manufacturers and service providers in the global economy. Extractive and primary-sector industries are governed increasingly by powerful interests outside the region, and petty trade and commercial activities are becoming key livelihood strategies for many Africans unable to find formal employment in factories and businesses. These trends raise important concerns both with respect to the overly hyped promises of the ICT4D community, and in terms of whether Africa can achieve widespread development absent industrial sectors that are owned and operated locally.

New ICTs can make major contributions not only to African social networks, but also to economic development, through their design and production in Africa. They can also help to create more distributed forms of development if they are absorbed into African firms' practices, such that they facilitate innovation through information collection, processing, analysis and management. This, however, depends on their being integrated into effective industrial and trade strategies which provide infrastructure, finance, subsidies, training, and incentives to upgrade and export. ICTs by themselves are not magic or silver bullets to solve the problems of economic (under)development, but rather can be a piece of the puzzle of how to transform African economies. At the moment it is the world's most powerful economic and political actors which benefit disproportionately from ICTs and informational capitalism. Reworking this will require a broader restructuring of power relations – perhaps not a revolution in the conventional sense of the term, but a strengthening of African states and their reorientation towards developmental rather than regime maintenance objectives. Economic development is fundamentally a political, rather than a technical or indeed technological project.

THE DATA REVOLUTION IN AFRICA

Prof Laura Mann, Assistant Professor, Department of International Development, London School of Economics and Political Science.

For too long researchers and journalists have focused their attention on the end users of mobile technology. We have read story after story extolling the virtues of the mobile phone in Africa. Mobile devices are said to open up new markets and new channels of information, decreasing poverty, increasing civic participation and reducing corruption and crime. But as well-informed readers will undoubtedly be aware, hype abounds when money is to be made. One of the most revolutionary impacts the mobile phone has brought to Africa has been to reveal the vast commercial potential of poor consumers at the "Bottom of the Pyramid". Claims about the poverty-reducing potential of the mobile phone help mobile operators and tech companies better market their products and garner the material support and legitimacy of the non-profit sector. Any virtuous tale about the mobile phone is part truth, part marketing ploy and it is often difficult to untangle the two.

More recently and perhaps more interestingly, scholars and journalists have turned their attention to what has been happening behind the screens of the so-called Mobile Phone Revolution, lifting the cover on the vast potential of the telecommunication network for data gathering, surveillance and analysis. While the farmer on the street is empowered to use her phone to check an address or search for the official price of tea at the Mombasa Tea Auction, the network administrator is empowered to know what all of Kenya's tea farmers (on its network) want to buy or sell at particular times and in particular places. A database of Kenyan farmers might be as valuable to a large pesticide company and a tax authority as the official website of the Mombasa Tea Auction will be for the individual farmer. The mobile phone will bring revolutionary changes but we should not be naïve or complacent about whom is being empowered.

The data gathering potential of the mobile phone network is likely to transform relationships between citizens and states, between consumers and corporate entities, and between corporations and states as well. These transformations are likely to play out in unexpected ways across the varied political and economic contexts of Africa's 54 countries. In places

where states are motivated and anxious about security, this capacity will undoubtedly be used for surveillance and perhaps, political control and closure. In places where politicians are under pressure to tackle poverty and drive economic transformation, data may be used to better understand economic policy-making (and perhaps also political control). And in places where politicians have better things to worry about than security or economic growth, corporations may have a freer hand in using data in unmonitored ways. As has been the case with a lot of past technological innovation, mutually beneficial relationships between states and private sector actors will undoubtedly form around data exhaust pipes.

In the last two years, 'Data for Development' has taken centre stage. The UN has established the Global Pulse lab in New York and established satellites in Kampala and Jakarta. Orange Telecommunications has held two 'Data for Development' challenges releasing West African call records to international researchers and NGOs hoping to use data to solve 'developmental problems". Various North American and European-based universities have used digital data to track diseases and conflict dynamics. African governments and NGOs have been encouraged to work with US and European-based private sector actors to understand how data can be used effectively to improve their activities and have been urged to release their data to those with expertise. The UN Secretary General and the AU have made declarations promoting public-private partnerships as the model for future D4D initiatives. There is a definitive 'win-win' narrative circulating in the air.

It has been said before but it bears repeating: behind every new trend in international development, there is a business opportunity.

Actors within the 'Data for Development' field operate within a particular understanding of 'development'. In many cases, D4D entails improving services and aid programs to the poor. Thus, the 'development' in D4D might be more accurately defined as charity: big data analytics promise to make the provision of that charity more efficient and targeted. For example, D4D might help organisations better target scarce resources, track health crises, monitor poverty and understand different aspects of vulnerability. In countries where the infrastructure for measuring such problems has been under-funded and neglected, D4D might be seen as extremely good news. However, if we take the view that development isn't just about charity but about addressing the underlying condition of dependence and moving beyond it, then we need to start thinking much more about the skills and knowledge being developed within D4D projects and asking more critical questions about the distribution of economic opportunities being facilitated.

Proponents of C.K. Prahalad's book 'Fortune at the Bottom of the Pyramid' claim that poverty reduction and profit-making can and should be combined. Dirty water is both a public health disaster and a business opportunity for water provision companies. Similarly, a mastitis outbreak is both a devastating problem for the dairy farmer and a business opportunity for the pharmaceutical or m-health company. This is all very well. When projects make money, they don't require funding. They become, as some might say, 'sustainable'. However, wouldn't the poverty reduction part of the BOP model would be a whole lot more effective if the profit-making was locally realised and the profits reinvested in the host economy? If a local entrepreneur provides the water or tackles the outbreak, there is indeed a 'win-win' in effect. This is the spirit of capitalism! But if a North American entrepreneur does so and repatriates the profit and expertise back to her Californian home when she decides she wants to start a family, then the win-win becomes rather more tenuous.

So whose learning and innovation is being nurtured within current D4D frameworks?

Data science is a new and innovative field. Data scientists experiment. They make mistakes, often costly, dead-end ones. This is precisely the nature of innovation: risk taking and learning. Innovators need support to learn and make mistakes. They need support to develop the tools and analytical thinking necessary to think new things and discover new applications. Data scientists operating within the D4D field are currently getting that support. They are getting access to public, private and non-profit data sources (often without the consent of the data subjects, or technology user). They benefit from the work of non-profit and government agencies that go out into communities, educate users about the benefits and get people signed up and online. They benefit from research funds from international organisations. They benefit from access to decision-makers and experts. They benefit from the reputational benefits of Corporate Social Responsibility.

With the exception of some small but excellent initiatives like the Data Science Academy and the Dedan Kimathi University of Technology, much of this incipient talent is currently being nurtured outside African economies, in the firms and universities of advanced economies.

Why does it matter?

First, facilitating the flow of data outside Africa into the computers of data scientists in North America or Europe does nothing to alter existing inequalities between African countries and rich countries. African countries such as Kenya, South Africa and Egypt have pools of talented and highly educated university graduates, many of whom are unable to find work. These countries also have outsourcing companies and IT system integration companies with managers who understand local economies and social needs. Given this talent, one might ask why IBM is hosting Open Africa Data jams in New York City. Why do data for development organisations such as Datakind concentrate their training efforts in the technological clusters of rich countries such as New York, San Francisco, Dublin, London and Singapore? Why did almost all of the participants of Orange's first Data for Development challenge in Cote D'Ivoire come from outside Africa?
In short, if we want African econo-

Dirty water is both a public health disaster and a Business opportunity for water provision companies. Similarly, a mastitis outbreak is both a devastating problem for the dairy farmer and a business opportunity for the pharmaceutical or m-health company.

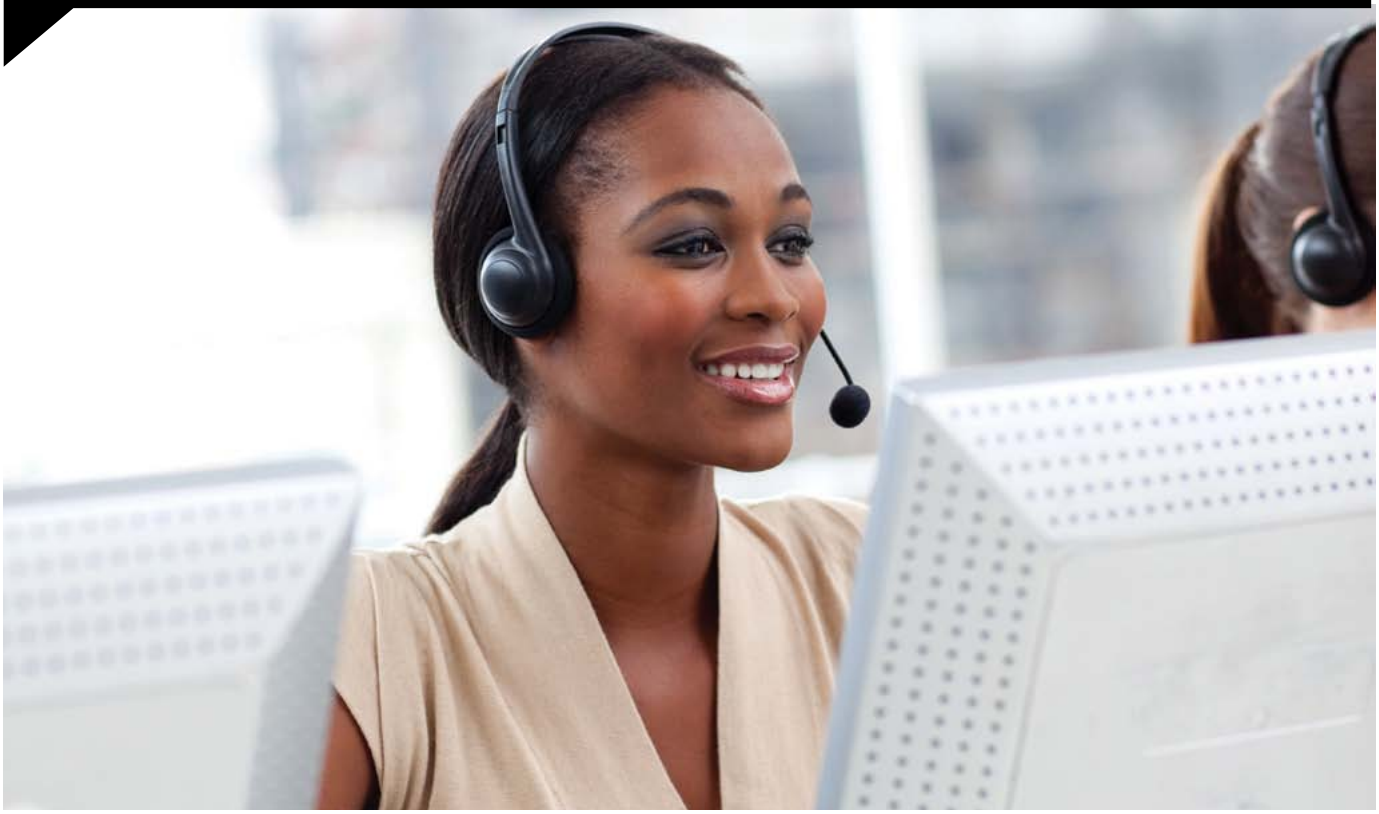
mies to grow, transform and develop, then we need to address these inequalities in expertise. It is not enough to pay lip service to local entrepreneurship in communities like Ihub and Mlab and to declare that M-Pesa is an example of local free-market innovation (while failing to mention its origins within a joint DFID-Vodafone project); rather we need independent research into what is actually happening in African tech hubs beyond the media hype, what kinds of benefits local companies receive from the presence and projects of foreign competitors and what kinds of constraints are holding them back. We also need to acknowledge that many of the core ICT innovations that shape our world of inter-connected devices such as satellite systems or the Internet itself, had their origins in projects funded by the US government and US military. In other words, government support has played and continues to play a role in innovation the world over. As I learned through my interviews in the Oxford-University of Nairobi project (discussed in another article in this magazine), Kenyan BPO/ITES companies are increasingly re-orienting their work towards local companies. Seizing the true value of the data revolution means building up the skills of middle managers and data scientists, and not just low-cost data processors. As I explain down below, it also means ensuring that activists and civil servants have the awareness to hold companies and local governments to account.

Second, there is a very real danger that inequalities in expertise surrounding big data will lead African governments and organisations to make unwise decisions about what kinds of systems are most appropriate to their needs and constituencies. I commonly listen to the woes of lowly civil service staff struggling to implement inappropriate and costly IT solutions because their superiors happened to be convinced by the impressive presentations of foreign consultants. In contrast, a system like India's biometric identity system, Aadhaar, relies on local companies for its implementation and administration. Encouraging local companies means lowering the costs of e-government projects, boosting local economic benefits and potentially building more knowledge within government about how these systems operate and run, and what they are capable of. As any person with even a passing knowledge of data science knows, the real value of big data is not in the data itself nor in the technical expertise required but in the analytical reasoning that puts data insights to good use. It is that marriage of technical expertise and local understandings that leads to innovative uses of the data.

Third, the future is likely to bring dangers as well as opportunities and it is important for African civil society groups to develop an awareness and level of expertise to monitor data-driven forms of surveillance and control. As I mentioned above, I do not believe big data infrastructures are likely to lead to all-powerful technology companies by-passing states. Rather, we are likely to see cosy relationships forming between large technology firms and their public counterparts in government. We have already seen evidence that governments inside and outside of Africa have used ICT infrastructures to police dissidents and track groups considered to threaten public safety and stability. In authoritarian contexts, this capacity could be used to shut down and torment opposition parties or civil society groups. We should also remember that while big data solutions promise to increase efficiency and reduce corruption, the actual tenders for large technology projects often end up in the headlines marred with the same ill they promise to cure: corruption. Technology will never be our saviour without smart people keeping watch and speaking up when things go awry. Given the great push to connect African citizens and consumers to ICTs, financial infrastructures and biometric identity cards, we should be wary of proceeding too quickly without the watchful eyes of strong consumer rights and civil society groups capable of understanding the ethical and privacy implications of increasing personal data flows.

History has shown us that top-down efforts to drive change can sometimes fail stunningly and expensively. Even for a relatively young researcher in her thirties, I am aware of the comings and goings of old wine in new bottles. We should be highly dubious that international experts will be able to solve Africa's 'developmental problems' if only they had more data. We have already learned the importance of local ownership and participation, of the importance of appropriate technology and of listening to what kinds of knowledge and expertise are already on the scene. It is time we applied that wisdom to the new data infrastructures and concentrate on building up the technical and analytical expertise of the real experts in African development: African workers, African activists, African researchers, African civil servants and African businesspeople.

GROWING THE KENYA BUSINESS PROCESS OUTSOURCING SECTOR



Prof. Mark Graham, Prof. Laura Mann, Dr. Nicolas Friederici, Prof. Timothy Waema

The arrival of East Africa's first fibre optic cables in 2009 promised a new beginning for Kenya's economic relationship with the rest of the world. Many hoped the faster and more reliable internet connectivity would boost the country's nascent Business Processing Outsourcing (BPO) sector and create 20,000 direct jobs and 10 Billion Kenyan shillings by 2030 (Graham and Mann 2013).

On addition to early investment into one of the four cables, the Kenyan government called for the creation of a 7,500 seat BPO Park at the Athi River EPZ, an aggressive marketing campaign, targeted training and the establishment of a new Kenya ICT Board to help guide the development of the sector.

A team from the University of Oxford and the University of Nairobi carried out a multi-year (2010-2013) study into the effects of Kenya's changing Internet connectivity on the country's nascent business process outsourcing (BPO) and information technology enabled services (ITES) sectors (for more on this work see Mann et al. 2015). This short paper briefly summarizes some of the key policy implications to emerge from that work.

Key findings in the Kenyan BPO/ ITES sector

The focus on international BPO work has not succeeded as originally envisioned. While some homegrown firms have been able to capture large amounts of work for foreign clients, the Kenyan BPO industry does not have the depth, scale, costs, and training to compete with competitors like India. Kenyan firms have often found most success focusing on the local and regional markets (Mann and Graham 2015). Knowledge of local contexts and the remaining importance of proximity to customers have been important factors here.

The country has been moderately

successful in attracting foreign BPO/ITES firms to Kenya. This success has the dual benefits of enhancing the country's reputation in the area and creating employment. However, there are also potential negative consequences such as crowding out the market for local firms and pushing down wages. Foreign firms are also likely to divide work between geographical locations and often retain high value work in other areas.

Kenya has been able to build a positive and successful brand around the BPO/ITES sector. The power of this brand is not to be underestimated. While the brand is largely based around a few success stories such as Kencall and Horizon in the BPO field and M-Pesa and Ushahidi in the wider ITES field, Nairobi is seen by many businesspeople in Africa and around the world as a city able to thrive in a digital economy. Many Kenyan firms report being able to harness Kenya's digital brand in order to tap into networks, opportunities, and financing.

The arrival of fibre-optic cables has been an important enabler for the BPO/ITES sector. The resultant faster and cheaper connectivity is a necessary condition for firms operating the sector. However, some interviewees complained that costs did not come down as much nor as fast as predicted. Additionally, connectivity alone isn't a sufficient strategy for a thriving BPO/ITES industry (Graham 2015). Other enablers include: affordable and reliable power, easy and affordable access to requisite technology and capital goods, a supportive regulatory environment, programs for skills development, and an ability to make trusted and verifiable payments.

Summary of recommendations

The recommendations that we outline below are derived from the extensive research that we conducted with a variety of stakeholders in the Kenyan BPO/ITES sector.

Adopt a multi-pronged BPO/ITES strategy.
Kenya is currently home to both low-end BPO work (e.g. contact centers and microwork) and some relatively limited high-end ITES work (e.g. software development and financial consulting). The low-end work provides much needed jobs, whilst the high-end work contributes to both value capture and skills development in Kenya. Wherever possible, and in line with the National ICT Master Plan (Government of Kenya, 2013), the country should encourage and support its nascent high-end ITES businesses in order to avoid a low-wage race to the bottom associated with low-end BPO work. But, given the constraints on, and competition in, the high-end market, low-end BPO work will continue to have an important place. In the low-end space, it is unlikely that Kenya will ever be able to compete with the economies of scale that India or the Philippines offer, unless their labor costs rise substantially in future. It will, however, be able to occupy certain strategically useful niches like impact sourcing and customer service for emerging African markets.

Cater to the critical mass of digital adopters in the region.
There are now over 20 million Inter-

net users in Kenya, and many more millions in the East African Community. The proliferation of the Internet into everyday life means that people, businesses, and organizations are creating an unprecedented amount of data and requiring an unprecedented amount of digital and customer services. Kenyan BPO/ITES firms have faced many challenges attempting to find work with foreign clients. However, the rapidly growing local and regional market offers local firms an important competitive advantage. Proximity to customers and an understanding of local contexts and business networks can allow Kenyan firms to gain a foothold and develop expertise in the face of foreign competition.

Encourage knowledge spillovers from foreign BPO/ITES work based in Kenya and build middle management and higher skillsets.

The movement of foreign BPO/ITES firms to Kenya will have positive and negative impacts on the homegrown sector. Many Kenyan BPO/ITES managers see the arrival of foreign firms as a way of enhancing the country's reputation, creating employment, and fostering spillover effects. It is those spillover effects that should be amplified and harnessed. Rather than allowing BPO to be seen as an extractive industry, government and industry associations could work to maximize knowledge spillovers. For high-end work, this strategy could entail continued support of innovation hubs and clusters (particularly outside of Nairobi). Because they often work with non-standardized tasks, high-end software and web developers are most in need of clusters and spaces to interact with other developers, clients, and investors. For low-end work, this strategy could mean re-energizing trade associations and encouraging more cross-sectorial managerial interactions. In both high-end and low-end work, training should not just focus on workers but on managers and middle-managers: a group currently in short supply within the BPO/ITES sector. Enhancing the skills of managers will help Kenya to gain a stronger control over strategic decision-making future and may help to embed the sector more deeply into the local economy and prevent it from becoming 'footloose' to international shifts.

Continue to build the Kenyan brand

In part because of a few high-profile success stories, Kenya is widely perceived to be a thriving technology cluster. The power of this brand should not be underestimated, and many in Kenya's BPO/ITES have used it to their advantage. The Kenyan government could continue to build and strengthen this facet of Kenya's international branding. Concurrently, it will be important to ensure that some firms are not damaging the larger industry's reputation through poor work. Industry-body led training, registration and certification schemes would be able to counter some of those risks.

Financially supporting SMEs

Many Kenyan BPO/ITES firms stress that they are at a disadvantage in tendering processes. Tenders are often configured to require or encourage formal guarantees, foreign backers, or large capital resources. Government departments could potentially loosen some of these tendering requirements. Whilst such a move would increase risk, it would also provide a fertile ground for Kenyan SMEs and entrepreneurs to develop their skills and ultimately expand their businesses. In contrast, the previous subsidy given to the sector (supported by the World Bank) does not appear to have been particularly effective. It encouraged unsustainable practices by some firms and was thus potentially damaging to the industry in the longer term. It could be more useful to further support local venture capital initiatives to invest in promising early-stage firms. Some progress has already been made in this regard. While attending an ICT innovation week in March 2015, the President announced a program called Enterprise Kenya and made an initial commitment of KES 1 billion to it. This fund would be used to support technology (largely ICT) start-up companies with high potential. The setup of this fund is still work in progress. At the same time, the number of technology incubation and acceleration hubs is increasing in Nairobi.

Research and training

There exists little general knowledge about the configuration of global and regional value chains in the BPO/ITES sector. Some Kenyan firms find themselves locked into relatively exploitative business relationships with foreign partners, and others are unclear about whether they want to pursue disintermediated strategies, work with intermediaries, or attempt to become intermediaries themselves. Better understanding the nodes at which value is captured in the BPO/ITES sector could allow Kenyan managers and entrepreneurs to develop more targeted strategies. The government could more explicitly highlight this need through targeted research programs.

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THE MOBILE MONEY EXPERIENCE IN SUB-SAHARAN AFRICA

LESSONS FROM THE INSTITUTE FOR MONEY, TECHNOLOGY & FINANCIAL INCLUSION (IMTFI)

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Think back to 2008: the first iPhone had just been released. M-Pesa, Safaricom's mobile money transfer service, was just beginning to hit the Kenyan countryside. The extent of the global financial crisis was becoming known.

At the University of California, Irvine, south of Los Angeles, researchers had just begun thinking about the collision between mobiles and money. Founded that same year, the Institute for Money, Technology and Financial Inclusion (IMTFI) was in the process of supporting its first set of research projects, in countries ranging from Nigeria to Indonesia. When it funded its first cohort of 17 researchers from around the world in 2009, only a handful were exploring the expansion of mobile money technology. Three of the projects were in sub-Saharan Africa–in Kenya, Botswana and Nigeria. The other projects focused largely on alternative currencies, informal savings practices, and microfinance and microcredit programs. Five years later, in 2014, almost all of IMTFI projects involved research on mobile money, and 50% were being conducted in countries in Africa.

Over these past few years, IMTFI's researchers have used their data to shift the global conversation about mobile money - for example from the sluggishness of uptake to questions about consumer protection, or from mobile money as a simple money transfer service to a whole electronic payments ecosystem. IMTFI has also set the research agenda around issues of community remoteness and mobile money, hierarchical social relations in determining uptake, and the role of deep histories, often much longer than the current quarter or business cycle, in assessing the successes or failures of mobile phone-enabled financial products and services. IMTFI's trajectory has reflected and helped to drive the burgeoning worldwide interest in and expansion of mobile phone technology as an instrument of financial inclusion. Here, we take a closer look at IMTFI's unique methodological approach and highlight its findings over the years to provide key insights into the shifting stakes and new directions for mobile money research in sub-Saharan Africa.

IMTFI's Approach and Methodology

IMTFI, housed in the Department of Anthropology at the University of California, Irvine, specializes in research that explores the intersection of everyday monetary behavior

By Ben Lyon

Mobile Phone with SMS credit in Sierra Leone

and technological change. IMTFI funds original research on cultures of money around the world, and it serves as a clearinghouse for research on the emerging mobile money phenomenon, as well as an archive of people's everyday socio-economic, ritual, and religious engagements with money. It issues an annual call for proposals and invites researchers from around the world to apply for small grants to support projects of 9-12 months in duration. Proposals are reviewed by a team of academics and industry experts. The process is competitive—last year, only 11% of the 192 proposals received were funded. IMTFI uses this process to find researchers interested in money, mobile and technology, who can then contribute to the worldwide discussions about mobile money and financial inclusion.

Over the years IMTFI projects have focused on user perspectives of the social uses and meanings of money and mobile money, design innovation in the mobile money space and qualitative research on the interface of money and the mobile platform. More than 70% of projects are undertaken by scholars and practitioners who are themselves from the countries where they are conducting their research. This international network of scholars has broadened and deepened global understandings of digital financial inclusion by adding voices from the Global South, especially Africa. With an emphasis on in-depth, qualitative approaches to researching people's financial lives, IMTFI informs a range of policy, advocacy, and design agendas.

Monetary Ecologies and Monetary Repertoires

IMTFI's approach to conducting research on people's engagements with mobile money technologies builds on prior work in the anthropology of money as well as industry perspectives. IMTFI has developed the paired concepts of "monetary ecologies" and "monetary repertoires." Monetary ecologies are those assemblages of technologies, objects, animals, people, relationships, forms of property, and methods of record-keeping that, together, make up the world of value and exchange in people's everyday lives. A monetary ecology might consist primarily of paper notes, coins, bankcards and online computers. Or it may involve small herding animals, cattle, family-owned land, kinship relationships, gold jewelry and a small store of cash. Cataloging the various entities and devices (broadly defined) in a person or community's monetary ecology provides the opportunity to understand the relationships and flows among them.

Monetary repertoires refer to all the ways people might use, deploy or manipulate the components of their monetary ecology. This could be the actions a person might undertake with a monetary ecology as well as the skill, style and effectiveness with which they do it - like a conductor with an orchestra. IMTFI's objective then, is to understand the place of mobile money in the shifting monetary ecologies and repertoires within which people operate and make meaning in their lives. Paying attention to a given community's "traditional" monetary pragmatics and attitudes toward finance has been influential in designing new mobile financial services deployments that people will actually use. IMTFI

By Steve McCord

IMTFI researchers mapping mobile money social networks at the 2014 conference workshop.

research suggests that insights like these can only come from engaged, qualitative research with the populations for whom such services are intended.

In-situ Research

IMTFI stresses the importance of researchers who are accepted into and are often from the communities they are studying. The backgrounds of IMTFI researchers allow them to be more attuned to local nuances of how people use and understand money and technology. As part of this methodological approach, IMTFI organizes a conference in Southern California for its funded researchers to present their preliminary findings and receive feedback from their peers. One day of the conference is dedicated to brainstorming about patterns across the countries and field sites, and addressing unanticipated occurrences and findings. This is the time when researchers' own biases and local knowledge get expressed more vividly. In one workshop session, after much deliberation about how informants reported that their mobile money use was largely for school fees, a researcher studying kenya finally threw up her arms in frustration and called everyone out for not discussing what they knew mobile money was often really being used for: male circumcision rituals.

Being from the communities that they are studying gives researchers privileged access to information that can only be gained through their own participation in the community and insertion into social networks and cannot be grasped by (or is often misreported in) large surveys or questionnaires. In the open session at one of the IMTFI conferences, one researcher from Nigeria recounted how he had deposited money in a local bank in Nigeria before going abroad to study, but when he returned the bank had failed and he had lost all his money. This led to a spirited discussion during the closed session, when other researchers openly discussed how no one—not even themselves—trusted the banks in their countries. Thus researchers' own experiences of financial instability contribute to their conclusions about whether, for example, a mobile network operator's mobile money service can be a more reliable instrument for savings than a bank.

In this way, IMTFI researchers bring their own historically and culturally situated understandings to their research, and the workshop sessions allow for moments of self-reflexivity where they can both acknowledge and question their own expectations and assumptions about how money ought to circulate. For instance, one researcher from Ghana casually stated that since someone was a "queen" (of high status) she was supposed to be generous and share her money. He suggested that common statements that "mobile money is only for rich people" sometimes refers not to economic wealth, but social position, expressing dominant normative frameworks of how hierarchy functions in some parts of sub-Saharan Africa. IMTFI researchers' own financial lives and engagements with money are therefore critical for new scholarly reflections on money and technology and lead to new industry-relevant insights.

Shifts in the Mobile Money Landscape: Money Transfer to Money Ecosystem

It is easy to forget that mobile money really began as an ancillary service to microfinance operations that gained prominence in Africa and all around the world with the awarding of the Nobel Peace Prize in 2006 to Muhammad Yunus and the Grameen Bank. But microfinance has always had problems with "back office" operations. Monthly meetings with peo-

By Ivan Small

M-Pesa Kiosk in Nairobi

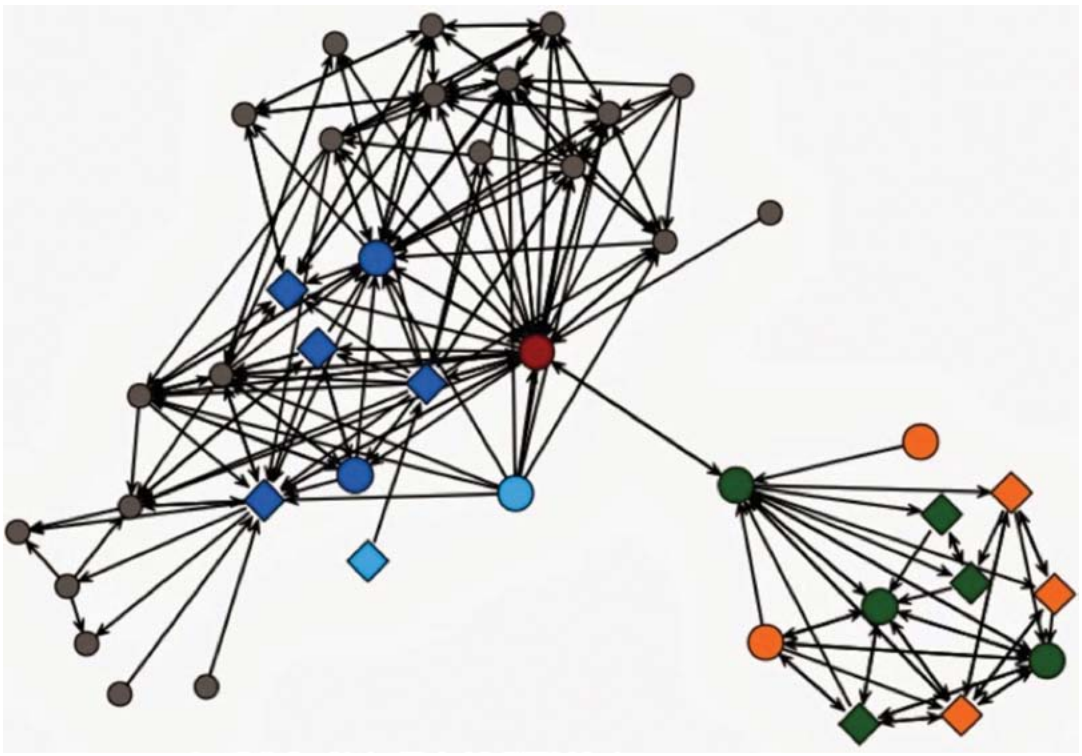
ple exchanging small sums of money needed a central record keeper and accounting system, usually being done by hand. Microfinance donor agencies and technology companies interested in microfinance to impact their own double bottom line saw in the mobile phone a promising solution to facilitate both transfers of money and the back-end accounting and processing of these numerous transactions. It is important to remember that these devices, like the old Nokia mobile phones, had very basic features that in the age of smartphone proliferation seem exceptionally simple. At the time, however, trading cash for electronic value solved many problems all at once, from cash handling to transportation. The risk of theft and the accounting problem were both taken care of by the mobile network operator that could track all the transactions. Mobile money also did not require heavy investment in infrastructure because cell towers could be set up in the countryside and could run on generators rather than being wired into an electricity grid.

If solving the back-end problems of microfinance was the initial motivation for mobile phone-enabled money transfer systems, on the ground and in the donor community there was interest in channeling the service for something more. As the dangers of credit became more apparent, especially in the wake of the global financial crisis, several critiques were levied against microfinance and some began to argue that the mobile phone could be used not just for microcredit, but also for microsavings. The mobile phone was considered to be a good corrective to the problems of microcredit by being a doorway to the formal financial sector - banking and savings. It was anticipated that other services, like insurance and even credit services could be added down the line. There was a big push for this savings agenda at the Global Savings Forum sponsored by the Bill and Melinda Gates Foundation, held in Seattle in November 2010.

Even as some data was coming in that showed various uses of the mobile phone to facilitate small savings—such as people sending money to themselves as a way to prevent them from spending it—other data showed an even wider range of uses. In fact, savings was also problematic: in countries with weak currencies, saving in the form of money might be less rational than saving in the form of land or livestock. People in the mobile money space began to wonder whether the mobile network should be agnostic as to what financial service was carried over it. At the Global Savings Forum, paradoxically perhaps, IMTFI Director Bill Maurer and other partners started wondering aloud whether mobile money was better seen not as a potential savings system, but as an electronic payments system. Could mobile money operate like a payment network that could be used for anything, not just for mini savings banks? This insight led him and other researchers to start exploring how the payments industry in Europe, the United States and the global South actually functioned and to seek to understand the infrastructures that serve as the backbone for any kind of financial product. In the United States, for example, the electronic movement of money is facilitated by the Automated Clearing House (ACH), as well as the debit and credit networks created by banks.

Prompted by the realization that perhaps we should be looking more closely at payment, IMTFI and its researchers did a landscaping exercise of M-Pesa in Kenya. Instead of being proscriptive, they took stock of what was happening on the ground as new businesses and startups popped up to build on top of M-Pesa other kinds of

By Sibel Kusimba



Nodes in Mobile Money Social Networks in Kenya by

services for consumers. Researchers in Nairobi went door to door to see what products these new companies were offering–savings, medical insurance, life insurance, agricultural insurance, different kinds of credit, etc. The conclusions of this study can be found in an article titled "An Emerging Platform: From Money Transfer System to Mobile Money Ecosystem" in MIT's journal *Innovations* where the authors argue that M-Pesa was transitioning from being simply a money transfer system, whether for microfinance or peer-to-peer transactions, into supporting an entire payment ecosystem. By payment ecosystem, the authors mean a service that enables a whole host of other services to operate on top of it, each of which is dependent to some extent on all the others.

With any electronic payment system, there need to be enough opportunities for customers to use electronic value in multiple locations for different products and services. For instance, if there is electronic disbursement of government benefits but no way to pay utility bills electronically, people will just cash out the government benefits and walk over to pay the bill in cash to the electricity company. In order for these mobile money services to really take off, and to provide benefits to people in the form of reducing their reliance on physical cash and the time and distance cash transactions can require—not to mention the threats they pose—a large number of institutions need to be able to accept electronic payments in order to see the multiplier effect of a payment ecosystem.

The World Bank Group's Global Findex Database 2014 shows that sub-Saharan Africa has the highest rate of mobile money penetration, with 12% of adults (64 million adults) having mobile money accounts. Several other studies discuss the explosive growth of mobile money schemes and the large percentage of global mobile money transactions taking place in Africa. While the M-Pesa model in Kenya has been much celebrated, its success is widely attributed to a confluence of specific circumstances that include Safaricom's sizeable national market share and the enabling regulatory environment. While other countries in sub-Saharan Africa evince conditions similar to that of Kenya, with poor financial brick and mortar infrastructure and large unbanked populations, the M-Pesa model has not been easily replicated. This is in large part due to differences in political economic and socio-cultural arrangements, religious practices, and rural-urban and transnational migration patterns—all of which impact cultural sensitivities around money, not to mention the diversity of monetary instruments and their repertoires of use.

Nonetheless, there is a rapidly evolving mobile money ecosystem in sub-Saharan Africa. Providers are finding ways to combine the back-end systems of existing financial institutions with the mobile money platform to offer a range of person-to-person (P2P) and government-to-person (G2P) transfer services and savings, as well as credit and micro insurance products. This developing industry has enabled other mobile-based products and services in the agricultural sector such as providing market prices for crops, weather forecasts and microinsurance for agricultural harvests. A number of health-related mobile applications have also emerged to give health advice and assistance as to well as determine the authenticity of medication.

Cross-border money transfers have proven a particularly difficult use case to solve. There are foreign exchange problems, regulatory differences between countries, and infrastructural incompatibilities, among other issues. Informal channels like hawala have been indispensable for end-users who do not trust or feel they cannot afford other money transfer services. But recently, "pan-African" mobile network operators (MNOs) such as Airtel (Zambia, Rwanda, and DRC) and Tigo (Tanzania and Rwanda) have been expanding their domestic P2P services to facilitate the movement of cross-border remittances. Where their network coverage maps onto existing trans-boundary remittance corridors, we can expect them to be successful.

Enduring questions and the role of deep Histories

Despite these shifts in the assemblage of services, technologies and operators in the mobile money ecosystem, the work supported by IMTFI to date reveals several enduring themes and organizing frameworks for countries in sub-Saharan Africa. Many of these questions echo the concerns of anthropological investigations in Africa long before the advent of mobile money. Sub-Saharan Africa was a major research site for anthropologists due to European colonialism as well as its diverse and complex socio-economic exchange systems. Anthropologists have spent decades studying the ways people in parts of sub-Saharan Africa historically classified and made distinctions between money and non-money "spheres of exchange" that preserved social relationships of status and power particularly through the movement of bride wealth. The money sphere was associated with self-interest and personal consumption whereas exchange in non-money spheres (particularly cattle) was seen to foster social relationships of trust and solidarity. In practice however, hybrid systems prevailed, even though conversions between the two spheres involved some tension. Understandings of historical cultural schema are imperative to frame and situate similar differentiations made between mobile money and other transactions in cash, livestock, or land in contemporary sub-Saharan Africa and to ascertain how mobile money complements or conflicts with existing financial practices.

Rank and Hierarchy

IMTFI has found that rank and hierarchy play a critical role in determining people's perceptions and adoption of mobile money. Rank refers not specifically to socioeconomic status, but a person's position in what are generally descent-based or community-based groups organized hierarchically. Practices of mobile money are often determined by how social relationships are ordered among kin and peers. One consistent pattern found in IMTFI research is the variation in Eastern and Western African countries' mobile money experience. Whereas some of these differences can be attributed to regulatory differences or contrasts in the state of the market and competition among mobile carriers, there are also distinctions in mobile money use based on the ways people have experienced social hierarchy historically in these different regions. In Eastern Africa, mobile money is more easily integrated into pre-existing kin networks. We therefore see a lateral diffusion of mobile money, which permits people to use it to draw in even far-away nodes into their social networks, linking relatives across time and distance (Kusimba et al. 2013). In West Africa, on the other hand, mobile money is seen as something for people of high status that poor clients shy away from adopting it (Dzokoto & Appiah 2014; Omeje 2013); people of higher social or economic status are thus expected to distribute funds through mobile money. IMTFI research shows how these differences in systems of social organization affect how mobile money circulates more horizontally in East Africa than in West Africa where transactions are oriented more vertically.

Researchers who study how people interact with mobile technology have long noted the phenomenon of intermediated use: that is, the person who uses the phone often has assistance from kin, children or friends (see Sambasivan, Cutrell & Nardi 2010). IMTFI researchers too have found that intermediated use plays a key role in mobile money adoption. Our research shows that since mobile money is layered on top of communications networks it also gives expression to and can change social networks. In such networks, specific individuals often become key nodes linking relatives, reactivating relationships, and accumulating power within a group. These can be elders or sometimes even children. In cases from West Africa like Ghana and Nigeria, we also find that intermediated use is hierarchically organized. What this means for the industry is that product designers should not assume that the owner of a phone or the user of a service is necessarily one person—it may be a person plus a helper, and the social characteristics of that helper and his/her relationship to the end user may matter a great deal in how the service or device ultimately gets used.

The sharing of mobile phones by many individuals has been widely documented in Africa and IMTFI researchers show how in Rwanda, for instance, women are more likely to share phones and the owners of mobile phones tend to be wealthier, better educated men (Blumenstock and Eagle 2012). In a recent discussion with MasterCard's Inclusion Hub, the IMTFI team advocated for any good financial inclusion strategy to take gender into account. Several IMTFI studies have shown how mobile money has led to the empowerment and social and financial inclusion of women in rural and urban contexts. Research from Southern Uganda shows how rural women have benefitted from access to mobile phones and mobile money, especially for support from kin during times of crisis and need (Guma 2015). In Kenya, we see that women, grandmothers in particular, have gained power as brokers that manage the flow of mobile money through social networks of trust and reciprocity (Kusimba et al. 2013). While mobile money technology has provided new financial and livelihood opportunities for many women and women's groups in Africa, IMTFI researchers also provide reminders of the persistence of hierarchically defined gender roles and experiences of financial exclusion and poverty experienced by more vulnerable groups of women, such as those with disabilities (Kiiti and Mutinda 2011).

By Sibel Kusimba

Coming of Age Ceremony in Kenya

Ritual and Religion

Research also shows that mobile money is not just about economic exchange but is influenced greatly by social practices of ritual and religion. Anthropologists have demonstrated extensively that despite the constant emphasis in sub-Saharan Africa on communal ties, reciprocal obligations, and notions of "wealth in people," hierarchies based on gender, age-sets, lineage, ancestors and deities are pervasive and often strengthened through ritual. However, in the context of shifting rural/urban labor arrangements, kinship networks and domestic and international migration patterns, mobile-money as a new channel of monetary transfer and store of wealth is often seen as disturbing or undermining traditional hierarchies by redirecting value flows.

The work of several IMTFI researchers supports these claims and also shows how ritual and religion sustains differentiated uses of money to uphold traditional kin relations, hierarchies and social institutions. For instance, in coming-of-age circumcision ceremonies in Kenya, M-Pesa is used for hidden transactions as a "contingency fund," whereas cattle is used to publicly express the continuity and solidarity of the patriline as well as an informal savings mechanism (Kusimba et al. 2015). In Nigeria, borrowing and saving from deities is common and chief priests have the final word in financial matters (Kenechi and Uchenna 2015; Omeje 2013). In rural Ghana, the "dead decide" the ends toward which mobile money can be used but the ancestors themselves do not accept fees in mobile money because they want their worldly intermediaries to touch the cold, hard cash (Santuah 2015); in urban Ghana the intangible and invisible nature of mobile-based contributions make them undesirable in church activities such as funerals and weddings where donations are markers of status and religious merit that have to be seen (Dzokoto & Appiah 2014).

The importance of visible cash donations for ritual have also been documented in Ethiopia and show that for mobile money to be adopted into these practices, design features will have to include ways of personalizing gifts and recording contributions to religious institutions (Mesfin 2012). In addition to the ritual uses of cash, IMTFI researchers also stress taking the preference for cash more seriously because of the larger social, moral and "spiritual" functions it fulfills in cultivating and nurturing social relationships through face-to-face interactions that go beyond just monetary exchange (Omwansa and Waema 2014).

Stickiness of Trust

Social lending groups, such as ROSCAs, have long been viewed as effective financial strategies for the poor because their group nature contains mechanisms for building and maintaining trust. Digitizing such groups is sometimes a goal of mobile money projects. Yet there are more kinds of groups and more kinds of trust than the academic or policy literature is generally attuned to. IMTFI researchers paint a more complex picture of trust and the role of groups by considering men's gambling groups formed around sports betting in Uganda (Yawe and Ssengooba 2014); old forms of informal banking such

Isaac B. Oluwatayo and Titilayo B. Oluwatayo

Small ruminants as sources of financial security in Nigeria

as Susu savings operations in Ghana (Osei-Assibey 2014); as well as how mobile money facilitates and extends *njangi* sociality and social solidarity in Cameroon (Nyamnjoh and Fuh 2014). Trust in different instruments in a monetary ecology is also a critical site of inquiry and is embedded in deep contextual histories. People in many countries of the global South have in their own or their parents' lifetimes experienced profound economic shocks, political crisis, violence and displacement, and the failure of institutions. These histories help account for why, for instance, banks may be more trusted in some countries than others. Insights from IMTFI researchers also show that people prefer to store value in gold or buy land or plant trees as more stable long term investments or in small animals or ruminants (Oluwatayo & Oluwatayo 2012).

There is a large body of literature on the "illiquidity preference" of the poor and we see this preference endure in Africa with the introduction of mobile money. Even in cases where mobile money services have developed around more formal services relying on "institutional trust" in banks, unreliable network quality can undermine trust in the service and affect adoption rates (Nartey and David-West 2015). IMTFI studies also show the ways long standing systems of money transfer such as hawala and newer technologies like mobile money get reinvented and play a critical role in providing security and mobility during times of political volatility, forced migration and displacement, as seen in the case of Somali refugees (Iazzolino 2014). On the other hand, amidst its lack of international recognition as an independent nation state, in Somaliland we see how mobile money service Zaad capitalizes on trust in US Dollars by enabling the transfer and storage of hard currency at a time of economic and political instability and profound mistrust in Somaliland's state institutions (Iazzolino 2015).

Future Directions for Mobile Money Research

How people handle, count, store, hide, show off, and even alter their money lends insight into broader understandings of value and impacts how people adopt a new technology of money. A deeper understanding of the several instruments that constitute monetary ecologies alongside mobile money will also allow designers to develop products, services and interfaces that target the specific uses of the mobile platform and reflect everyday practices of earmarking¬–that is, setting aside different stores of money for special uses. Attention to denomination, metadata and the aesthetics of mobile money (Mesfin 2014) could offer specific insights for design solutions and improvements of the user interface. Such solutions might, for example, take into account the needs of populations such as the illiterate, develop voice-enabled software for mobile money transactions, or offer transfer amounts in multiples of numbers that are consistent with local systems of accounting. Research can, in short, help the industry design more socioculturally appropriate products and services (see also IMTFI Design Principles 2010).

IMTFI research, for example on ATM fraud in Nigeria (Tade and

DO USERS VIEW MOBILE MONEY AS A GOVERNMENT SERVICE, A PROFIT-ORIENTED BUSINESS OR A DONOR-DRIVEN ENTERPRISE?

Adeniyi 2014), shows that there is a need for more work on fraud and data privacy in mobile money systems, particularly as they get linked to biometric identification systems, suggesting avenues for consumer protection for mobile money users (Donovan 2013). IMTFI researchers have spotlighted the specific needs of vulnerable populations, such as the elderly and the visually impaired (Kiiti and Mutinda 2011). While there is overall consensus about the urgent need for development policy to address women's financial inclusion, more consideration is required of the specific culturally embedded and differentiated ways that women and adolescent girls use and deploy mobile technology; a theme being explored by some of IMTFI's current cohort of researchers in Nigeria, Kenya and Ivory Coast. A closer look at the curricula, trainings and strategies of financial literacy and education programs is also of particular importance to understand their role in mobile money adoption. Initiatives such as the Bank of Zambia's National Strategy on Financial Education and its Financial Literacy Week 2014 would be a good test case to see how mobile money is explained and advocated for, and whether the way mobile money is presented in educational materials starts from an understanding of what people are doing with it now.

The bundling of different mobile-based financial services (bill pay, credit and microinsurance etc.) and other e-services in sectors like health, agriculture, disaster management and social assistance programs needs to be further investigated in relation to money transfer. One IMTFI study shows how clients used M-Pesa more when it was bundled with more complex financial services such as microfinance loan receipt and repayment (Omwansa and Waema 2014). Another IMTFI study, currently in progress, is examining services such as M-Shwari for M-Pesa customers operating small-to-medium-sized informal businesses in the Jua Kali sector (Kiiti et al. 2014). Such work needs to be elaborated upon, alongside inquiries into new cross-border remittance services provided through tie-ups such as Tigo (Tanzania and Rwanda), and between Safaricom (Kenya) and Vodacom (Tanzania) to see how they affect mobile money adoption.

To further unpack the stubborn nature of trust in mobile money uptake, a firmer grasp on mobile money users' (and non-users') sense of who or what is behind the service would be beneficial. Do users view mobile money as a government service, a profit-oriented business or a donor-driven enterprise? Do they lump it with other services or institutions like banks or particular government agencies? Answers to some of these questions could provide a better understanding of how trust in these institutions or organizations, or the reliability of infrastructure, attaches itself to associated mobile money services. It also helps assess the potential benefits–as well as the possible pitfalls–of financial inclusion, understood as the greater incorporation into (and dependence on) corporate- or government-run financial services as opposed to communal, familial and/or traditional practices.

Meanwhile, the technological landscape is shifting—rapidly. Smart phones are achieving wide distribution. The rise of the smart phone will bring with it a series of network shits and platform shifts. How will people adapt to these shifts, just as they are beginning to use mobile money more and more successfully to manage their everyday financial lives? Furthermore, smart phones are much more data-intensive devices than feature phones. How will people and companies think about, manage and use this data? What opportunities and pitfalls lie in the rise of Big Data for mobile money? Finally, smart phones require a lot more electricity. IMTFI has consistently argued that we cannot understand mobile money separate from the other infrastructures—such as the electrical grid—on which it relies. If there is room to expand the financial inclusion research agenda to include, say, goats, there must also be room for it to include electricity provision.

Since 2008, the Institute for Money, Technology and Financial Inclusion has developed a rich archive of the use cases for money, mobiles and mobile money throughout the world. It has done so by fostering a globally distributed and locally embedded network of researchers who add their unique perspectives and in-depth, grounded observations to the larger conversation on digital financial inclusion. In the process, IMTFI has contributed insights that inform academic, policy and industry discussions. It has also perhaps generated more questions and provided fodder for future debates, all the while keeping a watchful eye on how technology is changing the future of money in sub-Saharan Africa and beyond.

For more information, please visit www.imtfi.uci.edu, or read Bill Maurer's new book, How Would You Like to Pay? How Technology is Changing the Future of Money (Duke University Press, 2015).

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MOBILE TECHNOLOGY MEETS SOCIAL INNOVATION

Ken Banks
Founder of kiwanja.net and creator of FrontlineSMS

Talk is good, or so they say. But too much talk and not enough action isn't. After working for the past twelve years in the technology-for-development (ICT4D) field, I'm beginning to feel that talking is pretty much all it does, and that everything we could have said has, by now, been said. Actions speak louder than words. This is my call to action.


Magdalena Paluchowska / Shutterstock.com

But first, back to the beginning. It was late 2002 that I got my first taste of the fledgling world of mobiles for development (m4d), focusing initially on Africa. Back then people's general reaction to my work was one of surprise. 'Do they have mobile phones in Africa? Can Africans afford mobile phones? Do they have coverage?' While back then it was unclear whether mobile technology did have true development potential, today it is a surprise to meet anyone who thinks they don't (Banks and Burge 2004). It's been quite a turnaround.

Of course, a lot has happened over those 12 years. Driven by the private sector – not the aid industry – mobile coverage and services have grown exponentially, call costs have come down (although still not enough for some people) and handsets are a fraction of their original price. The real game changer, however, was the introduction of pre-pay. The pay-as-you-go model opened up access to the vast numbers of people previously excluded because they lacked a fixed address, a bank account or a credit history – or all three. Across Africa this model still accounts for the vast majority of connections. According to the GSMA's Mobile for Development Intelligence (MDI) portal, it remains over 90 percent, an almost mirror image of much of the so-called

developed world (where contract-based service plans predominate) (GSMA Intelligence).

Making sure we make the most of the incredible opportunity mobile presents has taken up much of the last 12 years of my professional life. My experience of the African continent began ten years earlier in 1993 when I visited Zambia to help build a school. Since then I've returned to live and work on the continent on many occasions, always spending time with grassroots non-profit organizations, the majority of which were locally run. With a deep understanding of the problems and challenges they faced, it was no surprise that the initial focus of my work in mobile was to be there. As mobile phones began to show their development potential they were the ones, I feared, who would be left behind. There were signs that, by focusing on the top tier of non-profits in the developing world – those with funding, access and resources - we were leaving those further down behind, and few people seemed to be paying any attention.

My response was to build a tool which would specifically meet the needs of that grassroots community. The idea for FrontlineSMS came about in early 2005 one rainy Saturday evening in Cambridge, UK. Over the previous two years I had been working extensively in South Africa and Mozambique with a South African NGO on a contract with the oldest international conservation organization in the world – Fauna & Flora International. We were looking at ways national parks could use information and communications technologies (ICTs) to better communicate with local communities – something that has traditionally been problematic. Since SMS (text messaging) usage was just beginning its astronomical climb, it seemed like an obvious communications tool to consider.

While many solutions at the time were being developed around something many grassroots communities didn't have – the Internet – FrontlineSMS focused on leveraging what they did. By connecting a mobile phone or a GSM dongle to a laptop computer, messages could be sent and received directly via the mobile network without the need for the Internet, without the need for expensive equipment and without the need for complex technical training. Today, as increasing numbers of both grassroots and international nonprofits find themselves working in places with Internet access, FrontlineSMS has evolved to offer a highly-scalable, web-based solution called Frontline Cloud.

But it's not only the spread of Internet access and mobile coverage – or the lower costs of handsets and calls – that has changed in recent years. We're also beginning to experience a shift in how technology-for-development solutions themselves are identified and developed. It's a disruptive shift that threatens the status quo – which is why I like to call it ICT4D's 'inconvenient truth' (Banks 2012a).
Unlike a decade or so ago, across the African continent today a tech-savvy program with access to a computer, cheap mobile phone, software development kit and the kind of entrepreneurial flare which many Africans have in abundance, possesses all the tools they need to solve a business, technical or social problem without the need for the intervention of the ICT4D community.

Innovation around the mobile phone has been particularly interesting in Africa for some time, often because it is born out of necessity. What's more, many African countries present an interesting environment where innovation in services is as common as innovation in hardware and software. If there's one thing I've noticed over the past 20 years working on-and-off across the continent, it's that Africans are not the passive recipients of technology many people seem to think they are.

In fact, some of the more exciting and innovative mobile services around today have emerged as a result of ingenious indigenous use of the technology. Services such as 'Call Me' – where customers on many African networks can send a fixed number of free messages per day when they're out of credit requesting someone to call them – came about as a result of people 'flashing' or 'beeping' their friends (in other words, calling their phones and hanging up to indicate that they wanted to talk). Today's more formal and official Call-Me-style services have come about as a direct result of this entrepreneurial behavior.

The concept of mobile payments did, too. In increasing numbers of African countries it is possible to pay for goods and services through your mobile phone, something which remains a distant hope for most people in so-called developed countries. Users in rural Uganda were figuring out innovative ways of using their phones to make payments long before Vodafone and Safaricom formalized the service under the guise of M-Pesa (Banks 2012b).

Local innovators are also at work in the middle ground between the grassroots and the more formalized private sector. Here, talented individuals are building all manner of solutions to all manner of problems. You only have to look through sites like Afrigadget, which proudly showcases African ingenuity, to see the kinds of things that are possible even in resource-strapped environments.

Things like Pascal Katana's 'Fish Detector' which, with the aid of a mobile phone, is able to acoustically detect shawls of fish and alert nearby fishermen by SMS. Or Morris Mbetsa's 'Block & Track' mobile phone-based anti-theft and vehicle tracking system.

Both innovations are equally ingenious, but the innovators backgrounds couldn't be more contrasting. While Pascal developed his idea while he was a fourth year student at the Department of Electrical and Information Engineering at the University of Nairobi, Morris had no formal electronics training at all. All they have in common is that they're both from Kenya,

Photo: Ken Banks.

Bushbuckridge, on the edges of Kruger National Park (2003): The early inspiration for FrontlineSMS.

smart, interested in tackling real problems and highly entrepreneurial.

Spotting and nurturing this kind of talent is critical to the growth of the ICT sector in East Africa, and universities are increasingly at the center of this new push. A number of initiatives today continue the earlier pioneering work of Nathan Eagle, a professor at the Massachusetts Institute of Technology who, through his Entrepreneurial Programming and Research on Mobiles (EPROM) initiative introduced the idea of mobile phone programming courses to many of East Africa's Computer Science departments, nearly a decade ago.

We have three reasons to be optimistic about the future in this part of the continent. Firstly, momentum is building on the education front, with increasing opportunities for students to learn how to program and innovate around mobile, the most widely adopted technology in use in many of their countries today. Secondly, more mobile devices are now being shipped to Africa with data capabilities than without. If it hasn't happened already, soon the majority of consumers will possess a device with the potential to connect to the Internet, spurring a whole new raft of opportunities for budding innovators and entrepreneurs. Finally, wireless technologies – likely a mixture of GSM and Wimax, and maybe others – will likely be the solution to sharing East Africa's newfound bandwidth among the majority of its citizens. Google is even experimenting with balloons. Facebook with drones. Increased coverage, particularly in the so-called last mile, represents further opportunities, particularly for the development sector who at present struggle to reach many of the people there.

This rise of home-grown developer communities is happening at a time of increased interest in the potential for mobile-based tools to solve social and environmental problems around the world. In fact there's something of an industry building up around it. Although things are slowly changing, many ICT4D tools continue to be developed as far away from the problem as you can get and then 'transplanted' into an unsuspecting community in the guise of a 'pilot'. When these projects fail, as many do, rarely is the technology or the approach blamed, however inappropriate they may have been. But this is exactly what often happens – inappropriate technologies implemented in inappropriate ways. There are lessons we can learn from projects that have gone before and lessons we can learn from projects which have gone on to reach global levels of deployment.

To reach its full potential, the ICT4D community needs to address these three key problem areas in the short- to medium term.

1. Executing best practice. Technology races ahead at a breathtaking pace, but behavior change chugs along in a much lower gear. As I remind people when I speak at conferences, technology is the easy bit – people (and their habits and expectations) are far more difficult to manage. Thanks to rampant innovation in the commercial sector, the ICT4D community has even more toys to play with than it did a year or two ago. However, so much of what it debates – and practices – remains the same year after year. 'Understand the problem before tackling the technology, put the user first, build tools and not solutions, learn from your failures, and don't reinvent the wheel, use appropriate technologies' and so on. How many more conferences do we need before we finally settle on a set of best practices? We should know by now what is and what isn't a good way to run an ICT4D project. Let's instead match best practice against projects, and let's ensure they become an intrinsic part of the development process rather than simple sound bites and tweets.

2. Keeping the tech real. New technologies lead to hype, which in turn leads to new conversations and new big ideas – as if earlier problems had been solved. It's unfortunate that

This rise of home-grown developer communities is happening at a time of increased interest in the potential for mobile-based tools to solve social and environmental problems around the world.

attention spans seem to decrease as rates of innovation increase, and it's easy to be distracted from the technological reality for much of the planet in the age of the ultra-smartphone and iPad. Trumpeting the need for 'appropriate technologies' at a development conference is only helpful if people don't then run off and build iPad 2 apps for African farmers. The reality is that we're still figuring out how to best use text messaging in a development capacity, and that particular technology has been around for years. In short, the ICT4D community needs to keep its technology choices firmly rooted in what's appropriate for their users, not what's newly available in their local store.

3. Mainstreaming ICT4D. Finally, ICT4D and m4d need to go mainstream within the varying sectors of development. Today, we have a crazy situation where each seems to be divided into two camps – the people who are deploying (or most likely figuring out how to deploy) mobile technologies, and those who aren't. The former put an 'm' in front of their discipline, giving us m-heath, m-agriculture, m-learning, and so on. The rest remain plain old health, agriculture and learning. Even worse, the people within them often go to different conferences.

These questions and issues, and a few more, are addressed in my recent Donors Charter, (http://www.donorscharter.org) an attempt to bring harmony to the funding of ICT4D and m4d initiatives. Recently I 'celebrated' ten years working in mobiles-for-development. We've all come a long way in that time – out of nowhere, in fact – but in impact terms we're still only scratching the surface. No one knows what the next couple of years have in store, let alone the next five or ten. Much depends on us. Quite rightly, we will ultimately be judged on what we do, not what we say, tweet, write or predict. I, for one, spent the best part of my university years critiquing the efforts of the development practitioners who went before me. Countless others have done the same. Looking to the future, how favorably will the students and academics of tomorrow reflect on our efforts? A wasted, or unnecessarily delayed opportunity?

That's up to us to decide. ■

Notes:

More information on FrontlineSMS and FrontlineCloud is available at: www.frontlinesms.com.

SMS refers to the short message service, which is more commonly referred to as text messaging.

Author's webpage: http://www.kiwanja.net/kenbanks.htm

More information at: http://www.afrigadget.com

For more information, see http://www.afrigadget.com/2009/07/21/fish-call-the-fisherman/.

This service has been covered online at: http://www.afrigadget.com/2008/07/16/18-year-old-self-taught-electonics-genius-invents-mobile-phone-based-vehicle-anti-theft-system/.

Project Loon is a Google initiative aimed at providing balloon powered Internet for everyone. For more information visit: http://www.google.com/loon/.

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COMMERCIAL FAMILY FARMS ARE MORE PRODUCTIVE THAN PLANTATION AGRICULTURE IN AFRICA

Prof. Joseph Hanlon, Visiting Senior Fellow at the London School of Economics and Visiting Senior Research Fellow at the Open University; Prof. Jeanette Manjengwa, Deputy Director, Institute for Environmental Studies, University of Zimbabwe; Prof. Teresa Smart, Senior Visiting Research Fellow, Institute of Education, University College London.

Rows of combine harvesters and giant tractors on grand plantations are always presented as the modern way to develop agriculture - but family farmers can produce more, and create more jobs. European investment and hedge funds continue to promote giant plantations in Africa as the way to meet global food shortages. And the promoters continue to mesmerise both individual investors and African ministers with images of huge, computer-controlled farms that will solve poverty and generate exports. But it is all a pipedream. Since the ground nut scheme in Tanzania 70 years ago, plantations have failed across Africa. In Mozambique, no new large farm, state or private, has succeeded since independence in 1975. In Zimbabwe, land reform farmers with six hectares are more productive than the white farmers with big estates that they replaced.

South America, with its massive wheat and soya farms, is often promoted as a model. But the World Bank in two major reports, Growing Africa: Unlocking the Potential of Agribusiness in 2013 and Awakening Africa's Sleeping Giant in 2009, looked at two alternative models, the Brazilian cerrado and northeast Thailand, and came to the unexpected conclusion that Thailand and not Brazil is the appropriate model for Africa. Small and medium scale commercial farmers with 5-15 hectares transformed Thailand into the world's leading rice exporter. The Americas are the exception; even in Europe the average farm size is below 15 hectares. And in the United States, family farmers control 78% of all farmland, according to FAO.

Government ministers and bureaucrats tend to assume "big must be best" and that it is easier to deal with one foreign investor with 10,000 ha than to deal with 2,000 family farmers with 5 ha each. This turns out to be false, because of four other conceptual myths that bedevil African agricultural policy:

- The first is inherited from centuries of colonialism, which leads European investors and, sadly, many African ministers, to believe that Europeans automatically know what is best for African farming.
- Second is the belief that farms are either very small or very large. The average African farm is just 1.3 ha and the alternative is often assumed to be thousands of hectares. This ignores the large number of family commercial farms, with 3 to 100 ha, which tend to be most productive.
- Third is the myth, often promoted by both the global peasants group Via Campesina and politicians, that 1 ha farmers are "subsistence" farmers, producing their own food. In most of Africa it is impossible to feed a family from the produce of 1.3 ha. Thus most families are

involved in a complex mix of farming for food and for sale, and being involved in wage labour - either day labour in rural areas or one member of a family working in the city. Most peasants are already part of the market.

- Fourth is the belief that although European and North American farmers must have subsidies if they are to produce, African farmers are so much better that they do not need subsidies. This indirectly drives the desire for foreign investment, because foreign companies always promise, initially, that they will not need subsidy - but they always do need direct or indirect support in the end.

Zimbabwe and Mozambique

We have written two recent books, Zimbabwe takes back its Land and Chickens and Beer, a recipe for growth in Mozambique, which looked at farming in the two countries, and we were surprised to discover the success of the family commercial sector. These were farmers who had expanded from 1-2 hectares to 5 hectares or more. Three factors permitted that transformation:

- First was that these farmers were innovative, entrepreneurial, and hard-working, and could become small business people. Many have above average education. And not all succeed - commercial farming is like any other small business, and there are many failures.
- Second, they had support to expand - with credit, extension services, fertiliser, seed, and an assured market. We discuss this below.
- Third is mechanical ploughing - cattle, tractor hire, or small two-wheel tractors - which permitted the family to farm more land.

These are still family farms, depending on family labour, with the family living on the farm and producing some of their own food. But they mainly produce for the market. And they normally hire extra labour, which means they create jobs locally. Labour intensity per hectare is normally double that of large plantations.

The mix of support is different in each place. Many countries do fertiliser subsidies, which is important if linked to seeds for high yielding crop varieties. In Zimbabwe, there is still an excellent agricultural extension service, Agritex, and the Grain Marketing Board sets a floor price for maize, the stable crop, which is close to world market prices and thus assures profitability. In Mozambique, the World Bank forced the marketing board to be closed and restricted the extension service, so these supports do not exist, and staple food prices are kept down to benefit urban workers. Thus maize is a peasant but not a commercial crop. But there was support from a set of aid agencies, notably Clusa (Cooperative League of the USA) to develop small holder soya production to provide food for locally produced chickens. This involved a range of support, including seed, extension services, ploughing (which allowed expansion of area), credit and organising markets with the chicken producers. Within seven years there were 27,000 families growing soya commercially.

In both Zimbabwe and Mozambique, tobacco is a major export crop which is grown entirely by small commercial farmers. This is done on a contract basis. The farmer signs a contract with the local representative of a large multi-national tobacco company. The company supplies seed, fertiliser and technical assistance, on credit, and promises to buy the crop. The farmer is committed to selling the crop to the contract company. In both countries there is an open valuation or auction system. In Zimbabwe there are several contract companies so farmers can change in the following season if they feel they were under paid. In Mozambique there is one monopoly buyer. And, of course, they are free to switch to other crops - and we found tobacco producers in Zimbabwe switching to maize (because it required less labour) and in Mozambique to soya (because it was more profitable).

The key point of tobacco is that the tobacco companies grow no tobacco themselves. Family farmers grow the tobacco, and the contract companies control the rest of the value chain. In both Mozambique and Zimbabwe this is replicated in other areas, including cotton and export vegetables which are grown on contract. Even sugar, which has been grown by foreign companies since the colonial era in both countries, is moving over to a contract model.

Many of the proposals for land grabs and huge plantations come from investment companies and hedge funds trying to attract the surplus capital held by the world's richest people - the top 1%. These are speculative projects built on the four myths noted above and promising impossible rates of return - one in Mozambique promised 40% return per year. In practice the promoters rarely expect to grow anything, but hope to sell the project on to others, or take out enough money before it collapses. They try to gain access to land in Africa, and speculate on the increasing value of that land.
In contrast, the food and tobacco companies expect to profit from their control of the value chain - the ability to sell to supermarkets and processors in the north. They have increasingly realised that farming is a headache and, for them, is unprofitable. One export vegetable company told us that family farmers are much more careful about keeping the quality high, and it cannot match that with wage labourers on its own farm. Thailand's success underlines this. Foreign companies are not permitted to farm, but they are encouraged elsewhere in the value chain.

Money, credit, and assured markets

The transformation from peasant to family commercial farmer has always required external support, and this was true in Europe in the late 19th century, the United States in the early 20th century, and Asia more recently. Most African farming families are extremely poor and often lack the cash to buy basic inputs - even a single bag of fertilizer can cost $40 or more, and many families rarely have that much cash at one time.

Thus the single biggest constraint to the development of family commercial farmers is lack of money. The neoliberal or "free market" ideology imposed three decades ago on Africa (but not Europe or the US) still restricts agriculture. The "free mar-

ket" is of no use when people are too poor to buy inputs and cannot take the first step on the ladder of increasing production. Most countries have, or had, agriculture banks, usually government subsidised and often government owned. The banks were necessary because high costs of administering many relatively small loans and the high risk of crop failure due to pests, drought, or flood made agricultural banking unprofitable for the private sector. In many African countries governments were forced to close their farm banks.

Microcredit was touted as the miracle cure, but the interest, typically of 10% per month, eats up any potential profit. And it takes no account of risk; if the crop fails due to pests or drought, the debt must still be repaid, and the family goes hungry. In India, unpayable debt is one cause of farmer suicides; in Africa farmers have tended to refuse microcredit as too expensive and too risky.

Contract farming works for many export crops and provides inputs on credit, but is not effective for domestic food crops, in part because it is too easy for farmers to sell their crops to other buyers and not repay their loan. In the colonial era, most countries had state marketing boards which guaranteed to buy staple crops at pre-announced fixed prices. Some moved to setting floor prices and becoming buyers of last resort, only buying when the private sector did not. But the international financial institutions (IFIs) still considered this an interference in the free market and largely forced the abolition. Producer prices fell, and market signals worked -- less food was grown for the market, and politicians resorted to exhortations for peasants to grow more food.

Donors and IFIs still hold fast to the neoliberal line and argue that the problems are lack of roads or poor information systems. But these never tackle the key problems for food production - inputs, credit, guaranteed market and risk sharing. Subsidised fertiliser and expansions of agricultural extension services are being done by several countries. Some countries are watching India, where a program to pay extra to small farmers for grain and then sell that grain at subsidised rates to the poor. But this has been challenged by the World Trade Organisation, which points out that permitted subsidies are based on historic subsidies, which means such subsidies are only allowed for rich countries.

Mozambique faces a similar problem. Tobacco has a monopoly buyer and sugar is protected by import taxes, and this is allowed because both are owned by multinational companies. But rice cannot be protected by an import tariff or have a monopoly buyer; rice producers are small domestic farmers. Always the bias is toward transnational companies that make big promises but demand concessions

not available to local farmers.

Thailand provides an alternative model for Africa. Government policy encouraged famers to expand cultivated area. There was heavy government investment, including successful attempts to reduce the price of fertiliser. And a state agricultural bank (which won unexpected praise from the IMF) lends to 95% of farmers. Could Africa be allowed to do this?
Family commercial farmers could transform rural Africa, but this will require a radical shift in thinking by African governments, to intervene in agriculture and support these farmers with inputs, credit, guaranteed market and risk sharing. You cannot pull yourself up by your bootstraps if you have no boots, and it is up to governments to provide those "boots".

Technological change

In Africa, the single biggest technical constraint is ploughing. Using just a hoe, a family can only prepare one hectare. Thus expanding the area requires mechanical ploughing. Zimbabwe has a long history of the use of cattle for ploughing and pulling carts, and after the land reform in 2000 the new farmers were able to use family or neighbour's cattle to plough, or could hire tractors. Because of tsetse fly, Mozambique and Tanzania do not have many cattle and animals are rarely used for ploughing. Tanzania has seen a rapid increase in the import of two wheel tractors (also called power tillers) from fewer than 100 two wheel tractors in 2000 to more than 5000 in 2012 (60% from China and 25% from Thailand). In Mozambique and many other countries, donors and ministers still prefer to import the biggest tractors, which look good in pictures and usually come from US, European and Brazilian manufacturers, but are much less useful to family commercial farmers.

Again, most African farmers cannot afford even the cheapest Chinese power tiller, and their introduction will require credit and subsidy for farmers. A second need is to establish repair and spare parts networks across the continent. Power tillers are much easier to repair than big computerised tractors, and motorcycle repair people can be trained for the job. But for the first few years, they will need support for training and to build up their parts stock. Finally, some basic training is useful for ploughing and extentionists need to be given short courses.
Another big challenge is to expand irrigation, using ponds to capture rainfall or wells or boreholes. This becomes more urgent as climate change make rainfall irregular. But it is already a need, because if more money is invested in ploughing and inputs, then it becomes more urgent to reduce risk and be able to cover at least two or three week gaps in rainfall. Irrigation can be profitable and should be promoted, but it also requires training to ensure that water is used carefully. And irrigation systems have a cost, so long term credit and subsidy is needed.

Yet again, northern models might be applied. During the great depression of the 1930s, the United States passed the Rural Electrification Act which remains in force. Government loans of up to 35 years are given to electricity companies to finance the construction of electric distribution, transmission, and generation facilities. Users then pay the installation costs as part of their bills, but over a very long period. Mozambique could do this, and it would make a huge difference to commercial farmers.

In most places, the technology needed to make the first step is already available - fertiliser, high yielding seeds, irrigation, power tillers, etc. Many family farmers are ready to try new crops and new technologies, and farm more land, if they are supported. And there is evidence of the importance of peer influence, with farmers sharing experiences and taking up the models of successful neighbours.

But present readily available technology is only adequate for the first step. Building family commercial farmers will require innovation, diffusion, research and development. Soil testing facilities are needed to be more precise on the fertilisers needed. Improved seeds need to be developed for the specific conditions of regions within countries. Better irrigation systems using less water are needed. Pest control and storage must be improved.

There is a move to various forms of conservation agriculture, which often require little ploughing and less water and fertiliser. These could provide a huge boost to family commercial farmers. But the techniques must be localised to respond to soils and rainfall. And all conservation systems have high start-up costs and need to be subsidised - that evil word again - over the first three years.

Not easy

None of this is easy. But the investors who fly in and promise the moon on a platter and seem to offer an easy answer continue to fail. Plantations rarely work in Africa. Meanwhile, the more educated children of poor farmers migrate to the city in search of a better life. The alternative is to create a better life in rural areas, by supporting family commercial farming. But it will require a hands on approach - working directly with the new commercial farmers on credit, ploughing, production, and marketing. This will require a total change of thinking within African governments and within the donor and IFI community. With support, ordinary family farmers can transform Africa into an agricultural powerhouse. ■

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FARMER GOVERNANCE OF LOCAL AGRICULTURAL RESEARCH AND INNOVATION

Dr Ann Waters-Bayer, Chesha Wettasinha & Laurens van Veldhuizen
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Government research and extension agencies receive public funds for their work but are seldom accountable to farmers. To be sure, in recent years, funding mechanisms have been set up for "participatory" research but these are usually managed and accessed by government agencies. If farmer organisations or other civil society organisations (CSOs) are involved, then only as minor partners. In most countries, small-scale farmers have little or no genuine voice in deciding how funds for agricultural research and development (ARD) are used, even if they have "representatives" in advisory bodies. However, some pioneering work, e.g. with Local Agricultural Research Committees in Latin America (Ashby et al 2000), showed that making small amounts of money available to farmer groups can accelerate innovation, enhance local adaptive capacities and strengthen farmers' voice in ARD. This work provided inspiration to explore alternative funding mechanisms so that farmers can invest in their own research and decide on the support they need for this, i.e. to enable farmer-led participatory ARD that is more accountable to and relevant for resource-limited farmers; and thus to develop greater local governance of ARD.

Action research on farmer-governed innovation funds

The international network Prolinnova (Promoting Local Innovation in ecologically oriented agriculture and natural resource management) seeks to scale up farmer-led participatory research and extension. Network members observed that, after learning to identify farmer innovations, extension agents tended to promote the innovations instead of encouraging farmer-led participatory innovation processes, and scientists wanted to "validate" the local innovations instead of helping farmers find answers to their own questions (Wettasinha et al 2008). Prolinnova members therefore wanted to explore whether and how changing the governance of research funds could create space for small-scale farmers to take the lead in decentralised ARD that is more responsive and relevant to local needs. They decided to try out farmer-governed "Local Innovation Support Funds" (LISFs) that give men and women farmers a chance to decide what will be investigated, how

and by whom, to conduct and assess local research and innovation, and to share findings.

After an initial pilot with an innovation fund by Prolinnova member LI-BIRD (Local Initiatives in Biodiversity Research and Development) in Nepal, small teams in eight African and Asian countries (Cambodia, Ethiopia, Ghana, Kenya, Nepal, South Africa, Tanzania and Uganda) involving people from national CSOs, agricultural research and advisory services and universities did action research on LISFs. This was designed to stimulate joint learning by community members and other key actors in ARD, including local government authorities.

Platforms for joint learning

In several districts in each country, the national teams helped set up a Fund Management Committee (FMC) of 5–10 members. The structure of the FMCs differed between countries. In Ethiopia and Uganda, they included only farmers (men and women); in other countries, they also included an extension worker and a local government official, but farmers had the strongest say in how the funds were used. The FMCs became "grassroots learning platforms" about local innovation and managing LISFs. The FMCs were advised by a district-level group of people from local CSOs and government research, extension and education. This group became a "district learning platform".

The national team was responsible for coordinating, monitoring, evaluating and documenting the action-research process, outcomes and impacts. To build the capacity of FMC members and the staff of local support organisations to handle the LISF, it gave an introductory training at local level, followed by periodic reflection meetings and annual workshops to discuss issues arising during the action research. It helped the FMCs identify other actors (e.g. technical specialists, scientists, entrepreneurs) who could support farmers' efforts to improve their farming systems. The team also brought together a wider group, including policymakers in national government bodies, in a "national learning platform" to reflect on the LISF experiences and draw lessons. This was a strategy for institutionalisation: when learning about the LISF, the platform members were stimulated to think about changes needed within their institutions to allow the participatory innovation approach to be applied more widely.

An International Support Team composed of agronomists and sociologists who were based at ETC Foundation (now based at KIT) in the Netherlands and the International Institute for Rural Reconstruction (IIRR) in the Philippines coordinated method development, monitoring and evaluation (M&E), inter-country exchange and learning, comparative analysis, documentation and international policy dialogue.

A scientist from a French research institute worked with the teams in Cambodia and Ethiopia to develop guidelines for participatory impact assessment (PIA) at community and higher institutional level (Triomphe et al 2012). These guidelines, which were later applied by all country teams facilitating LISFs, addressed four areas of possible impact: i) development of improved farming practices and systems; ii) spread of these new practices and systems among farmers and impact on their livelihoods; iii) changes in capacities of farmers to access relevant information and continue to develop technical and socio-organisational innovations; and iv) changes in terms of the interest of ARD agencies to support and work with farmer innovators and their groups.

Operating the LISFs

Each country team made an exploratory study to learn from any similar initiatives in the country and to decide how best to design the LISF to fit the existing political and institutional realities. However, the LISFs in all countries followed jointly defined key principles: i) funds were made accessible directly to small-scale farmers or their groups; ii) grants were used for innovation, research and learning by farmers; and iii) the farmers and their organisations played a strong role in deciding on fund allocation.

Based on lessons drawn from an international review of experiences with similar approaches (Veldhuizen et al 2005) and guided by the International Support Team, the national teams developed guidelines for fund management and helped the FMCs develop criteria for selecting grantees. In line with the key LISF principles and common values of the Prolinnova network, the main criteria for screening the proposals were similar across the eight countries:

- the idea was driven by the farmer applicants (not by outsiders)
- the innovation to be explored appeared sound in economic, environmental and social terms
- the innovation could be used by poor farmers (with locally available, low-cost inputs)
- the support through the LISF could add value to the innovation
- the applicants were willing to share their results
- the proposal was for local research and learning, not for farm investment.

The FMCs, supported by the district learning group, announced calls for proposals from farmers, screened the proposals to select topics and questions of local priority, helped farmers identify the support they wanted (if any) from external specialists, and monitored and evaluated the work supported by the LISF. FMC members helped farmers understand the eligibility criteria and write proposals of 1–2 pages with a simple budget, sometimes writing down oral applications from illiterate farmers. After the FMC had vetted the proposals according to the agreed criteria, the selected farmers (individuals or groups) were allocated resources for the proposed activities. The FMCs gave grants for farmer-led experiments as well as farmer-defined training, e.g. by local innovators, or study visits, e.g. to local innovators or other learning sites. They supervised whether the activities were done according to agreement. They organised field days or innovation fairs and used rural radio and farmer magazines to share the farmer researchers' findings and to motivate more farmers to apply for the next call.

LISF grants were less than €100 on

average, with grants as low as €5 in Nepal and up to €1670 in South Africa. Smaller grants were used mainly to buy tools and equipment to improve a local innovation or to buy seeds or record books. Grants were larger if costs of external services were included, e.g. laboratory analysis or involvement of research staff.

Facilitating learning at different levels

Reflection on the experience with LISFs in the eight countries led to learning at different levels:

- **Grassroots:** The FMCs, farmer researchers and wider rural community learned how to assess the relevance of proposed research for the community, prioritise activities, manage the funds and facilitate joint research with external specialists. One or more persons from the national team supported this learning mainly by asking the FMC questions based on an M&E tool ("register") used by all country teams. Most of the community-level learning happened during informal reflections and discussions while the FMCs made repeated rounds of calling for proposals, selecting grantees, monitoring how the funds were used and assessing what this contributed to the community.
- **District:** The district platform learned through training by the national team, its own mentoring of the FMCs and farmer researchers, making M&E visits and co-organising innovation fairs. These activities made the platform members more aware of the roles of farmers and others (including themselves) in agricultural innovation systems, gave them deeper insight into local priorities, and increased their capacity to facilitate and support farmer-led innovation processes.
- **National:** National team members learned primarily through M&E visits to FMCs and farmer researchers and in the national meetings for discussing the LISF process, M&E results and PIA findings. These meetings offered opportunities to reflect on how the LISFs worked, how farmer-led innovation can be enhanced, the roles of formal research and development actors in supporting this, and how an LISF approach could be mainstreamed. The country teams used the "register" to monitor the jointly identified indicators of how the LISF was functioning. This allowed them to adjust LISF arrangements during the action research and generated information comparable across the eight countries, such as about number and type of activities supported by the LISF, size of grants, and time elapsed between applying for and receiving funds.
- **International:** The International Support Team facilitated learning in the Prolinnova network by holding phone conferences with the national teams to discuss progress, using backstopping visits to stimulate the teams to reflect, supporting process documentation, arranging "writeshops" for comparative analysis of the process and outcomes, and organising sessions on LISFs during the annual International Partners Workshop. In this way, network members could learn about how to improve the funding mechanism and to scale it up (Prolinnova 2012).

Impact

The new way of funding grassroots agricultural innovation processes helped change the self-identity and power relations among small-scale farmers, scientists and extension agents. The effectiveness of the LISFs and their outcomes in terms of improved farming practices and livelihoods are discussed in Prolinnova (2012) and Macoloo et al (2013). For the purpose of this paper, we focus on impact in terms of a) capacity to innovate and to manage funds for this purpose; and b) interest of other ARD actors to support farmer-led research and innovation processes.

Enhanced capacity of farming communities to innovate

Farmers appreciated that the LISFs gave them the means to design, implement and evaluate their own research. They said the grantees and other farmers learned from the results of the funded activities to achieve higher farm productivity, savings on output costs and higher incomes. FMC members, grantees and non-grantees said their involvement in the LISF increased their capacity to access relevant information about agriculture. They reported more sharing on local innovation among farmers in the community and with outsiders. The FMC members and grantees said the recognition of local innovation by community members and outsiders increased their self-confidence to interact with people from government services in jointly exploring new ways to improve farming. They felt they could better express their research interests and extension needs to these people.

According to the PIA results, the LISFs stimulated and strengthened farmers' capacity to experiment. It reduced some of the risk involved in trying new things. Farmers learned how to compare different options more systematically. The grantees' successes encouraged other farmers to test new techniques.

Farmers in the FMCs became better able to organise themselves around funding and managing local research and development. They felt their capacities were improved in leadership, planning, M&E and keeping records. Farmers in FMCs in South Africa said they could better assess interventions and make informed decisions on whether to participate in externally initiated projects.

Enhanced capacity to manage funds for local innovation

Depending on the existing ARD institutional framework, the strength of farmer organisation and the capacities of and choices made by the different country teams, essentially two models for managing the LISFs emerged:

1)More centralised multistakeholder groups at district or national level comprising state and non-state ARD actors (research, development, education) and some farmer leaders, allowing more opportunities for mutual learning between farmers and other actors, stricter screening of proposals, approval of fewer but larger grants, and relatively high costs of the staff involved. Decision-making took longer and there was less strengthening of local capacity and somewhat less farmer influence in vetting proposals.

2)More decentralised FMCs with mainly or only farmers, usually in community-based organisations (CBOs), assisted by CSO and government staff in organising the process. Small-scale farmers could access these funds more easily: the number of applications received and approved tended to be higher. Grants were usually smaller, often covering only direct costs of experiments or travel by farmers to gain information; little was spent to bring in other experts to support the farmers' work. The operational costs of these FMCs were lower, but the costs of strengthening CBO capacity were higher.

Analysis of the FMCs' allocation decisions revealed that most funding went to: i) small-scale experiments and data collection by farmers individually or with other farmers; ii) improving local innovations with little or no systematic experimentation or data collection; iii) farmer-led experimentation together with research and/or extension staff using more systematic methods, covering some costs of the support agents; and iv) learning and sharing by farmers through training by farmer innovators, farmer-led documentation, and farm or community visits to learn about local innovations and possibilities to improve them.

Initially, proposals approved by the decentralised FMCs were mainly for farmers' experiments without outside support. After one or two grant cycles, as farmers realised that the LISF differed from conventional farm investment funds, the experiments became more complex and more ARD "outsiders" were drawn in. LISFs worked well under decentralised management by farmers when the supporting organisations had the experience and skills to build local fund-management capacities.

Some men and women farmers who were involved in handling LISFs or leading the research were invited by local officials to join other meetings to discuss and prioritise development and could play a self-confident and informed role in influencing decisions in such public fora involving formal research and extension staff.

Greater interest of ARD actors to support farmer-led PID

Focus-group discussions during the PIAs revealed that the LISF approach forged new links between farmers, advisors and scientists and increased the contribution of local knowledge to innovation processes. It stimulated the interest of other ARD actors to identify and support farmer innovation. Some scientists visited and advised farmer researchers and replicated their experiments or innovations on station. Extension agents organised field days to discuss results of the farmers' experiments.

Relatively few people in the support agencies were directly involved in working with communities managing LISFs. Linking the district learning platforms with other stakeholders in the country through field visits, workshops and innovation fairs helped to broaden awareness about local innovation and LISFs. Most ARD actors working with the LISFs felt they were better able to collaborate with each other and with farmers. According to a case study in the Axum site in Ethiopia, involving the field agents in facilitating LISFs led to greater awareness of local innovation and closer collaboration with farmers. This helped integrate farmer-led joint research into extension work at district level and made extension managers aware of the potential of the participatory innovation approach (Fanos et al 2011).

Some challenges

Understanding of the LISF concept

All involved in the action research, not only the farmers, needed time to appreciate that the LISF should generate and spread new knowledge and prac-

Joint experimentation provides more opportunity for scientific knowledge to be integrated by farmers, but scientists sometimes tend to "hijack" the process.

tices rather than pay for farm inputs to adopt technologies. This differed from investment funds designed to generate private goods to benefit individuals. The LISF generates public goods for the community: the new knowledge and practices developed with its support should benefit not only the grantees but also other farmers. To make the difference clear, it was necessary to facilitate development of transparent criteria and procedures for selecting grantees, to reflect critically on what the grantees did with the funds and who benefited, and to encourage wider sharing of results.

Involving scientists

Especially where the FMCs were composed mainly or only of farmers, it proved difficult to involve scientists in the farmer-led research. The farmers initially wanted to try things on their own, using local ideas and advice, while the research institutes had their own agenda and little flexibility to support local initiatives. One exception was in Kenya, where staff from the Kenya Agricultural and Livestock Research Organisation was responsible for M&E of the LISF process and for linking farmer researchers with scientists. In all countries, however, the LISFs generated interest from extension agents to become more involved in farmer-led research.

Scaling out and up

This refers to the double challenge of: i) scaling out the findings from the LISF-supported activities; and ii) scaling out and up the LISF approach itself in the relevant institutions, including farmer organisations. The PIAs revealed limited sharing of the results of farmers' experiments. Communication with other farmers took place mainly through informal exchange, during innovation fairs and when other farmers and extension agents visited the FMCs and farmer researchers to learn about the LISF process and outcomes. At national level, the annual sharing-and-learning workshops of the organisations involved were relatively small, and documentation about them was not widely disseminated.

Somewhat wider awareness of farmer innovation resulting from LISF support was achieved in May 2013, when four of the eight country teams involved in the action research brought ten innovators each to exhibit at the Eastern African Farmer Innovation Fair in Nairobi. However, the focus of this event was on local innovations and not on LISFs.

If the LISF is to become a funding mechanism that reaches millions of small-scale farmers, it needs to be integrated into institutions in each country. During the action research, it proved difficult to generate in-country resources for the LISF. In Tanzania, a district council contributed €7000 to the LISF work, a rare example of financial support from local government. In all countries, extension agents and a few scientists were involved in facilitating the LISFs and thus contributed through staff time, but the institutional basis for this was weak, as support to this work was not formally approved at higher institutional levels.

The national teams are exploring several strategies to scale up LISFs, such as: integration into the Ministry of Agriculture extension agency, development projects in the country or the local government (especially in countries where decentralisation to county or district level is occurring); or setting up an LISF in a national farmer organisation; or basing the LISFs in self-managed and self-resourced CBOs (Veldhuizen & Waters-Bayer 2013). The main challenges in these up - scaling scenarios – except possibly the last two – would be to retain the focus on small-scale farmers and the farmer-led character, and to retain an approach of continued reflection, learning and adaptation to changing institutional conditions.

Some lessons learnt

Small-scale farmers can take the lead in locally relevant innovation. The action re-

search showed that funds for local research can be managed at the grassroots, if support agencies facilitate interaction between farmers and other stakeholders so that farmers remain in the driving seat. Locally governed decentralised funds for farmer-led research and innovation are feasible and effective in stimulating site-relevant innovation in family farming at low cost.

Developing LISFs takes time and resources. LISFs have to be tailor-made for each setting. The core principles – giving small-scale farmers direct access to funds, supporting farmer-led innovation, farmer management of funds – must be applied according to local realities regarding farmer organisational capacities, availability of support services, and the specific policy and legal framework. By building on lessons gained elsewhere with LISFs, the start-up period for new LISFs can be shortened, but time will still be needed for testing, learning and adjusting the LISFs in new areas. Start-up costs need to be seen as an investment in de-learning old ways and learning new ways to structure relationships between actors in the agricultural innovation system.

Constant efforts are needed to prevent scientists from "taking over": Many farmers' experiments, with little outside support, yielded results that were easily understood and applied by their neighbours. This initial experimentation by farmers on their own helped build their confidence to engage with other ARD actors. Joint experimentation by farmers and other ARD actors may generate results that can be scaled up with greater certainty that the innovation is "valid", but is more costly than experimentation by only farmers. Joint experimentation provides more opportunity for scientific knowledge to be integrated by farmers, but scientists sometimes tend to "hijack" the process. Therefore, the interaction must be well facilitated, so that the scientists appreciate that farmers have own questions they want to pursue in the joint research. The greater the farmers' influence in deciding on fund use, the stronger their position in negotiating questions to explore. Where a balanced partnership can be achieved, the methods of externally supported local research can be more rigorous and the results better documented than when farmers experiment on their own.

Conclusions

Creating a farmer-governed local funding mechanism can gradually lead to a collaborative innovation process in which farmers exercise more control than in present-day ARD. Setting up the LISF by encouraging farmers and other ARD actors to design the mechanism to suit their conditions and then to jointly assess how it works helps link farmers and the others in joint learning driven by farmers' interests. The experience with LISFs showed the potential of giving farmers direct access to resources for innovation. This can complement conventional funding for ARD and can also be regarded as an alternative approach to extension. The LISF encouraged farmer-led participatory research and sharing of findings, both from farmer to farmer and through formal extension channels. The accompanying training and mentoring by support organisations (CSOs, research, extension, universities) built farmers' capacity to manage public funds at local level and stimulated a better understanding of the support organisations' own roles within innovation processes. By making locally governed innovation funds available to small-scale farmers, the LISF offered a path toward strengthening farmers' voices in deciding also at higher levels on publicly funded research and extension and making agricultural support services more accountable to, and relevant for, the farmers.

National policy support to farmer-governed decentralised funding mechanisms would give farmer innovators and other local ARD actors more opportunity to learn from each other and to benefit from each other's knowledge in agricultural innovation processes. Rather than homogenising one LISF approach for small-scale farmers country- or worldwide, multiple local learning platforms should be encouraged to develop site-appropriate forms of LISFs and other options that give small-scale farmers more say in deciding on use of ARD funds, and should create spaces to learn from the diverse approaches to LISFs. ■

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THE CHALLENGE OF GLOBAL HEALTH PARTNERSHIPS IN AFRICA

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Over the past 15 years, "global health" has become an increasingly hot field of international research and education. In the United States, student and faculty demand for global health experiences has led to a dramatic increase in the number of departments, programs, and institutes of global health within the nation's most prestigious research universities and medical schools.

Reflecting this trend, the Consortium of Universities for Global Health was inaugurated in 2005 and has grown to include over 130 universities from North America and countries in the global South. As interest and investment in global health has risen, so has Northern demand for international sites than can host global health researchers and students. African clinics, hospitals, and universities have become a particularly hot commodity, with some prominent African researchers receiving requests to collaborate on a nearly weekly basis. What is driving this global health "scramble" for Africa, and what are the consequences for African researchers, patients, and institutions?

The popularity of African research sites is partly an artifact of the global HIV/AIDS epidemic, which brought international researchers to the continent in unprecedented numbers. These researchers were drawn to African sites by a combination of humanitarian and scientific goals. Following the discovery of effective antiretroviral therapy in the mid-1990s, many physician-researchers in wealthy countries felt the humanitarian pull to apply their experience and expertise in the hardest-hit parts of the world where treatment remained unavailable. At the same time, working abroad also presented scientific

opportunities in the form of large numbers of untreated (or "treatment naive") HIV patients. As one Ugandan researcher told me in 2009, "We say HIV opened our doors to a lot of international organizations. If it wasn't for HIV maybe not many people would have come here. It's a bad thing that happened to Uganda, but I think it has exposed the country to certain things that maybe we would have never seen."

Of course, international health research has a long history that predates both HIV/AIDS and the current enthusiasm for "global health." In the 1960s and '70s, the field of "international health" worked hand-in-hand with international development, and focused largely on questions of nutrition and maternal and child health. "Tropical medicine" — a field born out of European colonialism — investigated infectious diseases like malaria and yaws. However, the field of global health claims a fundamental difference from these older, paternalistic models of transnational health science in that it aspires to equitable scientific partnership between wealthy and poor nations. In a widely cited article in the Lancet, a group of international authors representing the Consortium of Universities for Global Health argue for "a common definition of global health" that emphasizes "the mutuality of real partnership, a pooling of experience and knowledge, and a two-way flow between developed and developing countries." "The developed world," the authors note, "does not have a monopoly on good ideas."

Partnership is a laudable goal. But it is easier said than done, and easier "performed" than actually practiced. Wealthy Northern institutions and poor African (or other) institutions face the challenge of collaborating across steep inequalities with deep historical roots. Global health has places like Harvard—the richest university in the United States, with an endowment surpassing 30 billion dollars—collaborating with African public hospitals that struggle to keep the lights on and the water running. This dynamic is further complicated by the fact that it is these very inequalities (and the health challenges that go with them) that make African sites attractive to U.S. and European global health programs to begin with. To those in wealthy countries, "doing" global health is often implicitly understood to mean working in a much poorer part of the world, among patients with much poorer access to care and medications. In this way, wealthy institutions value—or at the very least, gain opportunities from—the same inequalities that hobble their African collaborators.

For example, I once shadowed a pair of visiting prospective researchers as they toured a rural hospital in Uganda. Though the two men (both from Western Europe) lamented the underfunded health care conditions suffered by these rural patients, they nonetheless observed the crumbling buildings, rusting bed frames, and crowded conditions of the hospital with a form of approval, assuring each other that this facility had "real wards," unlike the well-appointed, corporate-funded outpatient clinic in the capital city. The evident signs of poverty were what made the hospital a desirable research site.

Thus, there is a paradox at the very heart of global health science: it places a value upon the very inequalities it also deplores. This paradox poses fundamental challenges to the goal of mutual partnership.

Partnership and Paternalism

Researchers from wealthy countries are often motivated to pursue global health projects out of a humanitarian desire to assist the less fortunate. And, indeed, global health research often does provide health services and infrastructure, such as laboratory monitoring, which might not have been available otherwise. As a result, foreign researchers may envision the scientific resources they bring to Africa as a form of aid, and their African collaborators as aid recipients. This introduces a power dynamic of dependency and gratitude, rather than collaboration and negotiation, and makes it difficult for African researchers to shape research design or agendas.

Foreign researchers, blinded by their own good intentions and unexamined assumptions, may not realize that they are positioning their African colleagues as charity cases. Take, for example, a piece written by the editors of Nature for a special issue focused on research in Africa. In response to the question "What can individual researchers do for colleagues in Africa?" the authors argue that "scientists in Africa must be treated as real collaborators, rather than just recipients of aid" — the same argument I made above. Yet, in the same piece, the writers urge scientists in wealthy nations to "help out" their African colleagues by sending them their used equipment "when they return home." Is this not an example of the very practice of treating collaborators as aid recipients that the authors decry?

I have seen this kind of charitable blindness in operation in southwestern Uganda, where an influx of foreign researchers to a public, regional medical school has brought both new opportunities and fresh conflicts. Take, for example, "the Italian lab", a fully equipped laboratory set up by an Italian HIV research project and left to the university upon the study's completion. On one hand the laboratory provided valuable machinery, such as viral load testing equipment, which was in short supply at the time. On the other hand, the machines were from Italian manufacturers and thus of a type rarely seen or used in Uganda, where British and American products are more common. This made it quite difficult to fix the machines when they broke, or to restock them with the proper reagents. This is not to say that donating equipment is an inherently bad idea, but it is a cautionary tale against donation without consultation. Too often, good intentions and the imperative to engage in 'capacity building' trump the simple step of asking African collaborators whether or not such a donation would be welcome or useful, or what would be needed to make it so. The result is paternalism, rather than partnership.

Science and Standards

The steep resource inequalities that underlie global health science have profound implications for the careers

Too often, good intentions and the imperative To engage in 'capacity building' trump the simple step of asking African collaborators whether or not such a donation would be welcome or useful, or what would be needed to make it so.

of African researchers. African physician-researchers often carry heavy clinical loads and have little time or funding available to conduct research. Partnership with foreigners can provide welcome support for developing a research program, but it means playing by rules set by foreign investigators and their funders.

Failure to adhere to these rules can result in accusations of poor quality research or ethical breaches, as when a Ugandan study of the prevention of mother-to-child transmission of HIV was accused of covering up "adverse events" among their study population. In fact, the researchers had found it necessary to modify what they reported as an "adverse event" because the reporting standards set by the study's funder, the U.S. National Institutes of Health, were based on research conducted in the U.S., where people have a much higher baseline of basic nutrition and health. Because researchers are expected to report all adverse conditions that arise over the course of a trial, whether or not they are believed to be a result of the study drug, the small Ugandan team was quickly overwhelmed by the need to report the extensive number of health problems experienced by their already very ill study population — a population for whom they were also responsible for providing clinical care. They decided to modify the definition of "adverse event" to better match the baseline Ugandan context, a move that displeased regulators at the National Institutes of Health and led to extensive negative press coverage.

In this way, the same inequalities that draw Northern global health researchers to impoverished countries stymie the ability of their Southern collaborators to participate equally. Northern collaborators are drawn to research sites with poor health care infrastructure, but they are often unprepared for—or, at worst, unsympathetic to—the underfunded administrative and research infrastructure that goes with this. This makes it very difficult for African researchers, for whom these conditions are unfortunately normal, to achieve "global" — i.e., Northern—scientific standards. For example, publication in top "international" scientific journals often requires quantitative laboratory measures that underfunded African institutions cannot afford. Clinical measures, which are possible even in the most underfunded institutions, are not considered publishable data.

African researchers may also resent being held to "international" research standards while they are paid on a local, much lower, pay scale. When anthropologist Ferdinand Okwaro interviewed East African scientists about international collaborations, he found the issue of unequal pay to be particularly contentious. One top researcher he spoke with described this inequality with intentional irony, arguing, "If we are downgrading the salary to local standards, then why not also downgrade the quality of the science to local standards? We would then say, "You know this is a poor country and so if their refrigerators are not good and the specimen thaws a bit, that is ok, those are the local standards.'" African researchers recognize the unfairness of being expected to perform science to the standards of wealthy institutions, but nonetheless being compensated by the standards of a poor one.

Capacity Building and Corruption

In recent years, a growing recognition of the barriers faced by African researchers has pushed global health projects to go beyond research and engage in "capacity building" aimed at enhancing training, opportunities, and facilities for African-led research. This is a positive step, but even the most well intended collaborations may find their efforts thwarted by funders' reluctance to adequately underwrite "indirect" research costs such as facilities and administrative infrastructure. Reimbursement for these "indirect costs" is controversial even within the U.S., as funders want to see money spent on directly on research activities, not on "overhead" costs like power, research space, and administrative support. This antagonism is even more pronounced for federal grants given to foreign institutions, which opponents frame as foreign aid. As a result, the U.S. National Institutes of Health reimburses foreign institutions for "indirect" or "facilities and administration" costs at a maximum rate of only 8%, even though U.S. universities (who negotiate this rate individually with the NIH) frequently receive over 50%.

Put simply, this means that for every NIH research dollar granted to, for example, Makerere University in Uganda, Makerere will receive an additional eight cents to cover facilities and administration costs. The U.S. institution sharing the grant, by contrast, will receive fifty or more cents on the dollar. While foundations and non-U.S. government funders are not tied to this 8% rate, they too tend to reimburse African institutions at comparatively very low rates. As a result, African institutions involved in global health research are expected to house and manage multiple international

projects on a fraction of the overhead support provided to their foreign counterparts for the same work, often from the same grants. This drains, rather than builds, African capacity by chronically underfunding African institutions.

Take, for example, Uganda's Infectious Disease Institute (IDI). Founded by a consortium of Ugandan and American researchers and built by money from the Pfizer Foundation, it is now owned by Uganda's Makerere University but houses numerous international research collaborations. It boasts one of East Africa's premier laboratories and includes partnerships with some of the most prestigious medical schools in the United States, and so receives a large number of U.S. federal grants. But as a Ugandan institution, it is limited to overhead reimbursements at the 8% rate, a meager amount that may eventually threaten its financial viability. Ironically, when the IDI uses U.S. subcontractors—as it sometimes does for specialty laboratory services—it must reimburse those subcontractors at their U.S. negotiated rates, even though the IDI itself is limited to the 8% rate from the very same grant. It seems worth posing the question: if the roles were reversed, and Ugandan funders were reimbursing their national subcontractors at more than five times the rate given to their foreign partners, wouldn't this be called corruption?

Capacity building may also be hindered by the administrative structure of global health partnerships. Neither foreign nor African researchers tend to be trained administrators, and the administrative challenges of setting up an international partnership are substantial. Increasingly, U.S. and European universities involved in global health collaborations are devising administrative "enabling systems" designed to streamline legal and tax status, money transfer, hiring and payroll management, and compliance with local employment law. Unfortunately, these systems tend to prioritize the needs of their designers, and often serve to outsource the legal and fiscal risk inherent to international collaborations to lower income institutions in host countries.

Take, for example, the case of six Kenyan physician-researchers who recently won a landmark discrimination suit against the Kenya Medical Research Institute (KEMRI). KEMRI is Kenyan state research organization and one of Africa's best known global health research entities. The plaintiffs worked for a branch of the organization called the KEMRI-Wellcome Trust Research Program, a long-standing partnership between KEMRI and Oxford University in the United Kingdom that is funded by the U.K.'s Wellcome Trust. However, their lawsuit—which netted an award of 30 million Kenyan shillings (about US$341,000) as recompense for institutional racism and systemic discrimination— was against only KEMRI, because neither Oxford nor Wellcome are legally registered entities in Kenya. Thus, it was the local Kenyan institution, and not the foreign university or funder that bore the full legal and financial burden of the suit.

Towards "real partnership"

There are a number of actions that might improve the equity of global health collaborations and advance progress towards "real partnership." Some of these actions require broad, institutional change, while others are smaller, quicker fixes.

The most obvious big change would be to adequately reimburse African institutions for indirect research costs. U.S. research universities have risen to greatness largely because of access to federal research dollars, including the money invested in research overhead and infrastructure. African institutions need and deserve the same kind of support. While buildings and administrative labor are not "sexy", they are very much a part of successful science. Foreign institutions cannot, in good faith, continue to promote capacity building while simultaneously underfunding partner institutions in Africa.

Secondly, African governments and institutions should move towards developing their own sources of research funding, such that African researchers are not solely dependent on foreign collaborations for research funds. This will not be easy, and cannot be separated from ongoing struggles for economic stability and democratic rule. Nonetheless, local funding is one way to build capacity and move away from what Mahmood Mamdani has called the "pervasive consultancy culture" at African universities.

There are also smaller, more immediate changes we can make. Anthropological studies of global health collaborations in Kenya have shown the value of simply talking openly about inequalities, rather than treating them as a "public secret." In my own work, Ugandan colleagues have expressed the value of writing research proposals collaboratively, rather than being added on as "local PIs" after a study has already been designed. Peter Waiswa has argued that wealthy countries must to do more to facilitate travel by African scientists, who often find their efforts to participate in international conferences and workshops hindered by financial and visa restrictions. These kinds of barriers keep African researchers out of international circulation and conversations in ways that can be detrimental to their careers. They also serve to preserve "international" conferences as enclaves where researchers from wealthy countries can avoid confrontation with the social and scientific realities faced by the vast majority of the worlds' investigators.

Some of these changes may seem unrealistic, especially those that require significant governmental or institutional reforms. But to not mention them would be to admit defeat too readily. We must remind ourselves that achieving access to free antiretrovirals in Africa was also once dismissed as unrealistic. Though our systems of global treatment access are far from perfect, they are nonetheless a huge achievement, and it would be foolish to dismiss or underestimate their consequences for millions of patients and their families. The same goes for global health science. Partnership is easy to say, but hard to do. But that does not mean we should not keep trying.

SCIENCE AND TECHNOLOGY PARTNERSHIPS IN AFRICA

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Introduction

The establishment and sustainability of robust science, technology and innovation (STI) sectors correlates directly to a nation's economic growth and prosperity. Indeed, industrialized countries with thriving STI sectors are the world's richest. African countries recognize this correlation, and many are aiming to significantly boost their STI portfolios in an effort to bridge the development divide within a generation. With the right preparation and training, Africa's youth bulge can be leveraged to achieve this ambitious goal.

Increased investment in STI infrastructure, workforce development, and policy will accelerate economic growth on the continent, and yield relevant, timely and deployable solutions for African challenges. Such solutions, exemplified by the mobile technology revolution, will be demand-driven, scalable, lucrative and predominantly developed by Africans. However, African countries need not re-invent the wheel as they augment their STI enterprise, and each country need not establish or grow an independent STI sector single-handedly. Partnerships across borders, sectors and disciplines will facilitate rapid development and deployment of STI solutions and approaches. National science policies can provide the enabling environment for STI initiatives in academia, business and government to take root and flourish.

This paper aims to highlight some policies, practices and partnership models that have the potential to harness the power of science, technology and innovation for accelerated economic growth, social development and socioeconomic mobility across the continent.

Science Policy

The Science, Technology and Innovation Strategy for Africa (STISA-2024) places STI at the center of Africa's economic growth and development. This African Union (AU) strategy identifies several STI pillars including research infrastructure, workforce development and entrepreneurship for successful implementation of the agenda. In order to create enabling environments required for serious, relevant and long-term investments in STI, AU member states must commit to supporting continental, regional and national policies on STI. Already, several countries have pledged to increase their STI investments, including bolstering research ecosystems and enhancing science and technology (S&T) workforce development. The Joint Call for Action in Kigali in 2014 exemplifies such a commitment by the governments of Ethiopia, Mozambique, Rwanda, Senegal,

and Uganda to "adopt a strategy that uses strategic investments in science and technology to accelerate Africa's development into a developed knowledge-based society within one generation."

Investments by many African countries in R&D are typically less than the continentally agreed target of 1 percent of the GDP, although some countries are beginning to take this seriously. For example, Kenya's Science, Technology and Innovation Act of 2013 allocates 2% of the GDP to research and development (R&D). Africa's research productivity has been increasing. Between 2003 and 2012, the number of peer publications authored by African researchers more than doubled, while Africa's contributions to global research increased from 0.44% to 0.72%. The impact factors of research publications coming from the region also rose, with citations increasing from 0.06%- 0.16% to 0.12%-0.28%. Most of the research output is in the areas of health and agriculture. This is unsurprising since most funding has prioritized these areas over traditional science, technology, engineering and mathematics (STEM). Dedicating more funding to STI, including more support for research in all STEM fields, continues to be an important first step. However, such commitments must be accompanied by actionable and sound national science policies that create enabling environment for STI ecosystems to thrive.

National academies of science, engineering and medicine play an important role in advising governments on national science policy, and some African countries are beginning to rely more on these professional societies. The recently launched Alliance for Accelerating Science in Africa (AESA), a collaboration between the African Academy of Sciences (AAS) and the New Partnership for Africa's Development (NEPAD), aims to drive Africa's research agenda and to build scientific capacity across the continent. The African Science Academies Development Initiative (ASADI) is a decade-long collaborative program between academies of science of several African countries and the US National Academies of Science, Engineering and Medicine geared towards "strengthening the capability of African science academies to provide independent, evidence-supported advice to inform African government policy making and public discourse related to improving human health." Such science policy initiatives are encouraging, but more still needs to be done, including governments' increased financial contribution to initiatives such as ASADI and AESA, both of which are mostly funded by grants from foreign donors. Strong national leadership and political will is needed if science policy in Africa is to succeed.

Academic Partnerships

There have been several collaborative efforts directed at STI workforce development in recent years across the continent. The Pan African University, launched in 2011, is a network of four established African universities seeking to build STI capacity at postgraduate levels by offering masters and doctoral programs in Basic Sciences, Technology and Innovation (Kenya), Life and Earth Sciences (Nigeria), Social Sciences (Cameroon) and Water/Energy Sciences (Algeria). This AU program illustrates how a shared vision by African governments can lead to strategic utilization of resources for enhancement of STI capacity and capability at existing campuses. In a separate effort, the World Bank Africa Higher Education Centers of Excellence Project, launched in 2014 is expected to create "specialized world-class higher education institutions on the continent" in seven West and Central African countries: Nigeria, Ghana, Senegal, Benin, Burkina Faso, Cameroon, and Togo.

International bilateral university partnerships are also being established, with the aim of utilizing established resources and networks at foreign universities to train the next generation of Africa's STI graduates at home. For example, the Carnegie Mellon University (CMU) in Rwanda has pioneered the establishment of branch campuses of US research institutions in sub-Saharan Africa, and is similar to models implemented in China and the Middle East. This partnership seamlessly connects students with their peers at the CMU main campus in Pittsburgh, and the Rwandan government offers scholarships to all East African students eligible to attend. The launch of the CMU Rwanda campus in 2012 is an important example of how African countries can partner with leading STI universities to rapidly train a workforce ready for growing STI economies. As Rwanda prepares for leadership in information and communications technology (ICT), its CMU partnership will retain much-needed talent at home, and favor brain gain over brain drain. Such international collaborations should be viewed positively, as they complement existing national university systems.

The Inclusion of Women

Countries with greater gender parity are more prosperous, more peaceful, and enjoy greater politically stability. African countries cannot afford the economic, political and social setbacks that result when women are systematically excluded from full and equitable participation in all segments of society. Exclusion of women from the STI sector wastes precious talent and retards scientific advancement. The future of African economies depends on eliminating this wasteful practice. Providing equal opportunity to girls and women to enroll and succeed in STEM careers is not only morally right, but also the smart thing to do. As President Obama noted in his speech at the Global Entrepreneurship Summit in Nairobi in July 2015, "Any nation that fails to educate its girls or employ its women and allow them to maximize their potential is doomed to fall behind in a global economy."

Several countries have moved swiftly to fully and equitably include women in political, professional and social institutions. Rwanda has the largest proportion of women parliamentarians of any country in the world; 64% compared to the global average of 22%.Africa now has 3 women presidents; Ellen Johnson Sirleaf, Liberia; Catherine Samba-Panza, Central African Republic; and Ameenah Gurib, Mauritius. Similar progress is needed in the STI sector, and greater efforts must made to not only enroll more

girls in STEM tracks early, but to also ensure the success of women working in STI fields. Support in the form of equal opportunity and access to STI careers, mentorship programs at all levels, and family-friendly policies for both public and private sector male and female employees will allow Africa to retain and promote the success of its women working in the STI sector.

Efforts are currently underway across the continent to boost the number of girls enrolled in STEM programs at primary, secondary and tertiary levels. However, the success of these initiatives depends on the availability of role models - professional women who are active in STI fields. The "leaky pipeline" or attrition of women as they advance up the career ladder, continues to plague STI professions everywhere. Mentoring and coaching programs can go a long way in addressing this problem, and several career advancement programs have been established for African women in STI fields. The African Women in Agricultural Research and Development (AWARD) is a mentorship program with programs in 11 African countries (Ethiopia, Ghana, Kenya, Liberia, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda, and Zambia). AWARD aims to empower more women to pursue and succeed in agricultural science careers through career-development fellowships. In Africa, women comprise over 70% of farm labor in smallholdings, yet only 25% of agricultural researchers in African are women. Recognizing that women scientists are best positioned to work with women agricultural producers, marketers and processors, and that Africa's green revolution depends on sourcing talent from all women in agriculture, AWARD seeks to "make women researchers technically stronger, better networked, and more confident and visible". The program rightly aims to position its fellows as both leading scientists and strong leaders who will support, coach and mentor the next generation of young women in the agricultural sciences.

Arguably, African Diasporans are more highly educated than the population in their home countries.Indeed, they often outperform indigenous populations of their resident countries.

Environmental Stewardship

Harnessing STI for economic growth and development should occur in tandem with environmental stewardship. Countless and often irreversible environmental disasters have been wrought by unchecked industrialization and exploitation of natural resources in North America, Europe, and, now increasingly, China. Indeed, the UN Conference on Climate Change in Paris in Nov/Dec 2015 was a collective action aimed at addressing the ills of rampant and irresponsible industrialization, currently the greatest threat to the world's human populations, ecosystems, and economies.

African countries need not follow the paths of western countries, but should seek greener solutions that safeguard the natural and human capital on which Africa's economic growth and prosperity is predicated. Environmental policy in the form of punitive measures against national, business and industrial growth is counterproductive in countries seeking to industrialize, and is not being advocated for here. Rather, African nations should intentionally source and integrate STI solutions in the design and implementation of projects in areas such as (climate-smart) agriculture, (clean) energy, (green) urban planning, and (smart) water.

These solutions are neither obvious nor simple. But with political will and creative approaches, environmental stewardship at the national level is possible. In one generation Costa Rica has more than doubled its forest cover and reduced CO2 emissions, sharply bringing the country close to carbon-neutrality. In the same timeframe, the country has established a growing medical devices industry, and catered to a rapidly urbanizing population. The Costa Rican model is one that could well inform African countries as they develop their STI and sustainable development policies.

Diasporan Engagement

From Chinese in Indonesia to Indians in Silicon Valley, diasporans move money, talent and ideas faster than other groups. The African diaspora is no different: remittances from the African diaspora contribute to economic growth in Africa, and many innovative businesses have been established by diasporans, thanks to their international contacts, training and experience. Arguably, African diasporans are more highly educated than the population in their home countries. Indeed, they often outperform indigenous populations of their resident countries. When diasporans return home, lured by increased democratization and economic opportunity, they bring with them a wide array of skills and expertise. Local and global STI companies looking to recruit talent are tapping this cohort for both leadership and technical positions.

Many African countries recognize the power of their Diasporas as economic

and diplomatic bridges to other countries. Indeed, several countries including Benin, Mali, Somalia and Tunisia have ministerial entities dedicated to diasporan affairs. African diasporan organizations, including those in STI, are increasing their visibility and demonstrating their value as channels to opportunities and resources in Africa. The Africa Gathering is a group of the African digital diaspora (with annual meetings in Africa, the US and Europe) pooling resources, sharing ideas and coordinating efforts to use technology for positive change in Africa. With the belief that "lives of many ordinary Africans can be improved using the benefits of technology, using African solutions for African problems – sometimes with a helping hand from others", this group is challenging the outdated "Aid for Africa" paradigm. Africa Gathering argues that diasporan talent, energy, experience and capital can have greater and longer lasting socioeconomic impact than traditional foreign assistance mechanisms.

Organizations of STEM diaspora professionals also play an important role in facilitating collaborations in STI. The STEM Africa Initiative at the University of Michigan creates a platform for the "engagement of science as a trans-Atlantic affair" by diasporan STEM professionals in the US and their counterparts in Africa. The Carnegie Diaspora Program supports African diasporan professors in the US to teach and conduct research in Ghana, Kenya, Nigeria, South Africa, Uganda or Tanzania. The International Diaspora Engagement Alliance (IdEA) "promotes and supports diaspora-centered initiatives in investment & entrepreneurship, philanthropy, volunteerism, and innovation in countries and regions of diaspora origin."

Just as Indian and Chinese diasporans have contributed to the accelerated growth of STI sectors in their home countries, so can African diasporans enable African countries to leapfrog into competitive STI economies. The next 5-10 years will be critical in revealing the impact of the rapidly increasing diasporan engagement in Africa's STI sector.

Global STI Programs and Investments

African research institutions are increasing their brick and mortar investments through the Pan African initiatives outlined above. However, infrastructural projects take time and significant resources. In the interim, there are opportunities to access research facilities, scholarly networks and complementary expertise in other parts of the world through science and technology partnerships. International research partnerships with North American, European and Asian agencies should be pursued and can bolster the research portfolios of individual scholars, institutions and consortia. Importantly, there should be a greater recognition that these collaborations are mutually beneficial, and western partners benefit from access to resources (expertise, data, research sites) and skilled research assistants (e.g., graduate students in science). As such, these partnerships should be leveraged to develop research activities that are well integrated and relevant to the African researchers' projects allowing for continuation of the scholarly work beyond the lifetime of the grants.

Short-term visits for young Africans, including those working in S&T, are offered by various programs such as the Mandela Washington Fellowship of the Young African Leaders Initiative (YALI) and the MasterCard Foundation Scholars Program. Both programs are aimed at providing the brightest and most promising young Africans the opportunity to access thought leaders, professional networks, and world-class facilities at partner institutions in Africa and North America. The expectation is that these opportunities will catalyze contributions of these exceptional scholars upon their entry or re-entry into the workforce back home.

Africa now has 4 of the top 10 of the fastest growing global economies and its economies are diversifying away from agricultural and minerals commodities. In Nigeria, for example, the banking, mobile phones, and construction now contribute to 60% of the GDP. Africa's middle class is bourgeoning, and there is an increase in workforce ready university STEM graduates, in part due to increased enrolment in STEM fields. Attracted by this environment, global STI companies such as IBM, Hewlett Packard, GlaxoSmithKline, Google, and GE have established regional and country offices as well as state-of-the-art production and research facilities in African countries to increase proximity to markets and competitive talent. This global corporate interest is an indication of Africa's improved investment climate, and should lead to job growth in the STI sector. Several African universities are partnering with the private sector to ensure that their curricula prepare graduates for these anticipated new employment opportunities. In addition to bolstering national efforts in workforce development, such public-private partnerships should also be used to integrate appropriate STI approaches into national development efforts in all STI-relevant sectors.

Conclusion

Africa has been rising over the past decade. While global geopolitics has certainly played a role, the renaissance is in large part the result of a critical mass of progressive Africans taking the helm in politics, civil society, business and, increasingly, STI. The exponential increase in the global exchange of ideas via the Internet and through international travel has invigorated a new generation eager for more peaceful, prosperous and inclusive societies. Africa's growing middle class is changing the landscape in all sectors, including STI. Still, the potential of STI remains largely untapped. Strategic collaboration across the continent and around the world can help harness the power of STI for the overall benefit of African countries. With good governance, robust partnerships, and an enabling environment, STI can be harnessed to transform the continent within a generation. ■

Disclaimer: "The views and opinions expressed in this paper are those of the author and not necessarily the views and opinions of the United States Agency for International Development or of Towson University."

TACKLING INEQUITIES IN GLOBAL SCIENTIFIC POWER STRUCTURES

Angela Okune, Denisse Albornoz, Becky Hillyer, Nanjira Sambuli, Leslie Chan
Open and Collaborative Science in Development Network

Abstract

Global and local power structures systematically favor the knowledge of some privileged groups, while excluding or delegitimizing the realities of others. Many scientific research and development projects are extractive in nature, profiting from local knowledge and resources, while putting external objectives before local needs. We look at the case of ICTD research in particular to highlight barriers we believe may be preventing "for development" research from meeting its full potential to improve livelihoods. We close with recommendations for a more open and collaborative science agenda to better address social needs and development challenges.

Introduction

Researchers from the global South face many challenges in knowledge production and circulation due to inequalities in research funding, infrastructure, institutional support and research capacity. While these factors contribute to the systematic asymmetry in knowledge production between the global South and North, a crucial contributor is that the value and evaluation frameworks for legitimating knowledge are largely defined and controlled by powerful institutions from the North. Instruments such as the Journal Impact Factor owned by Thomson-Reuters have had a profound effect on rendering much of the research from the South invisible.

One of the original intents of the Open Access (OA) movement was to encourage scholars to take back control of their intellectual labor and outputs, and to challenge the existing knowledge institutions that perpetuate the continual structuring and restructuring of the knowledge center and periphery. As such, Open Access does not simply stand for free access and reuse of research outputs, but is crucially about opening the boundaries of what constitutes legitimate knowledge, democratizing of knowledge production by expanding participation, and the inclusion of voices that were traditionally excluded in knowledge production.

While OA may provide a means to challenge the hegemony of the global publishing system, it also needs to be part of a broader movement to rethink what constitutes scholarly publication, quality, and impact in an open networked knowledge environment. Several academic fields and movements proclaim to also be interested in building knowledge "for development" as seen in the proliferation of "open" and "for development" groups including Human Computer Interaction for Development (HCI4D), Information Communication Technologies for Development (ICT4D), Open Government, and Open Data. However, there is a disjuncture between these

movements' professed aims around "strengthening the evidence base for ICTs to impact socioeconomic development in more positive ways" and their actual practice. In this article, we assess this disconnect, using the field of ICTD as a case study to assess how to better tackle the inequity embedded in the current paradigm of traditional scientific knowledge.

For Development?

In parallel with an increased use of networked technologies in developing countries over the last decade, an academic field of study known as Information Communication Technologies in/for Development (ICTD) has emerged. Built on an assumption that more and better information and communication furthers the development of society, ICTD scholars explore the role of ICTs in social, political, and economic development. ICTD is one of many emerging academic fields that aims to use a multidisciplinary approach to understand how to improve development. Despite laudable goals of enhancing social justice, empowering citizens, and transforming social dynamics and institutional structure, unfortunately, ICTD as a field has been unable to tap into these purported benefits. Instead, researchers continue to study the deployment of technology projects, with the research approaches and funders' expectations often replicating existing power structures and dynamics of those in control of the resources over those who are not.

We argue that working within current power structures not only excludes local processes of knowledge production, but also impedes the work of social movements that advance principles of openness and inclusive participation. We do not aim to disparage the field of ICTD; rather we wish to assess it in order to better understand how to improve the quality of research "for" development moving forward. In order to better understand the challenges to development as described in the ICTD literature, Dodson et al. (2012) reviewed forty peer-reviewed ICTD research articles published in the leading ICTD journal, Information Technologies & International Development (ITID) between Fall 2003 and Winter 2010. We draw on this study as well as our own recent experience at the latest ICTD 2015 conference to assess challenges faced by the ICTD community that we hope will be of use to other emerging development research groups moving forward.

Open Access

For a research community that believes in development, it is critical that the knowledge produced is accessible to those that may benefit from it. Publishing in closed access journals is one clear way that a field can delegitimize its calls for development. Open Access has the potential to facilitate the flow of knowledge in all directions, not only from the global North to the global South, but also within the global South and from the global South to the North (Chan & Costa, 2005). This increased freedom in access and agency to publish can greatly facilitate the development of more localized, context-dependent understandings of development challenges and potential solutions. Therefore, it is expected that development research groups would be amongst those most in support of Open Access.

Unfortunately, although Open Access and Open Science are becoming increasingly well known within most research communities, there are still many actors attempting to assert influence within current systems of knowledge production. For example, a seemingly laudable initiative by Author AID revolved around the hosting of an online course, targeting "researchers from developing countries." However, in this course, there is virtually no mention of the importance of Open Access nor the current and historical power dimensions at play, which cause many Southern institutions and individuals to be at a disadvantage within existing systems of knowledge production. In essence, this initiative is merely pushing researchers to participate within the current system. Indeed, even if they do succeed in publishing high-quality research in high-ranking journals, this research will have little to no benefit to their countries, institutions or colleagues who are likely unable to afford access to these expensive journals. In that way then, efforts to "help" researchers of the global South are merely rearticulating the same system, without seeking to challenge the system and re-imagine one in which production and access to knowledge is more equal.

At the same time, the rhetoric of "openness" is becoming increasingly co-opted by those with power in the current system. Indeed, seeing the growing push towards open access as a threat to profit margins, some publishers are taking the opportunity to manipulate open access advocates into a similarly extractive framework. For example, an "Open Access" book launch at the ICTD 2015 conference, we discovered that an international development funder had (quite begrudgingly) paid $8,000 USD simply to make the book "open" online. In this way, instead of putting a price on knowledge for those who seek access, the system of extraction uses the same principles but reverses the model, placing the financial burden on the producer of knowledge. Clearly, within this model, researchers of the global South would once again be excluded from participating in equitable knowledge production and dissemination.

Representation

If the field aims to be more inclusive and tap into new voices for more inclusive development, it must be keenly aware of representation both across geographical locations, and also from within the country and communities. As part of this reflection, questions of who is the researcher versus who is framed as the research "subject," and whose voice is being heard need to be asked. There are many lessons that can be learned by studying the Writing Culture critique of the 1980's in Anthropology. Without such cross-disciplinary sharing, we find it still common for global North researchers to speak or write on behalf of the global South.

Dodson et al. (2012) note that particular countries are highly represented in ICTD research, while others remain untouched. Amongst the 40 projects reviewed, Dodson found that over 30% of all projects were conducted

Indeed, even if they do succeed in publishing high-quality research in high-ranking journals, this research will have little to no benefit to their countries, institutions or colleagues who are likely unable to afford access to these expensive journals.

in India and 42% of the sampled research was conducted in Sub-Saharan Africa as a region. There were no projects from China or Russia, and only one from Brazil. There were no studies from the Middle East and North Africa, and there were no studies from the Gulf States or the Caribbean. This geographic focus on a few countries continues to hold true to date. Half of the 24 full papers presented at the global ICTD 2015 conference focused on Sub-Saharan Africa, especially Kenya (6 of the 12 papers). Almost a quarter of the full papers presented had conducted their study in India (5 papers). Also notable, although field sites for all of the full papers at the ICTD 2015 conference were located in the global South, only four of the primary authors hailed from institutions situated in the global South.

The publisher for ICTD conference proceedings, ACM, uses a "hybrid open access model" where authors have the option to make their published work freely available to the general public if an open access fee is paid to ACM. Many institutions in the global South do not have the $700-$900 fee required to make their work open access therefore, few in the global South are able to access the research work that was done. If global South institutions are disproportionately restricted from both accessing and also enabling others from accessing their work, the question is, who is this ICTD research for? Despite a stated aim towards improving social and economic growth, the field of ICTD appears to still operate within the existing paradigm of traditional scientific knowledge in which global and local power structures systematically favor the knowledge of some privileged groups, while excluding or delegitimizing the realities of others.

Open & Collaborative Science Approach

Many of the themes found in ICT4D work, such as equity and sustainable development, are found in other fields and social movements tackling the issues from slightly different fronts - with some movements directly challenging the existing power structures and paradigms of traditional scientific knowledge, while others aim to change the structures from within. However, we believe the key moving forward is determining how to realize these common aspirations without perpetuating the status quo. In this regard, the potential of the Open Collaborative Science (OCS) movement is worth noting. In addition to its strong reliance on ICT to promote collaboration in the global research network, it shares with ICTD research the intent to advance community building and human empowerment in development processes, but with a further emphasis on the cognitive dimension of knowledge creation. Locating synergies between both fields can inform current practices of knowledge production, push the boundaries defining what constitutes valid scientific knowledge and break down hierarchies that situate views of the "expert" at the core of development-oriented research.

The approach advanced by Open and Collaborative Science is part of Open Science and Open Development movements seeking to dismantle traditional scientific knowledge production models, by opening up the research process to multiple social actors across disciplines, geographies and levels of expertise. OCS emphasizes collaboration above its other tenets and is interested in maximizing dialogue between actors at multiple stages of research: including the design of the research problem, data collection and analysis methodologies and the publication and circulation of findings, with the objective of exploring different modes of meaning making, production and circulation in scientific production. It seeks to build infrastructures and mechanisms to actively facilitate the inclusion of marginalized and often silenced groups in this process and ultimately create platforms, spaces and opportunities of exchange in which diverse sources of knowledge are viewed as legitimate, important and necessary for the development process.

This philosophy proactively eliminates the extractive and exploitative practices derived from global and local academia to establish new principles for research that support the restoration of a knowledge commons in which knowledge is collectively governed, used, produced and circulated under principles of equity and justice. Developing the ICTD field with an OCS lens implies introducing principles already guiding the ICTD discourse, such as empowerment, local participation, access to knowledge and citizen engagement, into the process of its scientific production. Radi-

cally taking authority away from the "expert" and including diverse social actors in the research process advances principles of cognitive justice - setting up a research environment in which different forms of knowledge are considered valid and exist in dialogue with each other (Reilly, 2011; Van der Velden, 2006). As argued by Reilly, this principle shifts attention away from the actors and systems constructing the development discourse and directs it to the spaces and practices in which development happens (2011). The current ICTD academic landscape contradicts these principles and continues to limit the extent to which the participation of local partners can inform its scholarship. Taking the case of the African continent, while the thematic focus of ICTD continues to be situated in African development challenges, the voices dominating, peer-reviewing and protecting the quality of research outputs continue to be based in the Northern institutions (Gitau et al., 2010). Language biases, high entry costs and lack of governmental incentives for research impedes the successful insertion of local scholars, community leaders or citizens in most stages of the research process, undermining the presence, representation and legitimacy of Southern voices in the scholarship circulating global research networks.

Civil society, social movements and citizens advancing alternative development models are also finding opportunities in the OCS movement to spread world-views that fundamentally challenge tenets posited by the West or by local academia. Citizen science projects, open science initiatives facilitating the participation of citizens and their collaboration with experts in scientific research, creates an bottom-up participatory structure to include locally relevant problems, questions, grievances into the framing of research problems, and more nuanced interpretations informed by the local context into their analysis. The rise of the "culture of sharing" (Castells, 2011) and the further interaction, cooperation and co-creating between scientists and communities, open up possibilities for innovation (Albagli, 2015) fundamental for the mission of ICTD programs developing technologically mediated solutions to development problems. Incorporating these mechanisms into ICTD research therefore strengthens the case of using ICTs to advance citizen participation and empowerment, as the existence of the research embodies the inherent value of participation and the radical possibilities to dismantle hierarchies' latent in its process.

OCS similarly to ICTD, has not finalized a working definition for development (Burell and Toyama, 2009) and this is an ongoing challenge in its practice. While the concept hints at the improvement of socio-economic, political, cultural and human conditions, the legacy of Western interventionist models used to justify strategies of cultural domination and the spread of neoliberal capitalism in the post-WWII era is still evident in the Western development agenda (Escobar, 2011). OCS and ICTD cannot continue advancing "for development" open research without fundamentally challenging the Western development discourse and opening up a debate around what development means, particularly to marginalized, excluded and dispossessed communities. As noted in ICTD literature, the existing gap between "researchers and realities" derives from a disconnect between ICTD programs and policies and local community needs (Gitau et al., 2010) that in many instances defeats the purpose of the interventions. Moving forward, an important task for the ICTD and OCS communities is to locate alternative definitions of development.

Conclusion

As we have laid out in this article, it is critical for development research groups to recognize the global power structures within which they are operating and reflexively assess the disjuncture between narratives promoting "for development" research work and its actual practice. We suggest leveraging Open Access as an entry point to being shifting the hegemonic system of traditional scientific knowledge. This will require greater engagement across different development research movements for increased collective influence. Through such cross-discipline collaboration and proactive bridging of development rhetoric with research practice, policies and programs implemented through these development research programs can greatly contribute to the democratization of debates around the meaning of well-being across languages, geographies, cultures, traditions of knowledge exchange.

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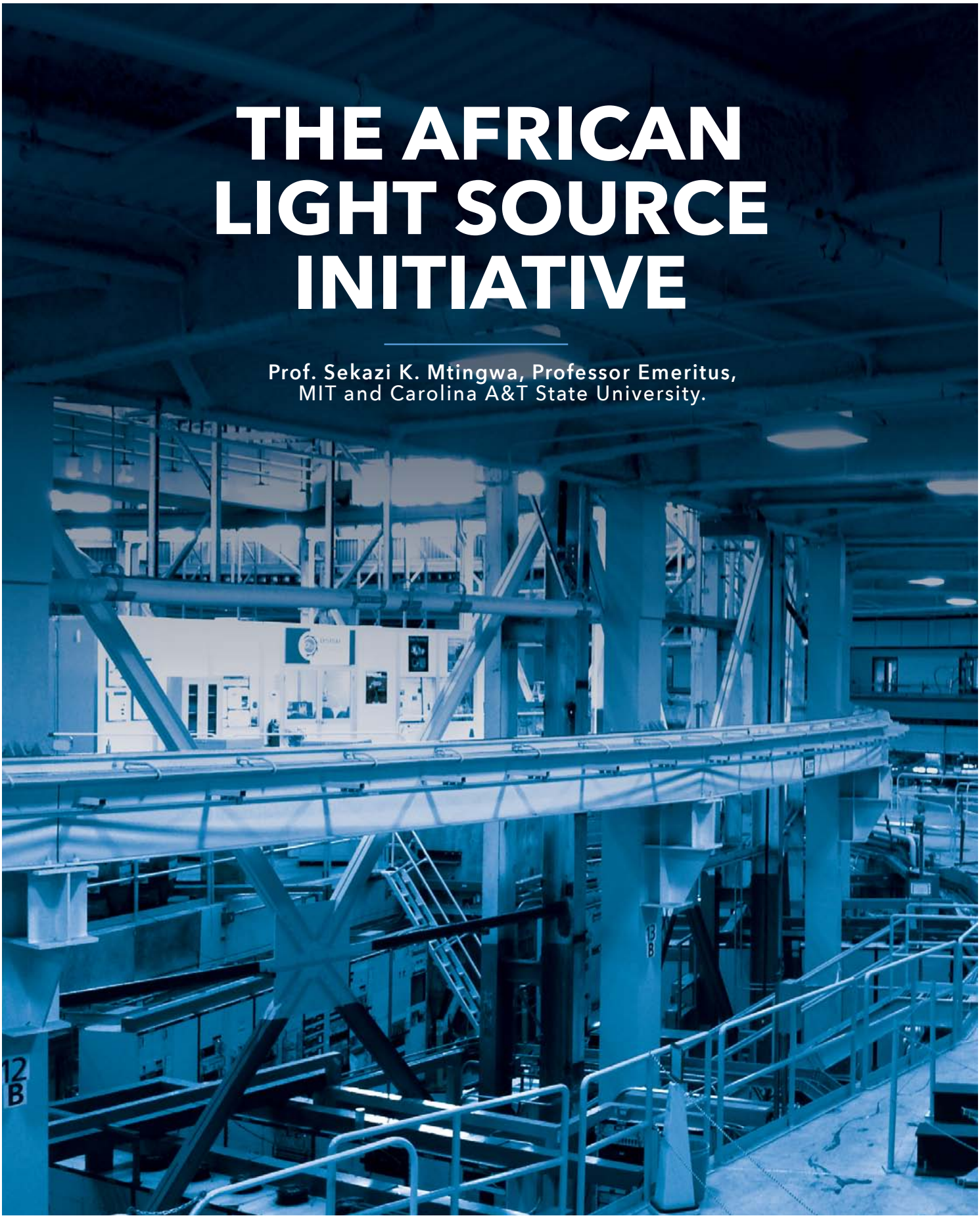
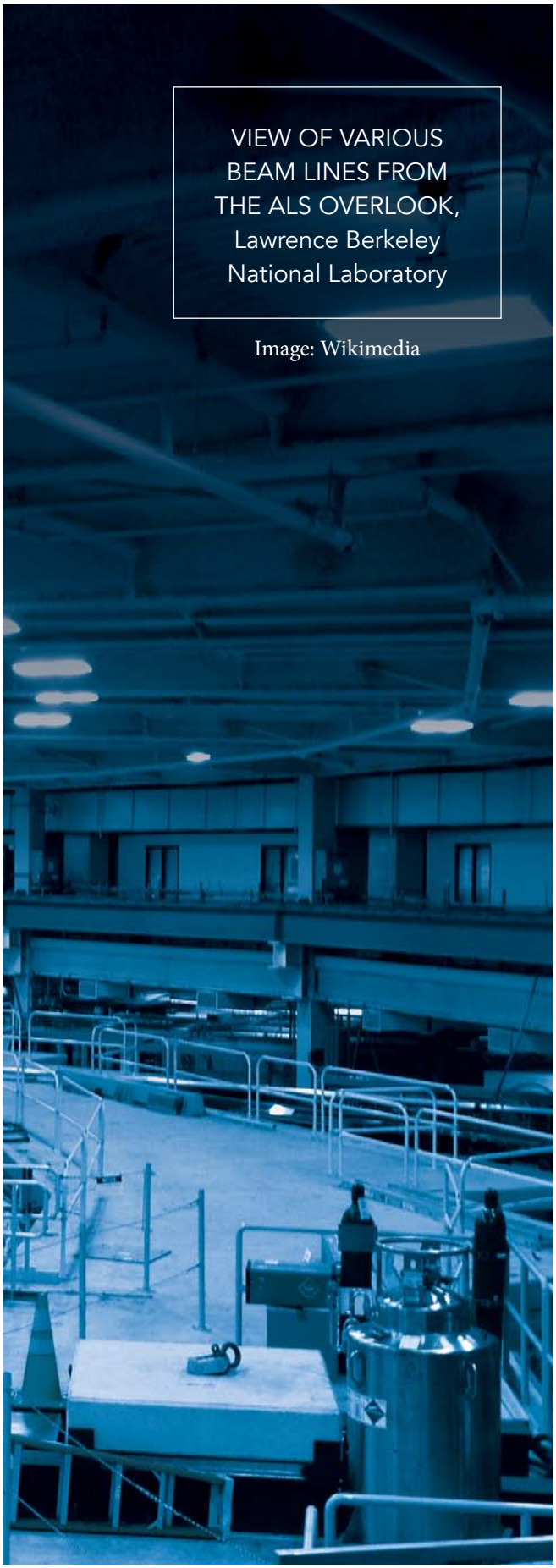
THE AFRICAN LIGHT SOURCE INITIATIVE

Prof. Sekazi K. Mtingwa, Professor Emeritus,
MIT and Carolina A&T State University.





VIEW OF VARIOUS BEAM LINES FROM THE ALS OVERLOOK, Lawrence Berkeley National Laboratory

Image: Wikimedia

Several decades ago, a new genre of scientific instrument burst upon the scene and has been revolutionizing many disciplines ever since. Called an advanced light source, or often simply a light source, it provides intense beams of photons, which are particles that make up beams of light as first realized by Albert Einstein and for which he received the 1921 Nobel Prize.

A synchrotron-based light source is more important as a first time investment, because fifty or more beams, mostly X-rays, can be extracted at many points around the circular accelerator, which is typically hundreds of meters in circumference. Hence, scientists and engineers from many disciplines can perform experiments simultaneously, creating a rich community of interdisciplinary users. Moreover, the X-ray beams are many orders of magnitude brighter than those from conventional lasers, thereby allowing researchers to collect their data during much shorter periods of time, allowing even more kinds of experiments to be performed. The free-electron based light sources have even higher brightness; however, there are typically less than ten beamlines in operation simultaneously. Thus, a synchrotron-based light source is the more urgent investment in times of limited financial resources.

In an article published on the lightsources.org, (http://www.lightsources.org/news/2014/09/05/synchrotron-radiation-research-facility-africa) Herman Winick, who is Professor Emeritus at Stanford University and SLAC National Accelerator Laboratory in the USA, together with this author point out that many countries, both developed and developing, are rapidly building higher brightness light sources. Today, there are approximately fifty such light sources in operation.

Fig. 1 Depicts the locations of advanced light source facilities, with some operating more than one light source.

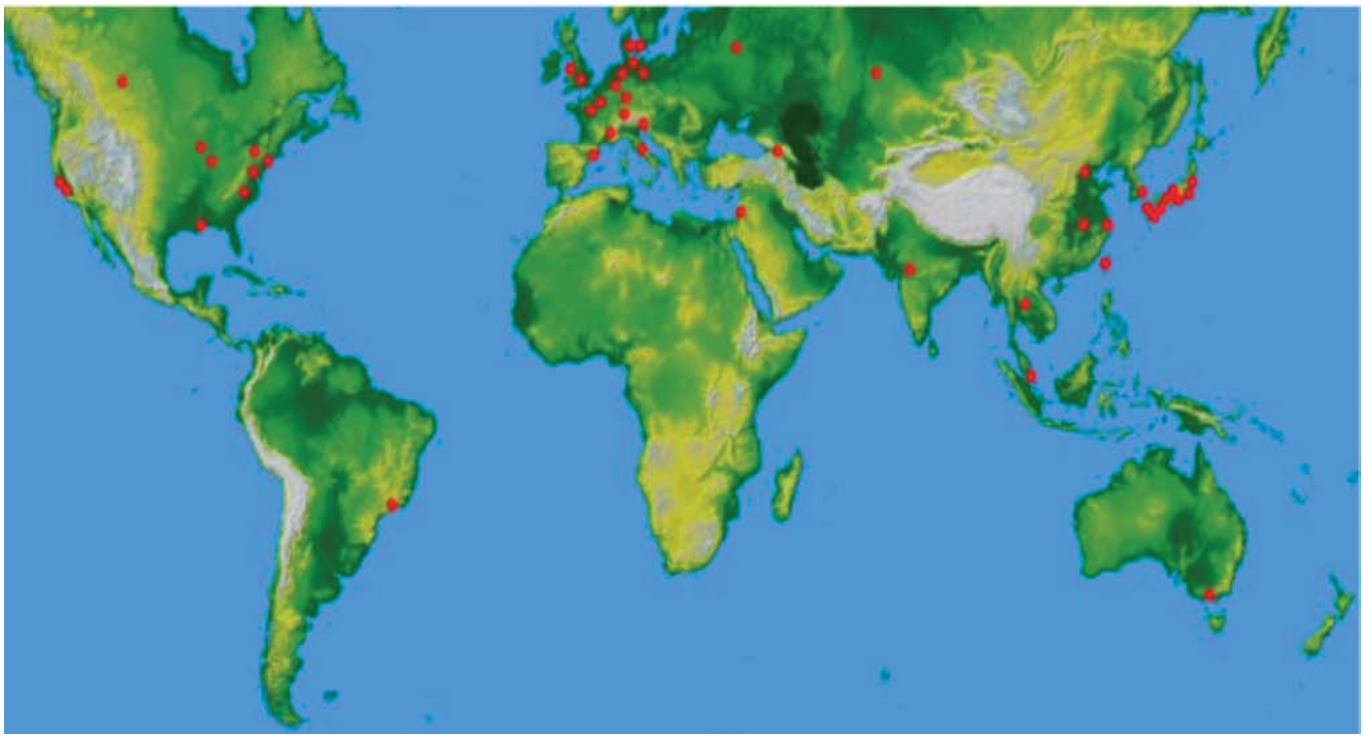


Figure 1

Africa is conspicuously absent from the list of continents with advanced light sources. This puts the continent at a distinct disadvantage. By far, the largest community of African advanced light source users is in South Africa and they must travel thousands of kilometers to Europe, mostly to the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, to perform experiments. The travel costs place a major constraint on the number of researchers that can be financially supported.

In the summer of 2014, interested parties elected an Interim Steering Committee for the African Light Source (ISC-AfLS), chaired by Simon Connell, who was Professor of Physics at the University of Johannesburg. The ISC had representatives from a wide range of countries, including Egypt, Ethiopia, France, Japan, Nigeria, Rwanda, Senegal, South Africa, Sweden, United States, and Zimbabwe. In November 2015, Connell led a subgroup of the ISC in organizing the First African Light Source Conference and Workshop at the ESRF.

The meeting consisted of two segments: two days of presentations on light source research by Africans, as well as presentations by both Africans and non-Africans on research of importance to Africa. The final three days focused on policy and strategy. The organizers decided that this first in a series of AfLS meetings should be located on the site of an operating flagship synchrotron light source so that participants, especially students and policymakers, could tour one of these facilities.

The AfLS Conference and Workshop had three major outputs: (1) a set of overarching statements, called the Grenoble Resolutions, (2) a Roadmap to guide future activities, and (3) the election of a fully mandated Steering Committee to replace the ISC.

Grenoble Resolutions

- Advanced light sources are the most transformative scientific instruments similar to the invention of conventional lasers and computers.

- Advanced light sources are revolutionizing a myriad of fundamental and applied sciences, including agriculture, biology, biomedicine, chemistry, climate and environmental eco-systems science, cultural heritage studies, energy, engineering, geology, materials science, nanotechnology, palaeontology, pharmaceutical discoveries, and physics, with an accompanying impact on sustainable industry.

- The community of researchers around the world are striving collaboratively to construct ever more intense sources of electromagnetic radiation, specifically derived from synchrotron light sources and X-ray free-electron lasers (XFELs), to address the most challenging questions in living and condensed matter sciences.

- The African Light Source is expected to contribute significantly to the African Science Renaissance, the return of the African Science Diaspora, the enhancement of University Education, the training of a new generation of young researchers, the growth of competitive African industries, and the advancement of research that addresses issues, challenges and concerns relevant to Africa.

- For African countries to take control of their destinies and become major players in the international

Fig. 2 Contains a group photo of some of the participants, which numbered more than one hundred.

community, it is inevitable that a light source must begin construction somewhere on the African continent in the near future, which will promote peace and collaborations among African nations and the wider global community.

MAJOR ELEMENTS OF THE MEETING'S SECOND OUTPUT CAN BE SUMMARIZED AS FOLLOWS:

Roadmap Summary

Short-Term Goals (within 3 years)

- Train large numbers of African scientists, engineers, students and technicians in the design and utiliziation of advanced light sources.
- Enhance the existing community of light source users.
- Establish formal partnerships with existing international light sources.
- Promote the involvement of industry.
- Create and/or enhance Africa's current and needed critical feeder infrastructure that empowers light source science.
- Promote outreach and communication around light source based science.
- Study the feasibility of constructing African multinational beamlines at existing light sources, perhaps with partners from other regions of the world.
- Develop a Strategic Plan for submission to African Ministries.
- Develop an AfLS non-site specific Pre-Conceptual Design Report, which specifies a detailed scientific case for an AfLS along with its various components, including the accelerator complex, experimental beamlines and ancilliary facilities.

Mid-Term Goals (within 5 years)

- Continue all the Short-Term activities, as required.
- Study the feasibility of constructing an AfLS, including costs, and appoint a Task Team approved by African governments to develop a detailed Business Plan and Governance Model for an AfLS.

Long-term Goals (5 years and beyond)

- Continue all the Short- and Medium-Term activities, as required.
- Complete an AfLS Technical Design Report that includes site selection, and when approved by a sufficient number of African governments, begin the construction of a latest generation synchrotron light source.

To drive the Roadmap forward, the Workshop participants and other interested parties cast online ballots and elected the new Steering Committee for an AfLS, with Connell as Interim Chair.

An excellent model already exists for Pan-African scientific and technological cooperation. It is called the African Laser Centre (ALC). It is important to note that the ALC called for the construction of a Pan-African advanced light source from its very beginning, when it developed its 2002 Strategy and Business Plan, which specified a synchrotron light source as one of its long-term goals. The ALC is a nonprofit organization, based in Pretoria, South Africa, and consists of over thirty laser laboratories from universities and other research and industrial institutions across the African continent. Officially launched in Johannesburg in November 2003

Fig. 3 Shows several of the researchers and students in attendance.

during a Ministerial Segment of the New Partnership for Africa's Development's (NEPAD) Conference on Science and Technology for Development, NEPAD declared the ALC to be one of its Centres of Excellence.

The ALC Strategy and Business Plan specifies the following:

Goals of the African Laser Centre

- Improve the quality of life of all African people.
- Stop the brain drain from Africa by providing a competitive knowledge base and attractive research facilities.
- Ensure that African laser facilities become preferred research environments for both the international and African research communities.
- Facilitate technology transfer to industry of knowledge obtained from laser research and development.
- Provide financial resources, technical assistance and equipment loans to laser researchers throughout Africa.
- Promote collaborations among laser researchers throughout Africa, as well as between African researchers and their international counterparts.
- Establish flagship facilities: femtosecond lasers, petawatt lasers, synchrotron light sources.

To assist smaller and less developed laser laboratories, the ALC identified several facilities that it classified as core nodes of the ALC network.

Those nodes, together with several of their major activities, are the following:

1. **National Laser Centre, Pretoria, South Africa (ALC Headquarters)**
   Manufacturing, machining and materials processing
2. **Laser Research Institute, University of Stellenbosch, South Africa**
   Ultrafast science, laser diagnostics, femtosecond laser research and development
3. **National Institute of Laser Enhanced Science, Cairo, Egypt**
   Medical and biological applications of lasers, femtosecond laser research and development
4. **Laboratoire Atomes Lasers, Université de Cheikh Anta Diop, Dakar, Sénégal**
   Atomic and molecular physics, laser spectroscopy, medical physics
5. **Laser and Fibre Optics Centre, University of Cape Coast, Ghana**
   Agricultural and environmental science
6. **Advanced Technologies Development Centre, Algiers, Algeria**
   Laser spectroscopy, surface studies, laser welding
7. **Tunis el Manar University, Tunis, Tunisia**
   Agricultural and environmental science, molecular spectroscopy.

Fig. 4 Depicts the countries with ALC member institutions.

Fig. 5 2003 group photo of the ALC organizers, with the second from the right on the first row being Philemon Mjwara, the first ALC Board Chair and currently Director General of South Africa's Department of Science and Technology.

Awarding 87 research and educational grants during 2006-2013, the ALC has empowered its participants to produce 151 articles in refereed journals, 210 publications in Conference proceedings, 12 book chapters, and 59 student theses. Moreover, between 2003 and 2013, 1249 students were trained in workshops, symposia and various short courses. Fig. 6 shows a session in progress at the Second US-Africa Advanced Studies Institute that was held at iThemba LABS, outside Cape Town, during November 2007. That Institute, which is held periodically and is co-organized by the ALC, is the brainchild of Alfred Z. Msezane, who is from South Africa and is Professor of Physics at Clark Atlanta University in Atlanta, Georgia, USA.

Most light sources are owned by a single country, while the ownerships of others are shared. An example of the latter is the ESRF, which is a collaboration of 18 European governments, plus South Africa and Israel, and has been in operation since 1992. Another example is SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East), which is scheduled to start its research program in 2016. It was constructed in Allan, Jordan, approximately 30 kilometers from Amman, as a collaboration of nine Middle Eastern governments, namely Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestinian Authority, and Turkey. SESAME is modeled after the high energy physics laboratory, CERN (European Organization for Nuclear Research), where researchers discovered the long sought Higgs particle in 2012. UNESCO serves as the umbrella organization for both SESAME and CERN.

Africa can learn tremendously from the experiences of other countries. An excellent example is Brazil. Discussions started in the early 1980s to construct a synchrotron light source there. At the time, Brazil had no experience constructing or operating an advanced light source, and it had few users of light sources at international facilities. However, the country undertook an ambitious program to train students, scientists, engineers and technicians in synchrotron light source science. From those early efforts, Brazil proceeded to construct its first light source, called UVX at the Brazilian Synchrotron Light Labo-

Africa will either pay huge sums to cope during and after the next Ebola attack or pay much smaller amounts to learn how to combat the virus before it returns.

ratory, which began experiments in 1997. It is still the only operating synchrotron light source in Latin America.

Over the years, the number of users has grown to more than a thousand per year. Now, Brazil is constructing a new light source called Sirius that is scheduled to produce its first beam in 2018, at which time it will be one of the highest brightness synchrotron light sources in the world, thanks to a new technology called the multi-bend achromat that was developed at the MAX IV Laboratory in Sweden. That technology has allowed for greater brightness, but smaller and less expensive light sources. As usual for light sources, local businesses in Brazil have benefitted greatly by designing and manufacturing components for the facility.

As for Africa, Brazil has diseases that are specific to its region of the world. An example is Chagas disease, which is caused by an insect-spreading parasite called Trypanosoma cruzi. It affects millions of people in Latin America with extremely high social and economic costs. Current treatments have low efficiency and often severe, harmful side effects. Researchers at Brazil's light source are hard at work investigating the protein structure of T. cruzi in order to identify vulnerable targets on its proteins that could be used for drug development to fight the disease.

Africa can learn tremendously from Brazil's experience in fighting Chagas disease, since it has a number of diseases that are ravaging the continent, with some not prevalent in more developed regions of the world. Thus, African cannot wait on others to take the lead in developing treatments for such diseases as Ebola and malaria. Indeed, Ebola will be back; the only question is when. The virus attacks and learns how to mutate itself to wreak more havoc when it returns. The only question is whether Africa will have learned enough before the next attack to defeat the new version of the virus. Thus, Africa will either pay huge sums to cope during and after the next attack or pay much smaller amounts to learn how to combat the virus before it returns. The fastest and most efficient way to identify target Ebola proteins for drug discovery is via the utilization of an advanced light source.

There is a tremendous urgency for African Governmental Ministers, especially those of Science and Technology, Health, Education, Energy, and Natural Resources, to meet with representatives from the AfLS Steering Committee to discuss the Grenoble Resolutions and AfLS Roadmap; tour international advanced light source facilities; send students, researchers and technicians to light sources for training; and commission a Task Team to study the feasibility of constructing an African advanced light source.

Now is the time for Africa to act, and act swiftly.

Prof. Sekazi K. Mtingwa is an accelerator, nuclear and high energy physicist, who is best known for seminal theoretical work on a phenomenon called intrabeam scattering, which sets an ultimate limitation on the performance of most modern accelerators, including synchrotron light sources. He is a member of the AfLS Steering Committee and founding Board Member of the African Laser Centre, having served as the Principal Author of its 2002 Strategy and Business Plan, which defined its goals and programs. He is a founding member of the African Physical Society, International Board of Editors of The African Review of Physics, and the African Institute for Mathematical Sciences in Biriwa, Ghana.

He received the 2015 Distinguished Service Award from the American Nuclear Society, chaired the writing of the Strategic Plan for South Africa's synchrotron light source user community, retired from the faculties of both MIT and North Carolina A&T State University, and currently is Principal Partner at Triangle Science, Education & Economic Development, LLC in the Research Triangle of North Carolina, USA.

AFRICA, FOSSIL FUELS AND THE GLOBAL ECONOMY

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Why We Love Fossil Fuels

For the last two centuries every nation that wished to develop its economy simply had no choice but to develop its own fossil fuels, or to buy them on the open market. The logic and necessity of doing so was not questioned for the world's economy ran unquestioningly on the fuels trapped underground, decomposed and recomposed fuels derived from creatures and plants that lived and died millions of years ago.

Coal fueled the 19th century, and then oil the 20th. There are five compelling factors that make fossil fuels, and especially oil, such an attractive source of energy. First of all, it has very high energy density, meaning the amount of energy, or work that you can extract from a given gallon or a liter of oil is very high when compared to other types of fuel. Your car can go 15 or 30 or even 50 miles on a gallon, or you can make a lot of electricity.

Second, oil is tremendously versatile. You can burn it in a car's engine or a giant power plant, or you can make it into hundreds of different kinds of plastics, from grocery bags to bullet proof vests to water pipes and computer keys.Third, when you combust it in an engine, oil's energy is available almost instantly. Thus, due to significant advances in steam engines, steel making, and cannon, all the world's navies converted from wooden sailing shops to iron clad steamships following the American Civil War, but it took five hours for a large battleship's steam engines to come to power because the coal had to be stoked and the heat and pressure of the flame built up gradually. Thus the entire ship was trapped in port for five hours even under direct threat. Because oil-burning engines come up to speed immediately, an oil-powered fleet can be in motion with only a few minutes warning. As military advantages go, this is quite decisive, and thus all the navies in the world had switched again, this time to oil, by 1910.

In our cars, meanwhile, we can step on the gas and feel immediate power, and we can fire up a power plant and generate massive quantities of electricity in almost no time. Another appealing quality of oil is how easy it is to transport. It is readily moved in trucks, rail cars, giant tanker ships, and very long pipelines. Through them, it can be transported relatively cheaply from wherever you find it to wherever you want to refine or use it. Finally, oil is found in many places, and as drilling and extraction technology has improved, the capacity of production companies to extract it from more difficult and elusive underground locations has improved enormously.

Because of these many benefits, oil has been the preferred fuel of the global economy for a century, and it is no exaggeration to say that the 20th

century's economic boom was an oil boom. Today a massive and very complex system of global finance, production and transportation infrastructure is fully in place to locate and extract raw crude, transport it to refineries, distill it into its desirable fuel products including gasoline, jet fuel, diesel, and many different forms of plastics, and redistribute those distilled products back to the gas stations and factories around the world, and manage the massive flows of capital that result.

Underground pools of oil are called fields. The first one to be developed was in Western Pennsylvania in 1860, and it was here that John D. Rockefeller made his initial fortune. As the demand for oil increased, the global industry thrived by finding new fields around the world. Oil exploration became a sophisticated science, and decade by decade new tools and techniques were created to locate oil and to extract it. Seismic studies mapped underground rock formations, 3D software modeled the structure of underground fields, wells were drilled deeper and deeper to exploit those fields, and then offshore drilling was perfected, followed by horizontal drilling, and the design and construction of massive pipelines, ports, and tankers followed. The Alaska Pipeline stretches for 2500 miles across the state to bring Prudhoe Bay oil to the port of Valdez, and over the forty years of its existence some 10 billion barrels have been pumped through it.

Crude oil provides the raw material for a global network of about 1200 oil refineries that transform crude into gasoline, jet fuel, other liquids, and also the raw materials from which all plastics are made. Their production then goes into the vast, global network of retail outlets that provide us with the gas for our cars, and into additional trucks, rail cars, tankers, and pipelines that transport refined fuels to airports and factories worldwide.

Supply, on the other hand, is a function of a very dynamic market environment. Oil wells do not produce indefinitely, nor do the fields that are composed of many wells. When a new field is discovered, the geologists attempt to determine the amount of oil it contains, and the proportion of that oil that can be extracted. The resulting calculation then becomes a significant asset on the owner's balance sheet, but as the oil is extracted the value of asset then declines toward zero.

The Oil Tax

As oil is the primary energy source of the industrial economy, energy consumers simply have no choice but to pay oil producers for the right to join the world economy. Because the ownership of untapped crude oil, as well as the infrastructure used to extract, transport, refine, and distribute it, requires a massive investment that is also highly centralized, the enormous demand for fossil fuels and thus the success of the industry has resulted in a tremendous concentration of wealth in the hands of a very small number of oil producers, particularly in the nations and companies that own oil reserves, and extract, refine, and distribute it. In essence, then, those who own the oil also hold the power to tax everyone else for the right to participate in the global economy.

As a scarce and highly valuable resource, oil is also a source of conflict and also a means of funding conflict. For example, ISIS, the Islamic fundamentalist group that controls Northern Syria, funds itself through the sale of oil, which is smuggled from the oil producing territories in every manner of vehicle and finds its way into every regional market. Ironically, ISIS oil is powering the cars in the Syrian cities controlled by its arch-rival, the government of President Assad. It is not just ISIS of course, as nations as diverse as Russia, Venezuela, Brazil, Saudi Arabia, Kuwait, Iraq, and Iran all depend for their economic viability on the sale of oil.

Since the majority of the world's economic activity is powered by fossil fuels and especially by oil, the leading oil producing nations are among the wealthiest nations per capita, and the big oil firms are among the most valuable corporations. Over the decades, as more and more countries developed their own economies and became more fully industrialized and more fully integrated into the global economic system, they also became more fully dependent on fossil fuels. Their per capita energy consumption increased as their economic production increased, which brought greater wealth, which then created a middle class. And as their middle classes expanded, their domestic markets for goods and services also expanded, further amplifying the demand for oil. The overall wealth of nations increased, and the oil industry came to be the single largest economic entity in the world.

In China, for example, this process was quite pronounced, and also quite sudden. During the years immediately following the transition to a capitalist economic system in 1978, the nation's economy expanded along an elegant exponential path, and consumption of energy increased exactly in parallel with increasing economic activity.

As a source of fuel for a dynamic, modern economy, increasing demand for the oil to fuel that very economy transfers wealth outside of it. It is a drain that benefits oil producers, to the detriment of non-producers. Consequently, every nation or community that does not own crude oil resources has, on the one hand, an incentive to consume more oil as a means of promoting more economic growth, but on the other hand an inherent incentive to not consume oil because the cost of oil is drag on economic growth. Now, nearly all of the world's nations and peoples are fully engaged in the fossil fuel economy, and consequently demand for oil is at an all-time high.

But as we know, all is not perfect in the oil lands. Every nation that is not an oil producer has a significant incentive to find an alternative source of energy. That is, every nation, wants a source or sources of energy they can own and control. Hence, even without environmental considerations and the impending impact of global warming, every global economic player that is not oil-rich has a significant financial incentive to switch to alternative sources of energy. Any source of energy that can be produced lo-

cally, at a competitive cost, is therefore highly attractive. Hence, as solar energy production costs become competitive, solar will find a ready market. If we are indeed approaching the end of the fossil fuels era, then the process that led to the concentration of wealth in the hands of the oil owners is about to reverse itself. The coal and oil producers would not then become more valuable, but less valuable, which will of course be economically traumatic not only for them, but across the entire economy. In fact, this may already be happening.

The Alternatives

Scientists, technologists, and entrepreneurs have targeted the energy market for decades, simply for the obvious reason that there's so much money there, and so many other possible ways to develop energy. As a result, the cost to generate energy from non-fossil sources has been steadily coming down for decades, and the declining cost combined with the previously-hidden impact of CO2 concentration has resulted in a broader field of energy sources that are increasingly attractive. Solar, wind, tidal, fuel cells, and biofuels are five very broad categories in each of which there are dozens if not hundreds of start-up companies, and even some that are quite well established, that wish to provide an alternative to fossil fuels. And when a buyer, whether that buyer is a nation, a city, a company, or a single individual, has the option not to consume fossil fuels, they often willingly take that option.

Hence, it is reasonable to expect that the demand for fossil fuels will drop as the reality of climate change sets in, but only if alternatives simultaneously become price competitive. Hence, the real race is not between fossils and alternatives, it is between competing scientists and technologists who are making massive advances in energy technology systems design. It is not a question of if, but when. When will the fossil fuel industry cease to dominate the global economy? Will its demise occur within twenty to thirty years, or perhaps a century or more from now?

If we take the view that the demise of the fossil fuel economy is imminent, then we also confront the reality of a new economic transition if not revolution. Based on the confluence of climate change and technological innovations, it is difficult to imagine a credible scenario in which oil retains its place of preeminence in the world's overall energy mix in the long term. This transition might occur sooner rather than later.

The Largest Economic Transition in History

The economic transition from fossil fuels to whatever comes next is of course not going to be a simple undertaking. The scale and scope of this economic transition could be the single largest economic project in the history of humanity. Large scale solar energy production is a massive design and engineering problem, but it is one which has already seen great success. For example, in 1977 the cost to produce one watt of solar-generated electricity was USD 74. By 2010, that cost had dropped to USD .74. This was of course the result of focused science and engineering effort and talent, applied to a very specific problem, and producing quite impressive results.

Electricity generated in large power plants from oil and natural gas currently costs about ten cents per watt to generate and distribute, so as the cost of solar approaches a dime then the impetus to switch to solar will become increasingly attractive to many nations.

Standing in the way of the transition would be a massive global infrastructure which distributes oil, gasoline, natural gas, and electricity, but which does not yet exist for solar-based power, or for hydrogen fuel (which some scientists believe may be preferable to solar as a transportation fuel). Creating a new non-fossil fuel based global infrastructure will be an expensive undertaking, but it is already happening in bits and pieces.

During the first few months of 2015, four major US corporations announced commitments to purchase electricity from solar and wind producers. These include HP and Dow Chemical, which purchased 112 and 200 megawatts of wind power in Texas; Kaiser Permanente which purchased 153 megawatts in California; and Amazon, which purchased 208 megawatts of wind-generated electricity in North Carolina.

These purchases are doubly significant. First, they demonstrate the growing commitment to search for alternatives to fossil fuels. Secondly,

these companies are very sophisticated buyers, who will expect and require that the energy systems they buy provide safety, reliability, and ongoing technological improvements. They have committed to obtaining electricity in 2016 and 2017 from these purchases, but year by year thereafter they will expect increases in efficiency and power yield. Hence, by playing the role of "early adopters" they are joining the venture capitalists in funding a massive effort in R&D, which should lead to improvements that not only benefit themselves, but which benefit all producers and consumers of solar and wind power, and which will serve to significantly accelerate the overall economic transition.

Powering the US Military

Another large organization that is committed to transitioning away from fossil fuels is the US military, one of the world's largest enterprises and organizations. Operating with an annual budget of more than USD 500 billion, the Department of Defense is the largest single consumer of energy in the United States. In FY 2006, the Department used almost 30,000 gigawatt hours (GWH) of electricity, at a cost of almost $2.2 billion. In 2007 it accounted for about 93% of all US government fuel consumption, mostly by the Air Force, in the form of jet fuel. The Department of Defense uses 4,600,000,000 US gallons (1.7×1010 L) of fuel annually, an average of 12,600,000 US gallons (48,000,000 L) of fuel per day.

Every branch of the US military has its own specific plans and initiatives to replace fossil fuels with renewable energy sources, all of which is intended to contribute to the overall goal that 20% of all energy consumed by the DoD should be from renewable sources by 2020. That is roughly USD 400 million of power purchases, which will probably mean that within the decade the DoD will be the world's number one consumer of renewable power. And of course long term commitments to purchases on this scale will also make it possible for power producers to invest even more heavily in ongoing research and development to further refine their technologies, which will increase their efficiencies and thus reduce their costs.

Mass Storage

There remain significant technological challenges to be overcome. Since solar collectors only produce when the sun is shining (duh!), reliable and very large scale mass storage systems are essential if there is indeed going to be a solar economy. Consequently, the search for solutions that provide cost-effective, reliable, large scale energy storage is also a subject of intense scientific and technological research. There are hundreds of potential solutions being explored and developed in labs around the world, labs run by corporations, governments, universities, and also by consortia of all three.

Since solar collectors only produce when the sun is shining (duh!), Reliable and very large scale mass storage systems are essential if there is indeed going to be a solar economy.

The Summary Argument

The basic economic argument, then, is a compelling one. At the same time that all this effort is going into the development of the science and technology of solar, wind, and the necessary batteries, the world continues to come to grips with the reality of climate change and its devastating consequences. Violent storms are increasing in both frequency and magnitude (remember that ten of the ten strongest storms in all of recorded history have occurred in this new century), and there are no indications that either trend, the one of increasing performance by renewable energy systems, and the one of climate change impacts, will change.

Hence, as the threat becomes clearer, governments and companies are likely to become more willing to invest more heavily in alternatives to fossil fuels. In short, the 21st century will not be a fossil fuel century as the 20th was. If you are living in an oil producing nation, or you are an oil company, this is probably bad news. Globally we are shifting from fossil fuels to what we euphemistically call "alternatives," that is, energy sources that aren't fossil fuels, but which actually powered all the world's nations through the millennia of civilization until 1800. In that sense we are returning to the pre-industrial sources of energy supply albeit harnessed using far more advanced technological and organizational or business innovations.

This likely transition will also impact Africa. On the one hand, lowering the cost of non-fossil sources will enhance and accelerate economic development across the continent. Large scale investments in power production and distribution will provide economic opportunities, and the resulting systems will enable cleaner transportation and cleaner industry. Escaping the oil tax will free up additional capital that can be applied to much more productive uses, and may even help to stimulate a new generation of entrepreneurs.

On the other hand, the decline of the fossil fuel economy will cause significant economic disruption in the oil producing African countries nations which are highly dependent on oil revenues (e.g. Libya, Nigeria, Algeria, and Angola). To avoid these disruptions, African countries, including oil producing ones, need to aggressively invest in alternatives to the oil industry. They need to become part of the new global energy infrastructure that is not wholly dependent on the fossil fuel economy. ■

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MULTINATIONALISM IN THE FACE OF A GROWING TERRORIST THREAT IN AFRICA

Bat-el Ohayon and Frank Charnas
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Africa has witnessed a cross border spread of terror and militant networks over the past decade. The functioning and geographic location of these networks has evolved, as militant groups acquiesce to the prevailing security situation in a particular region, and search for lucrative and accessible smuggling routes, enabled in part by the porous nature of borders and impacted by major geopolitical changes such as the fall of Muammar Gaddafi in Libya. As early as 2012, Africom warned that Boko Haram in Nigeria, the Algerian-based al-Qaeda in the Islamic Maghreb (AQIM,) as well as al-Shabaab in Somalia, were seeking to "coordinate and synchronize their operation". This spread of the African terror and militant threat has necessitated a shifting approach to counterinsurgency, resulting in the formation of regional counter-militancy formations. Modern African militancy is an asymmetric multinational

threat, requiring a multinational response - African brotherhood in the face of an African challenge. However, the success of these operations are compromised by several factors, most notably political tensions and competing national interests between participant nations. Africa's transnational security may thus hinge on the consolidation of the geopolitical aims and interests of partner countries.

Traditionally, national security and territorial integrity are cornerstone responsibilities for governments. However, the regionalization of militancy has foundationally altered the concept of national security, forcing individual nations to partially waiver territorial integrity and rely on regional partners for security and the safety of their population. Thus, there exists a high diplomatic and political risk for countries participating in regional military efforts, as they impart some of their security responsibility to partner nations. Additionally, there are significant logistical, financial and operational hindrances to the effective implementation of a regional joint effort.

Regional and sub-regional cooperation against militancy on the continent in recent years has led to the creation of the African Union Mission in Somalia (AMISOM) in Somalia, the deployment of the United Nations Multidimensional Integrated Stabilization Mission in Mali (MINUSMA) and French troops to northern Mali in 2013, and a joint regional force to combat Boko Haram in Nigeria, whose activity significantly spread to Cameroon, Niger and Chad. In The Democratic republic of Congo (DRC), activity by a number of small insurgent groups, some of whom have their genesis in neighboring countries, prompted the creation of the United Nations Organization Stabilization Mission in the Democratic Republic of Congo (MONUSCO) as well as its aggressive arm, the Force Intervention Brigade (FIB). However, in each of these cases, national geo-political interests have degraded the efficacy of counterinsurgency efforts, and possibly extended the lifespan and scope of militant groups.

Mali: French involvement and its domestic political price

The French and AU intervention in northern Mali in 2013 was initially deemed a success, having halted various militant groups from advancing on Bamako. That said, while the imminent terrorist threat was mitigated by international forces, a tactical retreat by members of AQIM, the Movement for Oneness and Jihad in West Africa (MOJWA), and other groups did not equate to the ultimate success of the joint intervention. African and French leaders came to the conclusion that pushing militants out of Mali simply prompted a further regional spread of the threat posed by these groups. This emphasized the need for a regional response to a cross-border militant threat, and thus the French launched the Barkhane Operation, a joint operation with African troops in several countries across the Sahel and Sahara. For this operation, France rearranged its troops and its logistical presence in the area, not only as a way to better counter the threat but also in an effort to have ready access to crucial logistical equipment and capabilities.

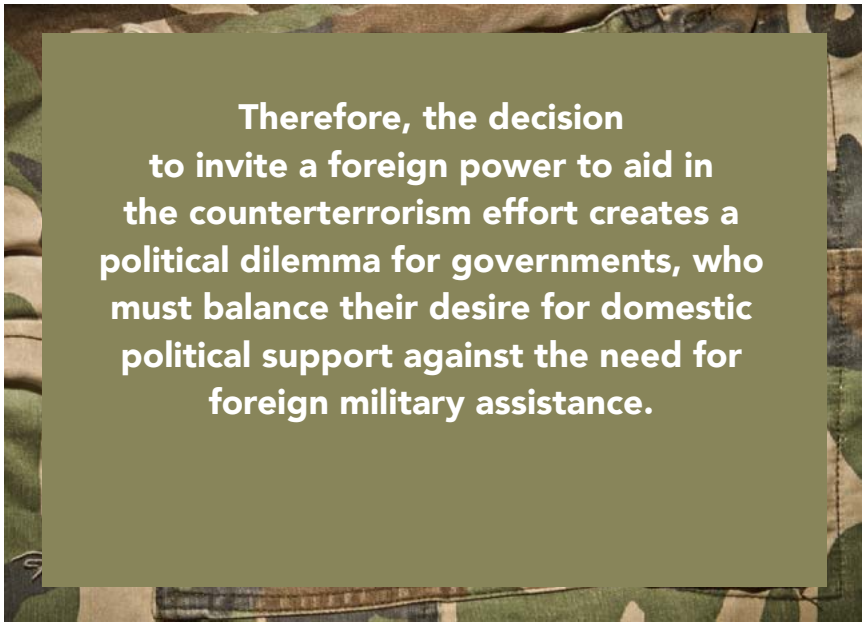
It is important to note that in this case, the right to strike was given to a foreign power, France, which maintains a well-established military in the affected region. French military involvement has had a strong political repercussion for many of the countries involved in the Barkhane Operation. In Mali, the local population, who had once welcomed the French troops, began questioning the former colonial power's role, while additionally linking the need for such a presence with the weakness of their own government and military. Furthermore, the presence of large French companies as well as important expatriate communities in the region have fueled doubt in the intentions of the French, as demonstrated by the negative sentiment toward France and French businesses in Niger. Therefore, the decision to invite a foreign power to aid in the counterterrorism effort creates a political dilemma for governments, who must balance their desire for domestic political support against the need for foreign military assistance. As such, these West and Central African countries chose to allow France the right to strike, therefore giving up political capital in order to provide counter-terrorism and security efforts a greater efficacy.

Somalia: Vested political interests contrary to development of host country

While the experience of France and the AU force in Mali serve as an interesting starting point in order to understand the regionalization of militancy and the need for a similar counterterrorism tactic, a clear example of divergent geostrategic intentions and its effects on operations can be seen in the case of AMISOM. In this joint-regional operation, the two most prominent and powerful fighting forces, Kenya and Ethiopia, were originally active within Somalia outside of AMISOM, but have since been absorbed into the regional forces. Ethiopia, which has a history of territorial disputes with Somalia, has been accused of arming warlords, and may benefit from a weakened southern neighbor. Kenya too, has vested geopolitical interests in its participation in AMISOM. The Kenyan economy is directly affected by al-Shabaab piracy and smuggling activities which endanger shipping to the Kenyan port of Mombasa. Kenya has been accused of attempting to create a buffer area in the form of the autonomous Somali state of Jubaland, which would be supported by Nairobi. Additionally, there is a strategic interest in maintaining a territorial gap between al-Shabaab dominated areas and the Kenyan border. Although, it should be noted that this has not prevented the terrorist group from carrying out attacks within Kenya.

Additionally, Kenya and Ethiopia have large Somali populations with whom there are strenuous relations, and both governments are interested in preventing the spread of radical Islam across their national borders, which they believe is done through these communities. Moreover, the two states share a vested interest in ensuring that a friendly Somali government comes to power, one that will not demand territory, exert pressure on its neighbors, or take up the struggle

of the Somali population outside of its national borders. A politically viable and economically stable Somalia would serve as a counterpoint to the maritime dominance of Kenya, as well as the political and diplomatic influence of both Kenya and Ethiopia. Political and diplomatic interests place significant limitations on the efficacy of AMISOM, and have been a subject covered in effective al-Shabaab propaganda campaigns. Thus, while major successes have in fact been achieved by this coalition, Somalia's political integrity and freedom have been overtly compromised, demonstrating the negative impact of rival national interests in regional operations and therefore justifying in part the hesitancy of countries such as Nigeria to allow for the presence of regional forces on its territory.



Therefore, the decision to invite a foreign power to aid in the counterterrorism effort creates a political dilemma for governments, who must balance their desire for domestic political support against the need for foreign military assistance.

Nigeria: Shared burden for limited success against Boko Haram

The conflict against Boko Haram has clear regional implications, as the terrorist group has successfully carried out attacks in Niger, Chad and Cameroon. Regional forces, ably aided by mercenaries, made significant territorial gains against Boko Haram terrorists in the lead-up to specially delayed Nigerian presidential elections in March 2015. The symbolic victory of Nigeria over this group has been a key catalyst in the diplomatic functioning of successive Nigerian governments, with Goodluck Jonathan clearly increasing his counter-insurgency efforts in the buildup to these elections. Upon his ascension to the presidency, newly elected President Muhammadu Buhari vowed to stamp out the group by December 2015, and improve the domestic military's performance against the terrorist group. This has included a reshuffle of the military hierarchy as well as a considerable effort to improve the quality and performance of Nigerian troops in the area.

Nigeria, Cameroon, Chad and Niger all have an interest in the Chad River Basin, which is likely to possess oil reserves, and thus Nigeria is uncomfortable ceding control of the area to foreign forces. Additionally, Nigeria is the largest economy in Africa, and therefore its failure at dealing with the threat of Boko Haram alone, and the apparent incapability of its forces, especially when measured against those of Chad, demonstrates Nigeria as weak, and likely influences the Nigerian desire to limit the presence of foreign troops on its territory.

These countries' efforts are likely to be in part hampered by Nigeria the host nation, and its desired need to project itself as a military powerhouse, capable of maintaining the integrity of its territory. That said, the continued presence of Boko Haram operatives in Cameroon, Chad and Niger likely aids the group's ability to withstand the ongoing military offensive in Nigeria. Nigeria itself is thus endangered by security shortcomings in neighboring countries. As such, efforts to combat Boko Haram are not only dependent on multinational cooperation, but is also subject to the negative impact of political interests of all partner countries.

DRC: Regional involvement creating proxy war situation

The UN Force Intervention Brigade (FIB) is the first robust UN force mandated to actively seek and engage armed groups. The large quantity of rebel groups in the DRC are responsible for gross human rights violations, as well as the plunder of the nation's vast mineral wealth, which is then smuggled internationally and used as a means to sponsor the continued operation of these groups. Moreover, some of these groups originate in neighboring Rwanda and Uganda, and thus are viewed as a serious threat by these countries. Further underscoring the regional nature of rebel activity in DRC are the recurrent accusations that neighboring countries are sponsoring rebels groups, weakening the DRC and profiting from criminal operations.

The FIB is made up of African contingents, but is backed logistically and tactically by the UN Mission for the Stabilization of the Congo (MONUSCO) as well as the DRC Defence Forces (FARDC). The primary target of the FIB was M23, a rebel group active in the Kivu regions that is reportedly backed by Rwanda and Uganda. The FIB force, when launched in November 2013, was made up of 3,069 troops consisting of South African, Tanzanian and Malawian infantry battalions, as well as Tanzanian artillery and Special Forces. This thus placed African militaries in direct and active conflict with rebel groups supported by fellow African states - a sort of proxy conflict.

The conflict created diplomatic and political tension between Rwanda and

FIB participant states, most notable of which was Tanzania who is a fellow member of the East African Community (EAC). Meanwhile, South Africa has an interest in strengthening the DRC, with whom there is already a signed bilateral agreement to develop the 80 billion USD Grand Inga Hydroelectric Dam project, which is designed to help South Africa overcome power shortages. It is also believed that South African President Jacob Zuma has facilitated a deal between his nephew Khulubuse Zuma and DRC President Kabila for control of an oil bloc in northeastern DRC. Zuma is also interested in having a strong and economically viable DRC to help prop up the Southern African Development Community (SADC), in which South Africa is the main power.

A strong DRC aids South Africa diplomatically vis-a-vis other economic groupings in the country, yet poses a threat to the position and relative power of neighboring east African states. Following a successful campaign against the M23, the FIB identified the Democratic Forces for the Liberation of Rwanda (FDLR) as the target for a further operation, to be named Sokola 2. In this instance, Tanzania was reluctant to once again donate troops, possibly as a result of the strained relations with Rwanda. Conversely, Rwanda was supportive of Sokola 2, as it aimed to rout out a rebel group hostile to Kigali, clearly demonstrating that the efficacy and form of counterinsurgency efforts hinge on the geo-political interests of connected parties.

Lastly, it should be noted that any campaign against rebel groups in DRC will be fruitless without a complementary and viable disarmament effort that would provide militants an opportunity for economic survival outside of the confines of the rebel group. Additionally, the conflict is unlikely to abate without the social, infrastructural and economic investment required to uplift the affected rural areas. However, the worth of an active and aggressive counter-militant multinational force is evident. In the case of the FIB, geo-political and economic interests have played a clear role in the operational capacity of multinational forces, and have demonstrated a lack of cohesion, including within regional economic groupings. Political interference in the internal functioning of the DRC enables the continuation of radical guerrilla and rebel group activity, and weakens the region as a whole.

While this paper has concentrated on the effects of geopolitical interests on joint regional operations, the success of such initiatives depends on a combination of factors. As previously mentioned, training, financing, social factors and other issues may hinder efforts, with drug and weapons smuggling routes throughout the continent helping to finance militancy. The cases of Barkhane and MINUSMA operations demonstrate the dynamism of the militant threat, further underscoring the complexity of militant activity in the region. The expansive nature of the Sahel and Sahara, the porousness of borders and the inability of local governments to control the whole of their territory further hinder counter-terrorism and counter-insurgency efforts. These conditions promote ease of passage for transnational smuggling networks, which in part finance terror in the region, and are present throughout Africa. The funding of these groups is often linked to the pillaging of local resources as aptly demonstrated in Somalia as well as in DRC. Moreover, the issue of logistics is evident in the regional offensive against Boko Haram, with the difficulty demonstrated in unifying the various military capabilities, as well as forming a proper command hierarchy, which was complicated by political motivations.

Overall, the need for regional counterterrorism and counterinsurgency efforts has been clearly demonstrated and is a factor of the evolution of the militant threat. It is clear that none of the major test cases discussed have been able to meet all of their goals, in large part due to conflicting political interests.

Given that conflicting geopolitical interests constrain effective counterterrorism efforts, it is worth examining how this challenge can be addressed. A possible solution would be the creation of a greater overarching continental military force, in order to reduce the effect of local and regional geopolitical interests on counterinsurgency efforts. This is being attempted in the form of the creation of African Standby Forces (ASF) which, after long delays, is set to become operational by early 2016. However, these forces are limited especially with regard to their airlift and logistical capacity as well as the legality of their deployment. Most notably however, ASF forces are to be made up of regional forces, who will then be deployed within their home region, and so political interests of donor countries would continue to limit the scope of the troop's effectiveness. Regional troops are best versed in the culture and terrain of theaters of conflict within their own home region, and thus it is most logical that they be used in such conflicts. However, creating a neutral or continental command may go a long way to minimizing geopolitical interference. Additionally, a professional continental force, in which units are multinational, would help troops gain a cultural and territorial understanding of their operational theater, while potentially limiting the influence of national political interference.

Thus, beyond the geopolitical issue, the complexity of the terrorist and rebel threat being faced by countries in Africa will require cooperation on issues beyond purely military operations, so as to ensure that the response to the threat is not reactionary but rather preventative. The ability to go beyond geopolitical interest and create a successful framework for joint military operations in Africa will further serve to prevent situations from becoming outright crises. At the end of the day, while terrorism and militancy is an international issue, the threat is also an African problem and thus requires a unique continental African solution. However, any solution will need to mitigate the effects of political interference in the security interests of affected African states.

AFRIQUE
CONSULTING
GROUP

Who Are We

AfriQue Consulting Group (AfriQue) is a Sub-Saharan Africa focused geo-political and business security risk mitigation consultancy. We produce multilingual, continent wide analysis on political trends, economic trajectories, market opportunities, threats to business, and security challenges. AfriQue delivers a realistic, accessible and focused analysis into all facets of business and politics in Africa, creating predictability on an unpredictable continent.

Our Unique Strength

AfriQue is specifically Sub-Saharan Africa focussed, with a deep multifocal understanding of the issues that affect the continent. This understanding is garnered with the aid of our vast network of on the ground sources and experts, as well as our specialty in media and social media coverage. AfriQue is thus able to give a clear picture of events on the continent, blending the various lenses of all those involved. This enables AfriQue to find relevant solutions to operational and business challenges throughout the continent.

Service Description

Through our small structure and variety of strategic partners, AfriQue Consulting Group is able to offer custom services to a wide range of clients in multiple languages. AfriQue understands that each business is unique and thus requires tailored information to solve specific problems. The AfriQue portfolio makes use of our social media and online analysis expertise, in conjunction with information received from our on the ground network, providing clients with useful, in-depth and customized reports.

1. Custom Reports

Using our unique blend of on-ground sources, media and social media monitoring, AfriQue custom reports deliver in-depth insight into a specific area of interest. Our reports are designed to answer each client's particular needs, providing usable security, economic, business, and political insight. Thus securing continuous and profitable operations.

2. Briefings

AfriQue analysts are well versed in briefings clients on issues and challenges affecting specific areas of interest. Our briefings are accompanied by multimedia and visual aids, encourage didactic discussion and are tailored to the requests of our clients.

3. SYT (Secure Your Travel) Service

Our SYT Service is a complete travel security package, designed in conjunction with on-ground experts, enabling safe and worry free movement in all situations. The service includes a short, easy to utilize document detailing specific travel security advice and intelligence. Additionally, SYT provides dynamic city maps and verified contact information for emergency situations. Completing the package, on the ground security is delivered by our strategic partner SCS, a continent wide physical protection provider.

4. Online Reputation Monitoring

Monitoring a client or individual's brand and brand perception online. Fusing information from blogs, social media, and traditional news sources, our analysts provide the client with insight into the perception of a company, individual or project. Our product is further enhanced through our strategic partnerships with market research experts.

5. Market Analysis and Strategic Consulting

Economic desk research into the market situation in the chosen country or region. Designed using a multidisciplinary approach, and with input from local continental market research firms. Providing trend recognition, profit maximization, market entry insight, and understanding into local business culture.

THE 'RESOURCE CURSE' AND CONFLICTS IN AFRICA

Prof. Jon Unruh
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Introduction

On what has become widely known as the 'resource curse', high value natural resources have been linked to armed conflicts and instability and lost opportunities for development. In many resource-rich countries, revenues from natural resources—oil, natural gas, minerals, gemstones, timber and others— constitute an important and integral (even dominant) component of national Gross Domestic Product (Bruch et al 2011). In conflict or post conflict countries of Angola, Sudan and Algeria, gas and oil account for well over 60 percent of government income and over 90 percent of revenues gained from exports. Sierra Leone is well known for both its civil war (which ended in 2002), and the export of diamonds to finance the war. After the conflict, diamonds accounted for approximately 96 percent of all exports for the country (IMF, 2009). For Chad, Libya and Nigeria, countries which have struggled with resource-related conflicts for some time, gas and oil have accounted for as much as 70 percent of the GDP, and over 80 percent of government revenues (Lujala and Rustad, 2012b). Gold and uranium are important in Niger, oil is important in Ivory Coast, and timber and diamonds provide significant revenues in the Central African Republic.

When well-managed, the natural resources sector can be important in financing development. However, when mismanaged, revenues from these resources can significantly weaken economies and governance, and greatly increase the risk of violence. Figure 1. Presents nine resource rich and conflict prone African countries while Figure 2 presents types of resource conflicts, causes, and manifestations.

Figure 1. The economic role of the natural resource extractive sector in primarily conflict-affected African countries. Source: Lujala and Rustad (2012b).

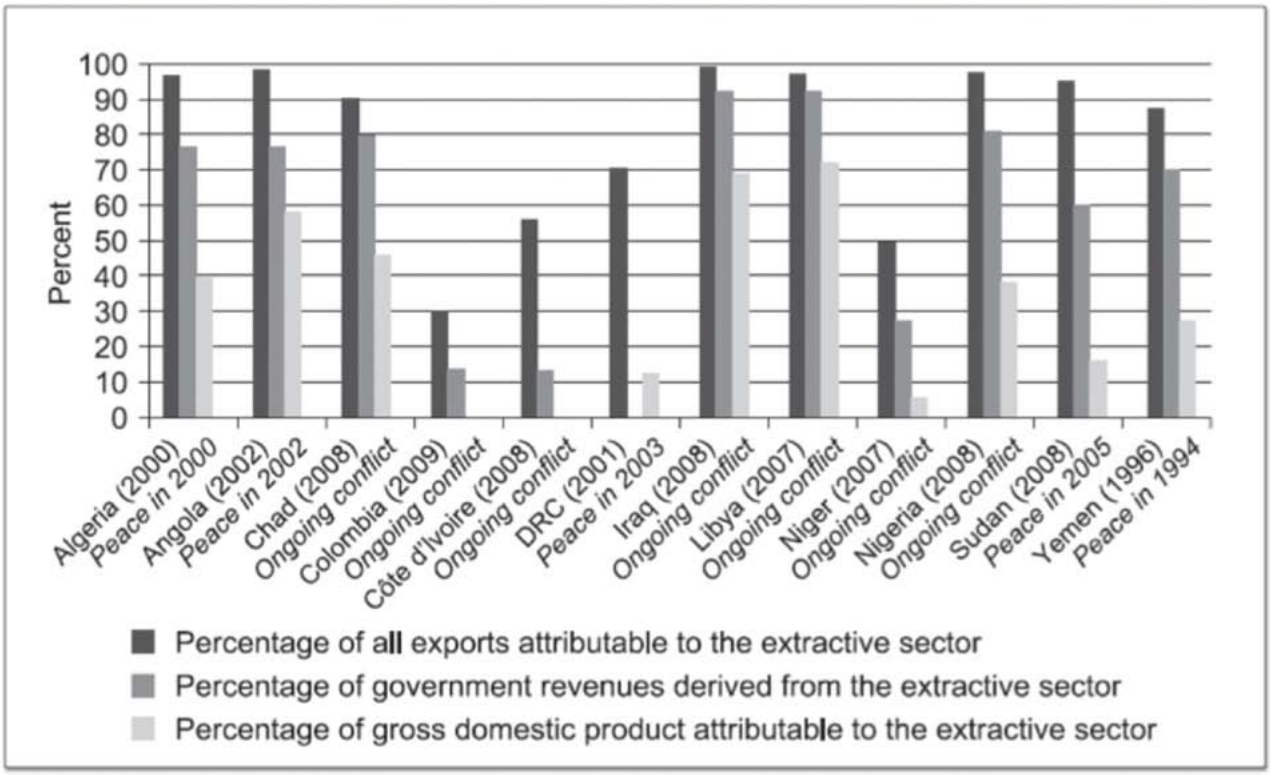
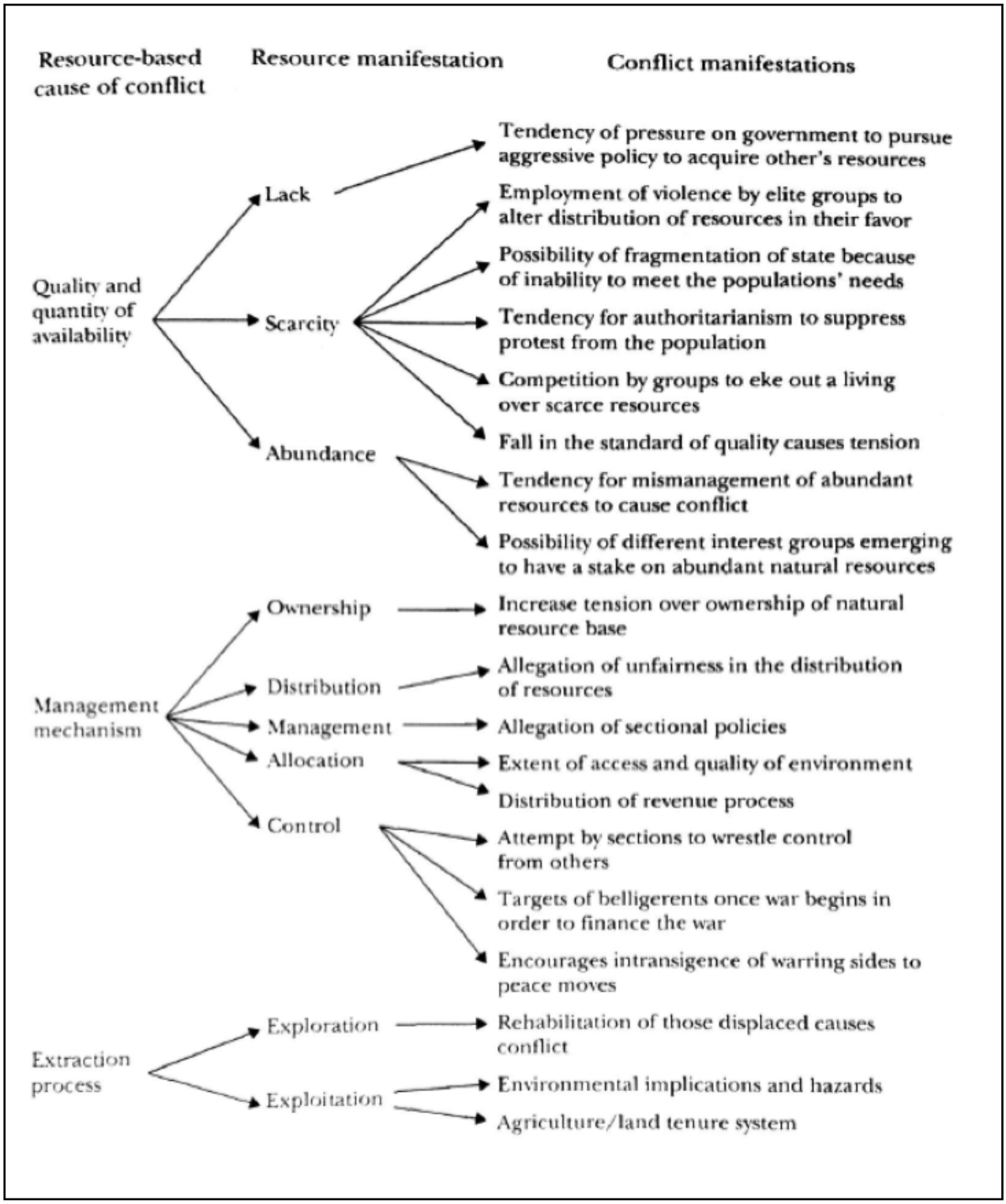
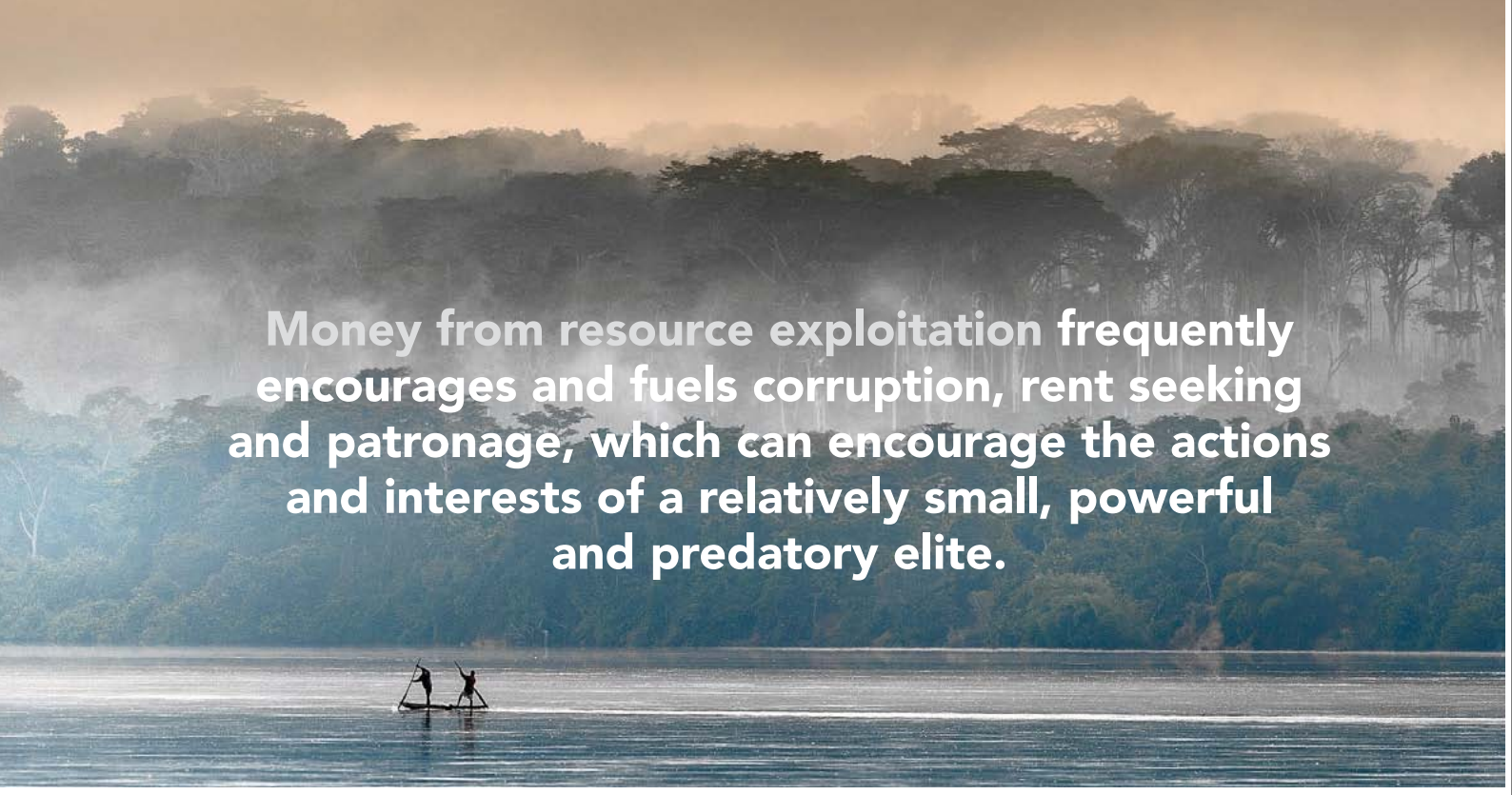


Figure 2.
A typology of natural resources and conflict causes for Africa. Source Alao (2007).





Money from resource exploitation frequently encourages and fuels corruption, rent seeking and patronage, which can encourage the actions and interests of a relatively small, powerful and predatory elite.

Natural resources vs. national resources

There are three broad types of 'resource nationalism': production country nationalism; consumer country nationalism; and investment target country nationalism (Ward, 2009). The first two, are the most relevant to Africa. Production country resource nationalism refers to the "increasing use of control of natural resources to advance policy goals—both economic and foreign" (Stanislaw, 2008). Production country resource nationalism can also refer to:

- a production country seeking to make maximum use and value of its natural resource endowment (MEES, 2006)
- an arrangement where resource producer countries move to maximize revenue from present resource production while changing terms of investment for future output,
- a set of policies and justifications given to policies that increase government intervention in resource development (Ait-Laoussine, 2008); and
- the nationalization of natural resource infrastructure investments made by non-state commercial interests (Stevens and Pearce, 2000).

Consumer country nationalism involves non-resource producer countries or commercial interests attempting to take control of the sources of natural resources in other countries (Ward, 2009). In extreme cases, this form of resource nationalism can lead to armed conflict (Ward, 2009; Williams, 2009). Investment target country nationalism involves the strategic use of sovereign wealth funds. In this case, revenues are directed toward such funds, often controlled in part or in whole by outside interests (Ward, 2009).

Because high value resources like minerals and oil are usually not distributed evenly across the landscape of a country, different stakeholder groups or constituencies will be advantaged or disadvantaged in the exploitation of these resources, depending on the model of natural resource governance deployed. For example, the people of the Niger Delta occupy land rich in oil but have long felt 'disadvantaged' and excluded from the benefits associated with oil extraction, given the way this resource has been managed in Nigeria. Likewise, the indigenous occupants of areas containing diamonds in Sierra Leone suffered dislocation and violence as outside interests sought to gain access to diamond areas. Inequalities, divisiveness, and civil conflicts can emerge if issues of equity, ownership and management of natural resources are not adequately addressed. When the distribution of resources coincides with 'tribal', clan, ethnic, linguistic, religious, class, power and other divisions within society, significant problems associated with real or perceived resource capture can emerge.

The conflict in Niger is partly attributable to management of mineral resources. The Tuareg, on whose lands the minerals and the mines reside, have had significant problems with national governments which they perceive as diverting too much revenue from minerals extracted from their lands to the national capital at the expense of their own regional development. In other cases, those with the instruments of state or economic power in their control may be reluctant to share income and benefits with poorer areas of the country. It is not surprising then that many countries in Africa endowed with high value natural resources have been plagued by civil conflicts.

Resources vs. rights

The (property) rights systems under which natural resources are extracted matters a great deal to a country's economic prospects, social peace and political stability. Different national legal and legislative frameworks have employed different models in terms of rights acquisition and rights maintenance for various investors (Borras

and Franco, 2010; Corbera et al., 2011). The purpose of the investment can be important in relation to acquisition of rights. For example, in the context of concessions as a form of land rights acquisition, such rights frequently have attached to them the prospect that they can be revoked if the implementation of the investment project does not comply with the stated purpose of the investment, as Mozambique has done.

Some resources are more easily exploited than others and so require less in the way of investment or time, and therefore can involve different kinds of rights than would longer-term investments. For example, timber extraction as an investment is relatively short-term and arguably easier to accomplish than forms of mineral extraction involving heavy equipment, facilities and excavation. It is common, however, for an investor to pursue multiple money-making opportunities based on a specific concession or right to extract a specific resource. If only mining rights are granted in a concession, but forest areas need to be cleared so that mining can take place, then money can be made from timber. If areas within the mining concession are unused for mining operations but can be used for plantations, then revenue can be generated in that way as well. The prospect of being able to pursue money-making opportunities within the area acquired for a specific purpose can lead to exploitation of lands well outside of the rights granted – and/or attempts to expand rights 'on the ground' in order to do this. Rights given for mineral, timber, or other extraction activities often do not include the right to exclude local communities from the concession area. However, as enforcement and monitoring capacities on the part of the state remain low in a number of African countries, investors often attempt to engage in exclusionary practices, so as to pursue a variety of revenue streams that were not part of the initial concession or rights (e.g. Yasmi et al., 2010).

The transfer of land resource rights to investors in Africa illustrates many of these problems. Despite widespread individualization, registration, and privatization of holdings on the one hand, and increasing recognition of informally held rights on the other, the overwhelming majority of high value natural resources in African countries are officially owned and administered by national governments (Corbera et al., 2011; Hallam, 2011). Although a number of contracts involve outright purchases and/or lease agreements with private individuals and institutions, the vast majority of approved and pending contracts involve long-term concessions of state owned lands--although such lands can also be claimed by customary groups. There are two reasons for this. First, land laws in many African countries often restrict (if not prohibit) private ownership of resources 'in the ground' by foreign or domestic individuals and organizations. Second, long-term lease agreements with state agencies can reduce the social, political and economic risks associated with acquiring large tracts of land in foreign economies, while simultaneously providing sufficient collateral to guarantee funding and to facilitate the acquisition process (Andrianirina-Ratsialonana et al., 2011; Vermulen and Cotula, 2011).

Beyond the significant gaps in available information on the contracts between investors and public or private landholders, a key challenge to summarizing the nature of the rights obtained is the sheer number of options available. Indeed, large-scale land resource acquisitions are not limited to a specific duration, number of actors or transfer of specific rights. Rather, contracts often 'mix and match' different resource tenure arrangements for different pieces of land as part of the same project (Cotula, 2011; Cotula and Mayers, 2011). Furthermore, Cotula and Mayers (2011) demonstrate that joint equity arrangements and multi-party lease schemes offer potential alternatives to current deals between investors, governments and informal land users. Although a large amount of recent literature focuses on the evolution of contracts between different actors and investors (e.g., Ping and Nielsen, 2010), the majority of areas generally fall within and across three main categories, 1) purchase of ownership right; 2) lease/concession from local land user or institution; and 3) lease/concession from the state (Nelson et al, 2012).

Natural resources – (under)development - conflict

Overdependence on natural resources can adversely affect a country's economy by exposing it to the risk of severe price shocks. When combined with political and economic institutional weaknesses, such shocks can have disproportionately large negative impacts – sometimes exposing countries to risks of armed conflicts. Positive shocks--as with large windfalls generated form easily extracted natural resources--sometimes destabilize economies as well, leading to missed opportunities (Collier and Hoeffler, 2012), or to overspending, poor investment decisions, and ill-conceived economic policies.

Studies have shown that oil increases the probability of armed conflict (Fearon and Laitin, 2003), and that co-location of gas and oil with conflict is associated with longer running and more severe conflicts (Lujala, 2009). These studies suggest that developing countries that are oil producing are between 1.5 to 2 times more likely to engage in armed conflict than countries without oil; and that where conflict occurs in an area containing oil, conflict can last twice as long and result in double the combatant deaths than it would otherwise (Lujala, 2010). Fearon (2004) has shown that gemstones have effects similar to those of oil—namely, conflict is more likely and tends to last longer. However it should be kept in mind that such statistical studies only demonstrate association, not causation.

Trans boundary conflicts related to natural resource exploitation deserve mention as a separate category: Liberia - Sierra Leone with regard to diamonds and forests (Alao, 2007; Richards, 2001) ; the DRC, and neighboring countries particularly to the east over mineral resources (NATO, 2012); Sudan and South Sudan, over oil (Newnham, 2012); Western Sahara and Morocco over potash mining (Gianadda and de Brito, 2012; Ciment and Waskey, 2007); and what have come to known as 'water

wars' involving transboundary watercourses, particularly the Nile and the Nile states (Alao, 2007; Klare 2001). Such conflicts can require a different approach, because they often involve neighboring states and their standing armies together with supported proxy militias and movements. Often such conflicts are not about the location of borders but rather how (and by who) access to resources are acquired.

What is most notable about these linkages however is their variation, and their operation at different scales? At the broad scale, easily extractable natural resources or agricultural products (rubber, bananas, cacao, etc.) can provide insurgents with the motives and the means to challenge the state, with the state's own lack of capacity (institutional and military) serving to increase the incentive to do so. Other broad scale linkages include:

1) a government able to finance the national budget exclusively or almost exclusively though revenues from natural resources, as opposed to public taxation, can then very easily become disconnected from the general population, and hence is less accountable to it.
2) political and economic underperformance--which is common in developing countries endowed with valuable natural resources—can make countries vulnerable to conflict as a pre-existing condition. Several studies show that low state capacity and dysfunctional institutions are positively correlated with an increased likelihood of conflict (Lujala and Runstad, 2012b).
3) A number of African countries (but certainly not all) with an abundance of specific natural resources, such as oil, gas, and certain minerals, have lower economic growth and lower human development than countries where these resources are scarce or absent (Auty, 1993; Karl, 1997). One fairly common explanation for this is that natural resources are not themselves revenues but instead assets. For example oil is an asset within the natural endowment of a country, and when it is taken out of the ground and sold (commercialized) it is simply converted into a liquid asset (Radon, 2007). But the transaction is not revenue, instead it is just a change in the designation of the asset from barrels of oil to U.S. dollars. Therefore the challenge for developing country governments is to be able to transform natural resource based assets into enduring development while not diminishing the assets themselves. But such transformation can be set back by negative incentives created by natural resources--tempting leaders to overspend; seeing revenues as prizes that different groups or segments of society or government attempt to capture, either by corruption or armed confrontation (Alao 2007; Humphreys, et al, 2007).
4) Rentier states can be fostered, in which governments rely on revenue from their natural resources, as opposed to revenues generated from their population's productive activities. Such rentier states are characterized by state-society relations that are weak, and by an authoritarian government that provides undue capacity to government and certain elites (while denying this capacity to others) in order to capture resources (Ottaway, 2003).

At the mid to smaller scale there are numerous linkages between specific resources and conflict. Money from resource exploitation frequently encourages and fuels corruption, rent seeking and patronage, which can encourage the actions and interests of a relatively small, powerful and predatory elite. Often this elite is quite small compared to the national population. For example in Nigeria one estimation indicates that only one percent of the population has control over 80 percent of oil revenues (Kalu, 2008). Stakeholders involved in the 'resource - development with poverty - conflict' trichotomy who have an interest in seeing conflict resolution efforts fail are known as 'spoilers' (Stedman, 1997). Spoilers usually have something to lose from a change in the status quo, either politically or economically. The stakes can be quite significant when high-value resources are involved. When potential spoilers are in positions of power and the gains are large, the temptation to spoil a conflict resolution process for example can be significant (Rustad et al, 2012).

A variety of circumstances can en-

courage spoiling. Stakeholders who have unrealistic expectations about the revenues or benefits associated with resource extraction, their connection to the process, and the speed with which benefits can be delivered can be particularly susceptible to spoiler temptations. Certain groups may wish to engage in spoiler activity out of resentment at being left out of a revenue and/or benefit stream. Others may refuse to participate in a more equitable resource sharing process either because they benefit from the current arrangement or because they see any new arrangement as a threat to the revenue provided by 'lootable' resources (Rustad et al, 2012).

Factionalism is a common problem in armed conflict, whereby certain factions may continue to seek better arrangements for their group (Rustad et al, 2012). As well the 'copycat effect' can be a problem; whereby peace agreements (which often include resource use and access arrangements) aim to deliver benefits to specific factions, who are then 'copied' by other groups who act or pose as factions because they desire access to resources as well. Some factions can come into existence for precisely this reason (Rustad et al, 2012). Liberia is an example of this. Between 1990 and 1995, twelve peace agreements failed. Abuja II, the thirteenth agreement, signed in 1996, was somewhat more successful, but the conflict did not end until 2003, with the signing of the Comprehensive Peace Agreement (Dupuy and Detzel, forthcoming). Among the various reasons that led to the failure of successive peace agreements were this copycat effect, and a related pattern whereby factions would sign a peace agreement (with significant international pressure), but then return to their previous ways of resource exploitation under different names, or through splinter groups. This maneuver would then avoid officially breaching the peace agreement (Rustad et al, 2012; Reno, 1999).

Gaining a commitment to stop certain forms of resource exploitation by spoilers can necessitate significant political concessions, involving for example the allocation of ministerial posts, authority over some segments of the natural resource sector, or allocation of certain land areas (Rustad et al, 2012). Such concessions are often made to encourage factions to join a peace process and transform them into political actors or movements (Rustad et al, 2012). Sierra Leone is an example of this, with part of the 1999 Lomé Peace Agreement, stipulating that Foday Sankoh, the leader of the Revolutionary United Front (RUF), was to be appointed as the head of the Commission for the Management of Strategic Resources, National Reconstruction and Development, and giving him the status of vice president (Binningsbø and Dupuy, 2009). In Angola, the 1994 Lusaka Protocol provided the UNITA insurgency with appointments at the ministerial level, including the ministry responsible for mining (Rustad et al, 2012).

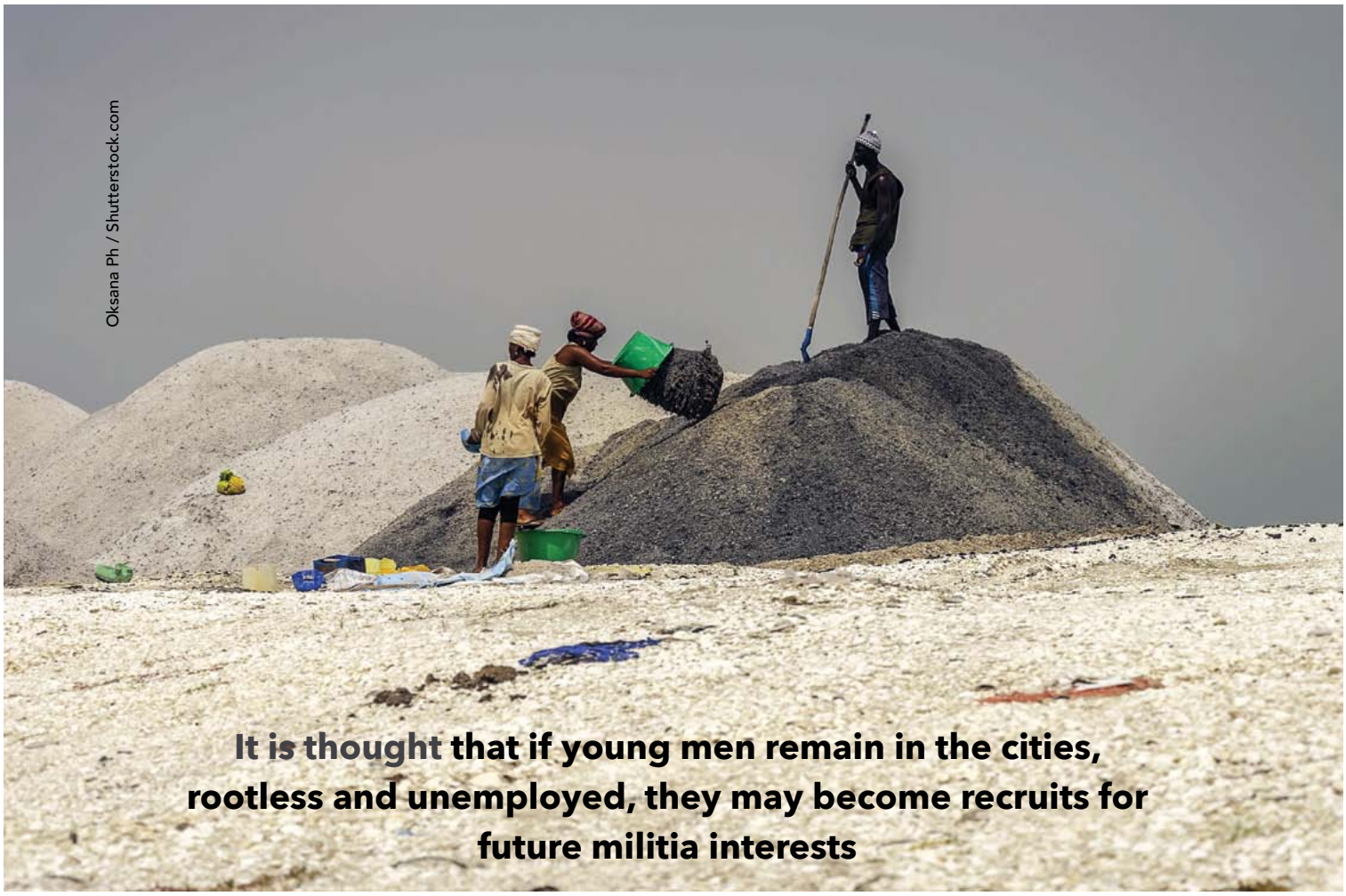
Small-scale stakeholders: implications for management

Small-scale stakeholders are primary actors in the 'natural resources - development with poverty - conflict' trichotomy, and are the focus of much international attention in the context of the resource curse. While there is an array of problems associated with small-scale resource extraction, there are also opportunities. In general 'artisanal and small-scale mining' (ASM) is practiced by basic, manual extraction techniques. It is mostly unregulated, and those that engage in extraction are exposed to a various physical hazards (Hayes and Perks, 2012). It is also associated with numerous economic and social problems--diversion of livelihoods from more sustainable activities; squalid camp conditions where substance abuse and sexual promiscuity create health risks; child labor; environmental damage; and localized inflation (Hayes and Perks, 2012).

As currently practiced in a number of resource rich African countries ASM is poorly done because the technical capacity required to identify, plan, develop, and exploit high value resources to their actual potential does not exist. As a result, small-scale stakeholder extractive activities fails to take full advantage of the overall value of the resource while at the same time consuming or contaminating other resources—such as wood and other forest resources, land, and water—which are essential to livelihoods particularly once the extractable resource is exhausted. Thus as currently conducted in many countries, ASM may deliver short-term monetary gains to miners and traders who are involved directly, but it may also worsen local poverty for those who are the 'diggers' and who receive very little in the way of compensation. In the DRC, ASM has been linked with armed conflict where minerals extracted by artisanal workers were used to purchase weapons and fund other aspects of the conflict (Hayes and Perks, 2012).

With regard to women's role in small-scale resource extraction, a study in DRC found that their involvement in ASM was for the most part driven by poverty. The study demonstrated that during the years after the conflict in DRC, women's participation in ASM increased as a consequence of the general economic downturn and decreased livelihood opportunities in traditional sectors, such as agriculture. As a result 75 percent of the women studied had been mining for less than two years, and 70 percent were their families' sole earners (Pact, 2007). Nonetheless artisanal mining has become an important source of livelihood for women in resource rich African countries because of its relative ease of entry compared with other sectors, because it requires almost no formal education, skills, or capital. In this regard ASM can provide impoverished women with economic opportunities that might not otherwise exist (Hayes and Perks, 2012).

Thus there is a need to acknowledge the large importance of small-scale resource exploitation for local livelihoods, and to examine the tensions and stresses that can come about from small-scale extraction activities, overlapping claims to the same resources, or to different resources in the same area. In a number of resource-rich African countries, small-scale extraction of high-value natural resources (diamonds, forest and wildlife products, etc.) may be long-established before any conflict, or well prior to the arrival of large-scale extraction interests. As well small-scale exploitation activities



It is thought that if young men remain in the cities, rootless and unemployed, they may become recruits for future militia interests

may develop as a coping strategy during conflict. Such exploitation--often unofficial and/or illegal--can often be the economic backbone of impoverished, or war-torn communities. Local populations hence may view any disruption of their livelihoods—through attempts to stop their small-scale extractive activities, or competition with large-scale exploitation--as a negative development. Economic development of resources that undergird local livelihoods should focus on formalizing and supporting the resource economies on which conflict-affected populations depend (Lujala and Rustad, 2012a). This should include legalizing forms of ASM, so that it is not acted against by the state.

At the same time, large-scale stakeholders themselves figure prominently in the local community setting. Often, large-scale interests are better equipped, organized, and capable than state authorities at the local level. Particularly in post-conflict areas, state organizations and institutions may barely function and so deliver few, if any services such as education, health, and security—whereas the large-scale interest will be very present with comparatively high capacity, infrastructure assets, and finances. In such circumstances, local community members may not only expect the company to step in for the state in providing needed services, but may transfer their grievances against the state to the company if they fail to provide (Anderson and Zandvliet, 2001).

One of the questions facing resource rich African countries is how to most effectively use a combination of small-scale / large-scale extraction approaches in the pursuit of development objectives. In this context while mineral deposits that are deep in the ground can only be exploited by industrial-scale mining (and foreign capital); other deposits are closer to or on the surface and therefore are much more accessible through small-scale, semi-industrial mining. Still other deposits cannot justify major industrial investment due to their remoteness or the small scale of the deposits, and so are only suitable for manual extraction (Hayes and Perks, 2012). As a result, deriving, regularizing and formalizing the right mix of approaches to natural resource exploitation can support exploitation objectives as well as local livelihoods for those who work in the small-scale extractive sector (Hayes and Perks, 2012). Thus for countries endowed with resources that can be exploited by the small-scale extractive sector, such extraction can be regarded as an opportunity rather than as a localized problem (Hayes and Perks, 2012). To attempt to thwart such an opportunity in order to control all deposits can lead to its own set of problems. In a case from Sierra Leone, President Siaka Stevens (1968 - 1985), set his country on the road to prolonged conflict and state failure, in part by centralizing state control of all diamond mining. This worsened already problematic and inequitable land relationships for smallholders and made small-scale diamond mining, on which many Sierra Leoneans relied for their livelihoods, illegal (Beevers, 2012)

It is important to look not only at the negative aspects of the relationship between small and large-scale interests, but the potential positive aspects

as well. For example, large extraction projects usually encourage migration on the part of those wishing to engage in small-scale extraction. And while migration can have destabilizing effects by putting pressure on resources, facilities, local social structures and services, and become a burden or obstacle to be dealt with by commercial companies, in some cases migration can contribute to stability. In Sierra Leone many people would like to see new large-scale investments being made in mining (or in other sectors, such as biofuel), which would draw young men back to their villages of origin, where they can take up employment in resource extraction projects. It is thought that if young men remain in the cities, rootless and unemployed, they may become recruits for future militia interests (Hayes and Perks, 2012). Thus large-scale commercial operations can be opportunities for resource extraction firms to provide unskilled jobs for local residents. Unfortunately however such operations are often capital intensive and provide a small number of unskilled jobs. In fragile socio-political environments such as after a war, it is particularly important for jobs—one of the primary benefits of investment—to be distributed fairly, transparently, and without exacerbating problems and tensions that contributed to the original conflict (Hayes and Perks, 2012).

Because of the often acute controversy about the relationship between large-scale extractive interests and local communities involving a wide range of tensions and conflicts, the international mining industry has in some cases been putting increasing priority on the practice of 'community relations'. Thus some companies have begun to use community relations specialists--sociologists, communications experts, and anthropologists--to develop procedures and initiatives to respond to local community concerns (Boeg and Franks, 2012). Community relations experts try to resolve real and perceived community problems in the context of large projects, and their work focuses on increased communication, improved understanding, and stronger relationships with small-scale stake-holders. By resolving disputes between local populations and large-scale interests, the best practice of community relations is thought to be able to reduce the risk of violent or belligerent actions such as blockades, protests, campaigns, and sabotage, particularly if small-scale extractors believe these to be the only forms of influence they can exert (Boeg and Franks, 2012).

Conclusion

The capacity of the actors and stakeholders involved in high value natural resource extraction, processing, marketing and management of revenues, is of fundamental importance in turning the curse into benefit for broader society. Such capacity however ideally needs to be balanced between stakeholders. There is a good deal of emerging evidence that 'capacity imbalance'--whereby one set of stakeholders enjoys significant capacity while other sets experience lower and in some cases much lower capacity--can result in corruption and exploitation due to a lack of effective checks and balances between sets of stakeholders. The resulting animosity then can have profoundly negative outcomes as the lower capacity set of stakeholders realize the imbalance and its repercussions. And while capacity building in the natural resource sector is often thought of as being needed by African stakeholders (government, civil society, etc.) a great deal of capacity is lacking on the part of the international investor, who is in many cases unable to 'read' local socio-political and economic environments in Africa so as to be able to innovate and derive arrangements that work and are mutually beneficial. ■

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THE ROLE OF TRADITIONAL INSTITUTIONS IN CONFLICT RESOLUTION

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Introduction: Conflicts in Africa

Most regions of the world became more secure as the turbulence that accompanied the Cold War was largely contained by the end of 2000. Although the end of the Cold War freed up political energies and material resources for institutional reform and constructive management of conflicts, serious armed violence persists in parts of Africa and Asia. The Centre of International Development and Conflict Management (CIDCM) produced a report which was summarised in a Peace and Conflict Ledger that ranks countries of each world region according to their capacity to manage societal conflicts in ways that enhance peace, security, and social justice. The authors judged a country's capacity for peace-building to be high if it was able to avoid armed conflicts, manage movements for self-determination, maintain stable democratic institutions, and was free of serious threats from its external environment. The study characterized countries that make up the broad middle belt of Africa—from Somalia in the east to Nigeria in the west, and from Sudan in the north to Angola in the south as a "bad neighbourhood". However, the study viewed southern Africa countries with promise, as they were seen to have managed to avoid serious conflicts and political instability.

A 2008 report from the African Development Bank showed that between 1990 and 2005, Africa accounted for approximately half of the world's battle deaths. Other reports show that from 2002-2007, the combined total of inter-state and intra-state conflicts declined by 64% from 39 to 14, while the official battle-related deaths over the same period decreased by over 70% from 9,368 to 2,727. Although the general analysis of conflict in Africa follows the general global trend of a decline in armed conflict, more recent trends point to an increase in armed violence from around 2010, potentially reversing the gains made immediately after the end of the Cold War. More recent reports show that 2014 alone was one of the most turbulent years in the continent's long history of instability. Along with the

horrific outbreak of Ebola in West Africa and the pockets of violence that erupted as a result, the continent as a whole experienced widespread protests, unrest, civil wars, and insurgencies. The most recent flare-up of this new wave of violence resulted in Boko Haram's deadliest attack to date, the massacre of an estimated 2,000 people in the north eastern village of Doron Baga.

Different perceptions of the African continent often create different and sometimes conflicting understandings as to why conflicts occur in Africa. A popular view is that ethnic and religious diversity within countries cause inescapable cleavages and violent conflicts. That African rebel movements are almost always ethnically defined is often taken as supporting evidence for this view. In this view, the solution to African conflicts requires radical social change: complete eradication of tribal and religious hatred. Others argue that deep political and economic factors are the main determinants of conflicts in Africa. The solution to the problem therefore has to be both political and economic. However, a more systematic and comparative analysis of the causes of civil wars in Africa by Elbadawi and Sambanis suggests that conflict patterns in Africa conform to the global pattern: a combination of political and economic as primary factors, reinforced by ethno-religious and cultural factors. Studies conducted by Collier and Hoeffler suggests that the risk of civil war is reduced by opportunity cost of rebel labour and greater natural resources are associated with higher risk of civil war. Put more simply, the economic cause of some conflicts can be attributed to the struggle for natural resources: land, water or minerals. The political cause, on the other hand are attributed more to the struggles for legitimate control over those resources which in a State structure ensures the control of the wealth of the State.

It is not easy to classify conflicts. This is primarily due to the fact that not all conflicts in Africa hold the same characteristics. However, the literature on conflict suggests four main categories: interstate conflicts or conflicts between countries; intrastate conflicts or civil wars; conflicts that are spread over a number of countries - such as the conflicts in central and west Africa ; and conflicts over transboundary resources (e.g. water). This paper addresses the role of traditional and communal institutions in ensuring peace, justice and reconciliation within their community. It focuses on informal institutions and specific mechanisms adopted in resolving violent conflicts within the context of intercommunity relations, with specific reference to traditional institutions in West and Eastern Africa. The State's role and how it has harnessed this form of peace-building to ensure greater State security, is also be addressed.

Understanding Conflict Resolution in Africa

Conflict or dispute resolution can be viewed as the use of nonviolent resistance measures by conflicted parties in an attempt to promote effective resolution. A wide range of methods and procedures for addressing conflict exist, including but not limited to: negotiation, mediation, diplomacy, and creative peace-building. Mediation is an integral component of peacemaking and has the potential to be instrumental in preventing, managing and ending conflicts. International mediation is a long-term process and depends on relationships between external and internal actors to be one of equitable partnership, synergy and complementarity. Collaboration between African and international actors has become critical in strengthening the African Union's role in conflict prevention and mediation. Africa entered a new era of conflict resolution and peace-building after the adoption of the Constitutive Act of the AU in July 2000. It became imperative for organisations such as the African Union (AU) in collaboration and coordination with strategic partners – namely the regional economic communities (RECs), the UN and the European Union (EU) – to develop specialist expertise and a systematic mediation practice.

This is in contrast to the OAU's emphasis on State sovereignty, which resulted in its non-interventionist approach towards conflict resolution. After 2000, a new peace and security architecture was contextualised within the principles of African leadership and ownership via the member states and RECs. Regional economic communities such as the Economic Community of Central African States (ECCAS), the East African Community (EAC), the Arab Magreb Union (AMU), the Southern African Development Community (SADC), the Economic Community of West African States (ECOWAS) and the Intergovernmental Authority on Development (IGAD) have taken on more responsibilities for conflict prevention, management and resolution. The formation of the Peace and Security Council (PSC) in 2004, established concrete institutions dedicated to the promotion of peace, security and stability on the African continent. The AU has a formal mandate to engage in mediation as a form of peace-making, which is legislated in the 2002 Protocol Relating to the Establishment of the Peace and Security Council of the African Union.

A substantial body of literature exists predominantly from scholars from Western societies whose analysis have dominated contemporary scholarship of conflict resolution in Africa. For quite some time, the assumption seems to have been made that Western techniques of conflict prevention, management and resolution also apply to developing nations. Increasingly, a number of scholars from developing countries are challenging this view. For example, Ineba Bob-Manuel argues that today's predominant pattern of conflict in Africa is proving resistant to the available and accepted tools of conflict management. It necessitates the need for a new range of flexible and adaptable instruments that can take the more subjective, complex and deep-rooted needs and interests that underpin conflicts in Africa into account. As a result, it is argued that special attention should be given to the valuable contributions from Africa, especially from the field of traditional measures of conflict resolution. It is only until conflicts in Africa are understood in their social contexts that there can be hope for their resolution. "It is important for values and beliefs, fears and sus-

picions, interests and needs, attitudes and actions, relationships and networks to be taken into consideration". During the years of traditional leadership in Africa, various conflicts caused by different issues were resolved using different approaches. Most conflicts and resolution methods were predominantly local. Conflicts were between individuals, villages, communities or tribes who lived in the same or adjoining areas. Those who intervened were often local elders, tribal leaders or both. When kingdoms developed about the 5th century BC in West Africa for example, stronger and wider authority came into being, but the traditional methods of instigating and resolving conflicts underwent relatively minor changes.

On the other hand, Osaghae argues that integration of traditional approaches with modern negotiation and diplomacy strategy is feasible. In federal Ethiopia, the context of decentralisation and devolution of power to regions provided ample opportunity for co-existence between community justice and formal government institutions that promote individual human rights. This system of co-option and partial incorporation of customary authorities and their procedures into modern institutional settings has been adopted by successive governments in Ethiopia and in Nigeria, helping to ease the burden of modern structures in dealing with conflict situations.

Conflict resolution as both a professional practice and an academic field is highly sensitive to culture. In Western cultures, such as Canada and the United States, we are made to believe that successful conflict resolution usually involves fostering communication among disputants, problem solving, and drafting agreements that meet their underlying needs. Such techniques have been spread by western ideologies and infused into the modalities of the modern State structure. Thus, in most practising democratises, communities are subjected to the retributive justice system which, over many years, has been adopted from primarily Western culture. In these situations, conflict managers often talk about finding a mutually satisfying scenario for the parties involved. In many non-Western (some argue, less liberal-democratic) cultural environments, conflict resolution is seen differently as it is at most times applied on a smaller scale, either between communities, families or individuals. In these circumstances, the involvement of either religious, tribal or community leaders to communicate difficult truths indirectly through a third party and making suggestions through stories are applied. Intercultural conflicts are often the most difficult to resolve because the expectations of the disputants can be very different, and there is much occasion for misunderstanding.

In many cases, issues that result in conflict may be similar. However, in most, the procedures and rules to settle the disputes may differ subject to cultural diversity and customs. It is the process of conflict management and resolution that differs, depending on the environment in which the process is needed. In Southern Sudan for example, each of the major ethnic groups (Nilotics, Nilohamites, and Bantu and Sudanese ethnic groups) have rules and procedures of conflict resolution. These conflict resolution mechanisms, as they are often called, form the foundation of traditional institutions in dispute resolution. The

main actors in conflict resolution among the Dinka are the Bany Bith and the Kuar Kwac in the Nuer community. Their offices are spiritual and hereditary, held by special priestly clans. Although these leaders have no political or executive authority to compel parties in a conflict to abide by the decision, they are however, well respected enough to make the parties to a conflict to comply. Another important actor in conflict resolution mechanism is the Bany Alath who the government appoints as chief. The Bany Alath is a member of the customary court – bridging a gap that could have been formed between traditional and state conflict resolution institutions. The Bany Alath interacts with the Bany Bith. The introduction of customary courts into the Dinka and Nuer societies did not contradict the role of the two actors. Cases that require traditional customs such as taking oath are referred to the Bany Bith or the Kuar Kwac before the Beny Alath makes the ruling.

Seeking justice to prevent conflict

There are two distinctive patterns of conflict resolution which are best illustrated by the enforcement of justice in different communities. One is based on what Ada Pecos Melton calls an American paradigm of justice, and the other is based on what can be called an indigenous paradigm. The American paradigm has its roots in the world view of Europeans and is based on a retributive philosophy that is hierarchical, adversarial, punitive, and guided by codified laws and written rules, procedures, and guidelines. The vertical power structure is upward, with decision making limited to a few. Lanek presented a paper in 1999, which he called:" 'Mato Oput', the drinking of Bitter Herb" to the All-Africa Conference on African Principles of Conflict Resolution and Reconciliation which was held from the 8th until the 12th of November 1999 in Addis Ababa, Ethiopia. In his paper, he was concerned with integrating indigenous approaches with national and international mechanisms for conflict resolution and reconciliation. He also compared indigenous approaches, especially the Acholi approach, common with the Acholi people of northern Uganda, with the Western legal ones. In Lanek's evaluation, the Western legal approach to justice or conflict resolution was more concerned with establishing guilt and executing retribution and punishment without reference to the victim or the wider families or future re-incorporation of the offender into the community. Physical and material penalties and the use of force, including costly prisons, provide the sanctions against the offender. The process, according to Lanek, encourages the accused to deny responsibility while the Acholi method of peace, conflict resolution and reconciliation are co-operative and can be indirect and circumstantial which, in his view, effectively encourages the accused to admit responsibility.

Retributive justice theory considers proportionate punishment, to be the best response to crime. When an offender breaks the law, she or he forfeits or suspends her or his right to something of equal value, and justice requires that this forfeit be enacted. This is sometimes taken to mean that justice involves seeking vengeance on behalf of the aggrieved party, to appease the victim, to satisfy society's desire for revenge, or to reconcile the offender to the community by paying a debt to society. It does not offer a reduction in future crime or reparation to victims. As Melton states, the American paradigm applies justice through an adversarial system such as the use of the courtroom to determine a defendant's guilt or innocence. A forum where evidence found through adversarial fact finding is presented and where punitive sanctions limit accountability of the offender to the state, instead of to those he or she has harmed or to the community.

The indigenous justice paradigm can be best described by the holistic philosophy and the world view of the aboriginal inhabitants of North America. These traditional systems are guided by unwritten customary laws, traditions, and practices that are learned primarily by example and through the oral teachings of tribal elders. The holistic philosophy is a circle of justice that connects everyone involved with a problem or conflict on a continuum, with everyone focused on the same centre. The centre of the circle represents the underlying issues that need to be resolved to attain peace and harmony for the individuals and the community. The continuum represents the entire process, from disclosure of problems, to discussion and resolution, to making amends and restoring relationships. The methods used are based on concepts of restorative and reparative justice and the principles of healing and living in harmony with all beings and with nature.

Similarities with other indigenous justice systems lie in the reliance on the mending process for renewal of damaged personal and communal relationships. In this regard, the victim or the community is the focal point, and the goal is to heal and renew the victim's well-being. It also involves deliberate acts by the offender to regain dignity and trust and to restore personal and communal harmony. Reparative principles refer to the process of repairing relationships to avoid further disputes. It is essential for the offender to make amends through apology, asking forgiveness, making restitution, and engaging in acts that demonstrate a sincerity to make things right. The communal aspect allows for crime to be viewed as a natural human error that requires corrective intervention by families and elders or tribal leaders. Thus, offenders remain an integral part of the community because of their important role in defining the boundaries of appropriate and inappropriate behaviour and the consequences associated with misconduct.

The Acholi, a Luo speaking tribe occupying northern Uganda, for generations have used Mato Oput as a means of reconciliation within the context of their tradition. The Acholi believe in leadership through consensus, allowing everyone in their localised clans to have a voice while the traditional head of each clan rules by consent. A major function of the traditional chiefs is to act as arbitrators and reconcilers when disputes occur in order to restore peace and maintain harmonious relations between families and clans. The reconciliation process he describes is called the "Mato

Oput" process (Mato Oput - an Acholi vernacular meaning drinking the herb of the Oput tree) because it ends in a significant ceremony of "Mato Oput", the traditional drinking of a bitter herb of the Oput tree. The bitterness of the drink symbolises the psychological bitterness that prevailed in the minds of the parties in conflict.

The significance of traditional institutions in conflict resolution

The frequency of conflicts in Africa has led to the use of conventional mechanisms of conflict resolution that have excluded traditional approaches which are, according to Ofuho, now in greater demand than ever. The collapse of the Somali nation-state and the reversion to the post-traditional method of social and political organisation in northern Somaliland shows how dynamic these traditional systems can be. The restoration of the gurtii system of clan elders who intervene to settle conflicts different warlords has helped to maintain a semblance of order and stability in an otherwise hostile environment. The dia-system which was based on bloody compensation and revenge, is undergoing transformation, while also providing a reference point for the reorganisation of Somali society, conflict resolution and conflict management.

In the south-west of Zamfara state is Dan–Sadau Forest Reserve and connected to it is the neighbouring Kamuku National Park in Birnin Gwari Local Government, Kaduna State. A large number of the pastoral groups using the Dan-Sadau Forest Reserve as wet season base camps also use the converted Kamuku National Park as their traditional resting point en-route to the south for dry season grazing. In 2002 the national park officials denied pastoral groups access to the area and blocked three stock routes leading into the area. There was resistance from the pastoralists and conflict between the herders and the national park guards resulted in the shooting and wounding of three pastoralists. In reaction, the pastoralists mobilized for revenge. Although the matter was reported to the federal government and a committee set up to resolve it in liaison with Zamfara and Kaduna state governments, little was achieved. In light of persistent clashes, the Gusau Emirate Council took the initiative to constitute a committee which included the district heads of Maru and Dan-Sadau and the pastoral leaders. The committee collaborated with the Birnin-Gwari Emirate Council to discuss and resolve the matter. The two councils met the officials of the national park and it was agreed that the pastoralists would have limited and supervised access with a payment token fee of N10 per cow. This system remains in place and is being monitored by the Emirate Councils from the two states.

A deeper look into the meaning of conflict to traditional communities opens up an even deeper understanding of the functions of traditional mechanisms of conflict resolution. Conflicts can be generally viewed as non-isolated events, within a social context. According to Brock-Utne, "when Africans sit down to discuss a conflict, the talking usually covers all kinds of relevant background and goes into the thoughts and intentions of others. The elders from a family, clan or state see their traditional objectives in conflict resolution as moving away from accusations and counter-accusations, to soothe hurt feelings and to reach a compromise that may help to improve future relationships". They also dwell on values, aspirations, perceptions and visions. All over Africa, people have deeply rooted cultural commitments, and in many of the conflicts in Africa this cultural heritage plays a decisive role. In Africa, family ties and community networking are constantly respected, maintained and strengthened because of the impact on dispute resolution and conflict management. When there is

a dispute between different parties, priority is given to restoring the communal relationships.

The Afar people strongly believe that all disputes within their ethnic group should be settled peacefully and according to their long standing customary laws (Mad'aa). Mad'aa consists of specified guidelines and rules on how to handle dispute cases. This is a tradition followed from the time of Hamadu Sirat, whom informants identified as their apical ancestor and the father of all Afar in the area. Once a conflict is in the hands of elders, there can be very little room for an individual to further his/her interests by force. This seems to be the norm no matter how long it takes the elders to process the dispute and reach a settlement. In this regard, the modern legal principle that 'justice delayed is justice denied' does not hold true among the Afar.

The key actors in traditional conflict resolution institutions

Conflict managers such as judges, mediators, conciliators, counsellors, negotiators and lawyers exist within the state structure. At the traditional African level, dispute settlements normally involve supporters of the disputing parties and the elders meant to talk the matters through. Relationships are given prime attention. Relationships are viewed in 'historical and future perspectives'. Indirect relationships are analysed along with direct ones to see cross-stitching potentials. For example, if each of the disputing parties happen to be musicians, this commonality may be utilised as a converging factor.

In northern Nigeria, family issues are handled by traditional rulers at all levels including emirs or chiefs, depending on proximity. In theory, an important emir can never refuse to listen to a subject on the pretext that he is busy. Nonetheless, in reality, emirs play their most important role in mediating and resolving larger-scale civil conflicts. The Northern Traditional Leaders' Forum has been reactivated with the Sultan of Sokoto as Chairman, meeting regularly to review the peace and security situation. All first class chiefs and emirs are members, in a structure reminiscent of the Northern House of Chiefs and indeed making use of the same building. The forum met three times in 2006 and on 17th August 2006, changed its name to a council to reflect the increasing role it expects to play in peace-making.

A western mediator may begin the exploration by retracing the steps of the parties to the point of the initial conflict, but an experienced traditional elder, considering the social realities, may start from a vantage point further back and try to form a frame of social reference. He may ask questions like: Who are you, and where are you from? Explain your family link. Where did you grow up? What do you like doing? These may provide clues, not only about immediate causes, but potentially, long-standing grievances, offering a wider and deeper insight into the differences and similarities between the parties. Parties often have fairly similar needs, but rather different interests. They may also have similar or different ideologies and beliefs. The age and power differences must also be considered. All these help the African elder in the discussion to get at the remote and immediate causes.

According to Lawrence O. Bamikole's paper, "Agba (elder) as Arbitrator: A Yoruba Socio-political Model for Conflict Resolution", conflict resolution sometimes requires a third-party or certain persons who enjoy the confidence of their fellow human beings in a political society. The concept of agba (elders) is a Yoruba socio political model for conflict resolution, and it is the third-party that is responsible for effective conflict resolution in indigenous Yoruba societies. The agba are usually relied upon as arbitrators and agents of conflict resolution in view of certain qualities possessed by members of the community. Agba are respected individuals identified by age and other qualities, which mark them out in their families, communities, nations, regions and the world. For an elder man or woman to be an agba he or she must be fearless (alakikanju); must be knowledgeable and wise but must be someone who gives room for criticisms (ologbon, oloye, afimo ti elomiran se); must be tolerant (alamumora); must be upright in all ways (olotito, olododo); and must not be selfish (anikanjopon).

Similarly amongst the Afar people, there is a strong sense of respect for the legendary traditional rules and guidelines that was passed to them from their forefathers. One such fundamental norm is the fear of and respect for elderly personalities in the respective villages. Elders are believed to have the wisdom and insight accumulated over long periods of time and are instrumental in the transfer of traditional knowledge and custom to successive generations. They not only provide informal education and teach younger generations on preventing violent conflicts, they are also believed to have a spiritual link to supernatural forces in the conviction that living longer on earth is a gift from God signifying some purpose. Gerontocracy is therefore at the centre of traditional patterns of behaviour and social action. In other traditions, it is either the monarch or the religious leader who act as conflict managers.

Pastoral efforts

Ofuho,In his paper on 'African Principles of Conflict Resolution and Reconciliation' Ofuho brings to light the experiences of grassroots peace-making efforts among the communities of the Kidepo Valley of Eastern Equatoria. Kidepo is a big forest that starts from Karenga Hills in the north-east of the border with Uganda and extends deep into South Sudan. The people living along both divides of the valley regard Kidepo as a major asset in terms of both water and grazing resources, particularly during the dry season. Communities of the region have lived in hostility and co-existence for years. Their conflicts have just recently picked up intolerable propor-

The elders from a family, clan or state see their traditional objectives in conflict resolution as moving away from accusations and counter-accusations, to soothe hurt feelings and to reach a compromise that may help to improve future relationships

tions due to the proliferation of modern weapons. The common source of conflict in the Kidepo Valley is cattle rustling as cattle herds are the main source of income. The communities within this area have made attempts and practices of peace-making as there have been wars over resources in the region. Each member group of the communities often begin their attempts of peace-making by first identifying the root causes of the problem. Most problems arise as a result of revenge for death previously committed over cattle rustling or during fighting over grazing and water resource areas in the Valley. Once problems are identified, communities convene meetings that may last two to three days in isolation in some forest where they deliberate over resolutions. The role of what may be called opinion leaders and council of elders is crucial in the conflict resolution process. These elders have gained their authoritative influence through wisdom and experience. Another way of grassroots peace-making used by these elders, is the use of the curse by elders to deter the young mojirimots from continuous raids. The curse of elders are believed to be capable of leading, among other effects, to mysterious deaths. The word of elders are bitter and those who have caused troubles often vanish from society. Rituals, symbols and interpretation of myths are all mechanisms for conflict resolution in many traditional systems.

Traditional processes and methods

Indigenous methods of conflict resolution include traditional dispute resolution, peace-making, talking circles, family or community gatherings, and traditional mediation, described only by the language of the tribal community. All these refer to the methods of resolving problems and to the methods of restorative and reparative justice. The structure of relationships in many tribal communities is tantamount to a legal system exemplified by the clan system. Tribal law determines clan identification, which is often matrilineal. Among the Pueblo communities, moiety and clan affiliations determine for which group an individual will dance, sing, or hunt in social activities, which religious or medicine groups one may join, which political positions one may hold, whom one may court or marry, or what property one may own. The clan system regulates the behaviour of its members. The interlocking relationships in tribal communities often determine the flow of how problems are handled. The Afar people practice Afar customary law known as Ma'ada. The laws regarding compensation payment among the Afar people are elaborate and detailed. Virtually every offence has a corresponding compensation payment. Even nail injury has its specified compensation. In principle, the Afar claim that all compensation payments are fixed by customary law. In practice, however, payments are negotiable. For example, according to the law, the payment for murder is 100 heads of camel; but following bargaining less than half may actually be paid.

Verbal accountability is an important process because it is key in discovering the underlying factors precipitating conflicts and when the offender has the opportunity to express remorse to the victim and the victim's family. The decision making process is characterised by consideration of the social importance of conflict resolution as social relations and internal solidarity are crucial. At this stage having looked at both sides, your community may suggest that you - the one party - make this concession. It would then be fair to expect you - the other party - to respond by reciprocating concession from your side. The point is to make a fair exchange for public recognition. Consensus seeking is the next important approach. This may develop into an extended search as every new consensual outcome confirms the validity and value of the time-proven tradition of this process. It also creates confidence that such a jointly developed decision will prove to be effective and long lasting. In traditional Yoruba societies, early intervention is essential to the process of conflict resolution. Conflicts are usually managed such that they do not degenerate into violence and armed conflicts.

It is important for government to not adopt a 'one solution' fits all approach to conflict resolution. There is a need to codifying such traditional practises.

The early intervention of the agba in reconciling disputing factions often prevents disputes from turning violent conflicts.

The relationship between traditional and State institutions

The status of tribes as sovereign nations and their traditional institutions are both pre-constitutional and extra-constitutional. Traditional cultures have existed long before the introduction of the state system and although the administration of justice, law, and order is a function of government retained by the tribes as sovereign nations, it is within this realm that indigenous justice systems exist and is at times called upon as an alternative conflict resolution approach by the state in times when state measure proved ineffective.

In Ethiopia, the role of the state at the inter-clan level seems to be very weak because of weak links between the modern Woreda Court officials and the indigenous council of conflict resolution. Generally, the council makes no appeal to the court. Rarely, individual disputants may, on their own accord, take their cases to the court. Moreover, court officials usually tell disputants to go to their respective clan heads in order to allow intervention by the indigenous council. It has now become an established fact in Afar region in Ethiopia that this is the only solution as far as inter-clan disputes are concerned. Accounts point to a situation where modern courts are not effective in handling such disputes. Conflicts resolutions made at this level have generally failed to bring long lasting peace to the community. Only in incidents inducing chaos and feud would the government administrative and military organs intervene to prevent further escalation of conflict. Once relative peace is restored, however, the government police and military units hand over the case to the council and prepare the necessary ground for resolution of the conflict according to custom.

In northern Nigeria, in an attempt to modernise the political system, the government decided to merge traditional institutions into the formal State system. 'Native Authorities' were developed as agencies of local governments to be integrated into a parliamentary system of government. Native Authority (NA) was the administrative name for the ensemble of emir and councillors who were responsible for a defined area, such as Zaria in northern Nigeria. The Emir and his council in turn constituted a Native Administration which took care of much day-to-day administration under guidance of the Resident. Although there have been many efforts to limit the jurisdiction of tribal justice systems, tribes retain the authority to determine the legal structure and forums to use in administering justice and to determine the relationship of the legal structure with other governing bodies. Although traditional rulers had significant state powers, this was changed as the 1976 local government laws changed the status of traditional rulers from administrators of local government to advisers.

It is argued that this system was designed to meet the aspirations of emerging regional elites and the new political parties they were joining. In the process of political modernisation, the authority of traditional rulers was seriously undermined. According to Miles, Hausa chieftaincies in both Nigeria and Niger had been co-opted by the nation state who now owed their survival and continuing legitimacy to this source rather than to traditional loyalties. At the time of the first military coup and the reorganisation of the states and local government in Nigeria, the powers of traditional rulers in the NA were reduced. Key law and order functions were removed from the NAs by stripping them of their control over courts and the police. In April 1968 the administration of justice at local level was taken over by the government when area courts were established to replace the previous native courts. Following an earlier recommendation, the NA police were also taken over and integrated into the national police force.

Northern Nigeria has long had a centralised traditional political system. Gobir, Katsina, Kano, Zaria and Borno in the early sixteenth century are examples of such structure. Kano in 1824 had an estimated population of between 30,000 to 40,000. Today, only hints of the Sokoto Empire exists. This is primarily because the Sokoto Sultanate has no supervisory role over any emirate or chiefdom. However, the Sultan of Sokoto still functions primarily as the paramount leader of the traditional institutions in Sokoto state and his supreme authority in Islamic matters transcends territorial boundaries, as he is considered the overall leader of Nigerian Muslims. In 1804, Shehu Uthman Dan Fodio's jihad state and his followers imposed the emirate system throughout most of what is now Northern Nigeria and the ruling Hausa dynasties were replaced by Fulɓe. The hierarchical structure of traditional leadership in the core Hausa and Fulɓe states start with the Emir/Lamido as the top, as the paramount ruler in-charge of one or more local government areas; followed by district heads (Hakimi), a traditional ruler in charge of one or more village areas; village area heads (Dakaci); and lastly ward heads (Mai Ungwar).

Today these rulers function as government appointees and are subject to civil service rules. However, they can appoint officials directly as well as allotting titles to individuals who then become advisors to the ruler. One of the most important duties of traditional rulers is to be present at government occasions such as foundation laying ceremonies, project commissioning, welcoming visiting government officials and so on. However the daily business of most traditional leaders is the settling of disputes involving family, communal and religious life. In many ways this is both useful to the community and valuable to the state, as many disputes that might otherwise clog up court system are settled informally and usually in ways that accord with the local community's sense of appropriateness. For instance, in some matrimonial cases, rulers have been known to provide hospitality to a woman during the period of arbitration, if they are perceived to be suffering injustice from both religious and judicial avenues.

Conclusion

The trends of conflicts and violent

conflicts in today's world are very complex. This is far from surprising considering the expanding populations, multi-complex structure of contemporary societies, diverse (and sometimes interlocking) interests of people and serious complications in the very causes of conflict. In this regard, the indigenous model of conflict resolution becomes very important, especially when the state and local communities can find a middle ground on ways of resolving internal disputes. The issue to consider here is that traditional institutions and social behaviour have undergone radical change as the result of the many factors – some more uncontrollable than others. The mechanisms of conflict resolution outlined above can as easily be damaged by these factors. This includes civil war, poverty, high unemployment, to name just a few. However, today's trends have also shown that other new actors have emerged in the field of traditional conflict resolution. These actors not only include state and local governments, but NGOs and civil society organisations (CBOs). For example, faith based organisations such as the New Sudan Council of Churches (NSCC) combined both traditional and modern values of conflict resolution to build peace in Dinka and Nuer communities of Upper Nile and in Bahr el Ghazal during the period of active warfare.

The operations of these actors continue in the post-conflict period, widening the scope of traditional conflict resolution beyond dispute resolution to include post conflict development strategies. These strategies are more long term as they are developmental in nature. They require all parties to look to the future to work towards conflict resolution strategies that ensure such conflicts do not remerge in the future. Structural development, peace councils have been known to have partnered with traditional institutions to ensure a sustained peace.

Not all models of the indigenous of conflict resolution result in peace. The application of the principles in the communities mentioned above can lead to other social-economic concerns such as increased violence, poverty, unemployment; human rights abuses; or result in a political end rather than an end to violence. Wassara illustrates with the seizure of cattle in Nuer communities as the basis for settling disputes, which in effect rekindles more violence in cattle owning communities. Traditional conflict resolution can also be restrictive to many international instruments of human rights. Taking a girl for compensation, passing judgement on a person based on immaterial evidence such as magic or sorcery are summarised as flagrant violations of human rights by Wassara. The practices of conservative traditional authorities often overlook, such rights enshrined in the constitution of the State, not to mention those at the international level.

Although there is a growing concern that African cultural traditions are losing their influence in a global system that relies heavily on external traditions and values. It is however, important not only for States but for the people involved to hold on to such traditions and for the State to ensure that such authorities are not used for political gain or to further marginalise or discriminate against certain groups.

To this end, there is a need for governments to protect and monitor such traditional authorities by assuming such institutions into State institutions. It is important for government to not adopt a 'one solution' (in this case a 'one institution') fits all approach to conflict resolution. There is a need to codifying such traditional practises. In doing so it means that such practices have gone through certain legal, political and societal tests to ensure that it will does not work against the constitution and laws of the state; is democratic; and follows the norms and practises akin to the state.

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RETHINKING SECURITY IN AFRICA

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Why do African security planners and strategists need to rethink security and the threats to it? To what extent do state security officials interact with African security analysts, scientists and other knowledge producers in tertiary institutions and think tanks? Should the ordinary people in Africa be afforded opportunities to participate in national security debates? Answers to these questions could help African state authorities to begin to effectively tackle numerous national security threats, including those posed by militant groups such as Boko Haram and Al Shabaab and the breakdown in law and order in various countries, including Somalia, South Sudan and the Central African Republic.

National Security in Africa

I define 'national security' in the African context as the protection of the African people and the preservation of their values, interests and resources, in the face of military and non-military threats. Non-military threats to national security may include, but are not limited to, natural disasters, ecological and environmental degradation, poverty, severe economic problems, human rights abuses, and the erosion of democratic institutions. The above definition of security is broad enough to include the preservation of the state, as well as the structures, principles, and institutions on which it is anchored. It incorporates many elements of traditional security that is largely based on the pursuit of the "national interest", which includes the survival of the state in an anarchical international system.

The protection of state boundaries and the governing structures and elites need not be privileged over the protection of the people. This people-centered security is predicated on the assumption that the African people are the foundations of their states. The political communities that we call sovereign states have international legitimacy only because they are organized around people. Moreover, African states achieved independence on the basis of self-determination, and self-determination is the only group right currently recognized in international law.

To this extent, it could be argued that sovereign statehood in Africa is based on self-determination or human rights. Therefore, the pursuit of the "national interest" by African states ought to revolve around the needs, hopes and aspirations of the people. Given the crucial relationship between self-determination and sovereign statehood, there is a need for recognition of the view that the security of African states derives from the security of their people. Moreover, in an era in which human rights and democracy have been recognized as global entitlements, no definition of security should ignore the people and their needs. As the African people's values, interests, and needs evolve, the definition of security also has to evolve. This people-centered security is achievable only under conditions where sovereignty is also defined in terms of the African people's needs, hopes, and rights.

The diversified nature of national security threats in Africa means that a military or armed forces approach is only one albeit a critical component of guaranteeing national security. Non-military action, or actions by actors other than national security agencies are just as important in ensuring national security. However, many African countries tend to have a narrow and often factional conception of national security. The conception of national security in Africa is seldom 'people centered'. This in and of itself is a major constraint to national security.

The lack of a people centered conception to national security has led to any number of challenges. In many conflict affected African countries, the military and other state security agencies have turned out to be the main threats to security, often brutalizing the very people whose security and sovereignty they are sworn to protect. In a number of other African states, ordinary people often avoid any encounter with the police because of the fear that they would use their status to extort money or to demand other kinds of favors.

In general, national security threats may emanate from a number of sources, including other states as well as non-state actors such as mercenaries, terrorist and other armed groups. Most national security threats in Africa in recent years have come from non-state actors. There have been no inter-state conflicts in Africa since the end of the Cold War. Indeed, the military in Africa hardly ever engages in fights with other professional military formations or national armies. The 2011 air strikes on Libya by Western countries, which led to the fall of the Muammar Gaddafi regime, was a rare recent example of a formal aggression by a collection of foreign powers on an African nation-state.

What has become more frequent in the past two decades is transnational terrorism (I have excluded terrorism that was limited to one country, such as FIS in Algeria in the early 1990s). Starting with the Al Qaeda sponsored attack on the US diplomatic missions in Nairobi (Kenya) and Dar es Salaam (Tanzania) in August 1998, there have been a number of attacks in several African states. The frequent terrorist attacks by Al Shabaab and Boko Haram against Kenya and Nigeria respectively, are examples of transnational terrorist attacks. Al Shabaab and Boko Haram are driven by a global jihadist ideology. So far, at least, responses by many African governments to transnational terrorism have raised a lot of questions. For example, the Kenya government's perceived disproportionate focus on ethnic Somalis in Nairobi in 2014 following a spate of terrorist attacks in that country provoked a fierce debate on both the wisdom of its counter-terrorism strategy and the right balance between national security and civil liberties in the fight against terrorism. Given that Al Shabaab has recruited people from different ethnic groups in Kenya, a more effective counter terrorism strategy against them would

be much broader in outlook – to include working closely with the general Kenyan public, including ethnic Somalis to combat radicalization.

Transnational terrorism is just but one increasing threat to national security in Africa. Other growing threats to national security in Africa emanate from non-military sources. For example, ecological and environmental national security threats result from the activities of governments, corporations, communities and individual citizens. In the past few years, many analysts have explained conflict and insecurity in Africa in terms of ethnic differences. Others have explained these problems in terms of competition over resources, the depletion of the environment, the scarcity of water, the persistence of misguided macro-economic policies, and the lack of adequate access to vital services, such as health, food and shelter. Indeed, some of these problems have been observed in conflict and war situations, but are they the underlying causes of instability and insecurity or are they manifestations of deeper problems? Should ethnic differences be regarded as a cause of insecurity and instability or do they become a problem only through the intervention of other variables? The UK has more African ethnic groups than any single African country, but it does not experience the political instability or the kind of insecurity that affects much of Africa.

I believe that terrorism, insecurity, and political instability in much of Africa are underpinned by one crucial factor, namely bad or poor governance. Poor governance facilitates corruption, undermines public trust, national unity and the effectiveness of public institutions, and adversely impacts the provision of basic public services. Poor governance also constrains the formulation of clear and effective national security strategies and plans. A good example of a place where poor governance has generated insecurity for everyone is South Sudan: the newest and youngest African country. While ethnic differences exist among the South Sudanese groups, it is poor governance that has set one group against another. Contrary to many claims, the main problem in the country is not between the Dinka and the Nuer. Nor is it between the military groups and the party machinery. These divisions, in addition to those between the educated elite and the semi-literate power brokers, exist, but the country imploded in late 2013 primarily due to poor governance: lack of effective political leadership; a weak bureaucracy; inability to adhere to the rule of law, etc. National Security in Africa should be an integral part of political leadership.

Quality leadership incorporates reflection and self-examination, a willingness to abandon old habits and make room for new ways of performing, and the capacity to mobilize like-minded individuals or groups in order to make transformative change. It is this type of leadership that sets the policies and environment in which the people can enjoy and enhance security. Moreover, dealing with security or terrorist threats and establishing the appropriate conditions for peace and order requires broad political legitimacy and prestige. Unfortunately, few African leaders command these qualities.

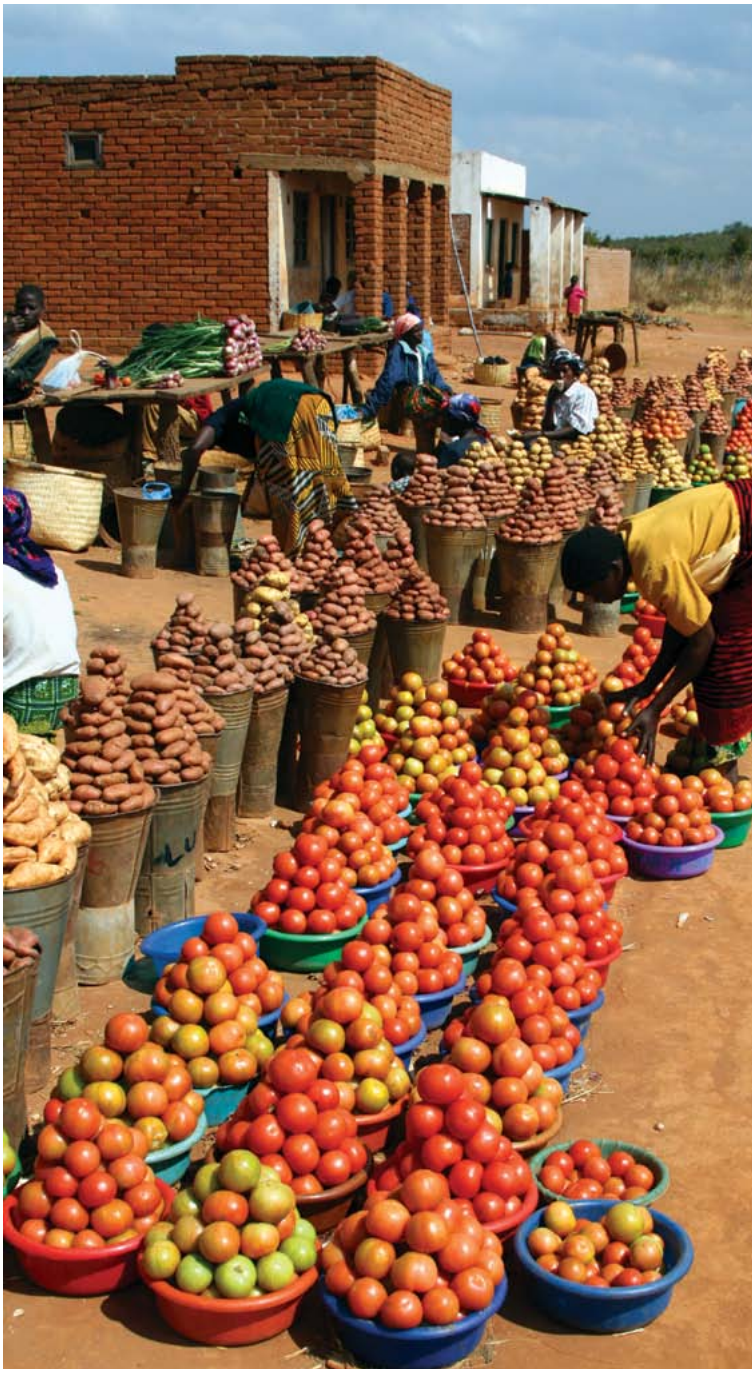
The concept of national security is embedded in norms, rules and institutions. If these values are in atrophy or in a state of decay, national security will be threatened. Corruption and nepotism are not just social vices. They undermine national cohesion and provide fertile ground for unpredictability and insecurity. At the normative level, it is plausible to argue that security in any African country may be achieved and enjoyed only if there is an environment in which the people, institutions, and other agents in the country respect each other and are willing to operate in accordance with the rule of law.

At the bureaucratic level, national security will be achieved only if the various security agencies are individually and collectively competent, effectively commanded, controlled and coordinated. The police, the military, and intelligence agencies need to be highly trained, adequately equipped, commanded and controlled in a professional and disciplined manner. They need to establish effective mechanisms for exchanging information and for coordinating responses, while maintaining and respecting a clear division of labor or roles and responsibilities.

I conclude that national security in Africa hinges on what the political leaders, governments, military establishments and the ordinary members of the public do. Honest and responsible governments are likely to consult experts, design viable national strategic plans, and generate appropriate conditions for peace and security. Dishonest, corrupt or irresponsible political leaders and governments are more likely to ignore expert advice, place unqualified personnel in key positions, and aggravate factional or partisan national divides. A people centered approach to national security has the potential to diminish or to restrain these tendencies.

GODAN AIMS TO FILL CRITICAL KNOWLEDGE GAPS FOR SDG #2

Diana Szpotowicz, GODAN



Sustainable Development Goal #2 aims to achieve 'zero hunger' by achieving food security, improving nutrition, and promoting sustainable agriculture. Initiatives focused on science, innovation and technology (STIs) play an increasingly vital role in ensuring the success of the goal's outcome.

One such technologically-driven resource is the Global Open Data for Agriculture and Nutrition (GODAN) initiative, which shares 'open data' to make information about agriculture and nutrition available, accessible and usable to farmers, governments and organisations throughout the developing world.

The GODAN initiative is a voluntary association that was announced at the Open Government Partnership Conference in October 2013 following G8 discussions in 2012. It is a rapidly growing group with over 160 partners from national governments, NGO and private sector organisations. Together, they cooperate to build a high-level of support for growing the volume of data generated by new technologies to benefit farmers and consumers.

Andre Laperriere, the Executive Director of GODAN, explains that 'open data' is "information that is available for anyone to use. There are some conditions to make it achievable, which is accessibility, meaning that it is easy to find, as well as usability, which means it should be in a format that allows users to make use of it."

The ultimate purpose of 'open data' is for "all people -- be it government officials, CEOs, civil society leaders, farmers, and regular people alike -- to make enlightened

I've seen the potential of having accurate data. We sometimes have natural disasters that wipe out entire investments in the country. We had a disaster in 2008 where for three to six months farmers were unable to farm

decisions to improve their food and nutritional situation through yield increases, cost reduction and better distribution channels," says Laperriere.
He adds that the idea of sharing knowledge is a centuries-old practice.
"Even before the time of the computer, there was a tradition of societies passing along knowledge from one group or village to another, and from one generation to the next. Now GODAN is organizing this in a more systematic manner," he says.

Some of the initiative's partners include the US Government, the UK's Department for International Development and the Open Data Institute. GODAN is supported by a small secretariat hosted by The Centre for Agriculture and Biosciences International (CABI) in Wallingford, UK. Any organization that supports 'open access' to agriculture and nutrition data is encouraged to join the network.

According to GODAN, closed or inaccessible data limits the effectiveness of research and innovation in agricultural and nutritional policies. The initiative seeks to advocate for new and existing 'open data' projects with a focus on agriculture and nutrition and aims to expand their wider use by the rural and urban poor.

Laperriere says initiatives like GODAN are important because "soon there will be three times more people on the surface of the Earth than there was 100 years ago. This means that in order for everyone to survive in good health, we need to collectively be able to produce much more food and much better food than we used to before and make sure it reaches those who need it."

"Through open data, we found that countries, cities and organizations can better prepare to mitigate and if not possible, to adapt, to the effects of climate change. Therefore, we can reduce the negative impact of climatic disasters that are becoming more frequent these days," he adds.
One of GODAN's most active partners is the Government of Kenya, which practices a policy of open access and transparency through its Kenya Open Data Portal.

According to Casper Sitemba, the Director of Intergovernmental Relations in the Deputy President's office and the lead figure in his country's partnership with GODAN, the country is now in a better position to stimulate its production and better protect its agricultural industries with 'open data.' His motivation to join the organisation came from the idea that "data could play a key role in ensuring better incomes for the very poor in Kenya."
"I've seen the potential of having accurate data. We sometimes have natural disasters that wipe out entire investments in the country. We had a disaster in 2008 where for three to six months farmers were unable to farm," he says.
As a result, 'open data' is "good example of a win-win-win position," says Laperriere.
"The government is in a better position to increase agricultural production, the private sector experiences less losses through insurance coverage, and the farmer is better protected," he explains.

GODAN recently held a summit in The Hague, Netherlands which explored how national policies and agricultural innovation can be enhanced by different technologies such as satellites and drones, with the aim that their collected data can become accessible to producers with even the smallest farms.

It's the use of these new technologies that Laperriere says "brings additional means to obtain more information and to share it with a broad range of people that would either wise be unable to benefit from this 'next step' in the food production progress."

He explains that "this is especially important for Africa, where a lot of farmers manage very small farms and have limited economic means, was a result of which they generally cannot afford the use of more advanced technologies as developed countries have."

The GODAN team is now focused on the upcoming Global Forum for Innovations in Agriculture in Durban, where it will participate in a workshop with African farmers in order to talk about innovation in agriculture, with a specific focus on Africa. Soon after, it will be advocating its role in contributing to the fight against climate change at the upcoming COP21 climate change conferences in Paris.

For further information on the GODAN initiative or to learn how to become a partner, visit its website at www.godan.info or follow it on Twitter at @godanSec

ACTS IN THE WORLD!

The Executive Director of ACTS Dr Cosmas Ochieng, presents his credentials to the Kenyan Cabinet Secretary for Foreign Affairs and International Trade, Hon Amina Mohammed.

ACTS TO HOST THE ECOSYSTEM BASED FOOD SECURITY ASSEMBLY (EBAFOSA) SECRETARIAT AND TRUST FUND.

The EBA for Food Security Assembly was formally established during the 2nd EBA for Food Security Conference (EBAFOSC 2), which took place from 30-31 July 2015, at the UNEP headquarters in Nairobi, Kenya. The two-day conference which was attended by 1200 delegates from across the African continent adopted the EBAFOSA constitution as well as a Conference Declaration: The Nairobi Action Agenda on Africa's Ecosystem Based Adaptation for Food Security. The Declaration observes that EBA is essential for climate resilience, ecosystem productivity, food security, job creation and value addition in Africa. The Assembly seeks to promote environmentally friendly approaches to food security and ecosystem health. The Assembly appointed ACTS to serve as interim Host Institution of the Assembly Secretariat and its Trust Fund.

To date, EBAFOSA National Branches and bureaus/secretariats have been established in 35 African countries in Eastern, Southern, Western and Central Africa. National memberships are multi-stakeholder based: government ministries and agencies, private sector, universities and research institutes, civil society organizations, NGOs, CBOs and farmer organizations. Besides the 35 national branches, 7000 individuals and organizations have registered as EBAFOSA members. Organizational members include private sector organizations, universities and research institutes, NGOs and CBOs. Individual membership is also multi-stakeholder based. The Continental Secretariat and Trust Fund have both been established and are operational at the African Centre for Technology Studies (ACTS)

Dr Cosmas Ochieng (ACTS) addresses the EBAFOSA delegates

H.E. Rhoda Peace Tumusime, Commissioner for Agriculture, African Union Commission addressing delegates

Dr. Richard Munang (UNEP) addressing EBAFOSA delegates

ACTS JOINS THE LAUNCH OF THE KENYA NATIONAL DATA FORUM

The First National Forum on Sustainable Data for Development (NFSDD) in Kenya was convened at Laico Regency Hotel in Nairobi (August 28-29) under the auspices of Presidency through the Office of the Deputy President in collaboration with Local Development Research Institute (LDRI), Partnership for African Social and Governance Research (PASGR) and the Kenya Association of Manufacturers (KAM). The Forum emphasizes the domestication of the data revolution as a key step in accelerating the implementation of Kenya's national development agenda. The Forum is organized around 5 Key Thematic Pillars and 4 Cross-Cutting Thematic Pillars. The 5 Key Pillars are based on the current focus of National Vision 2030: These are Education; Transport; Health Water & Sanitation; and Peace and Security. Each thematic pillar is led by co-chairs from Government, private sector, academia, research institutions and civil society. ACTS co-chairs the Pillar on Climate Change.

	PILLAR	**CO-CHAIR ORGANIZATION/S**
1	*Agriculture*	*Agriculture Transformation Team (ATT) /Ministry of Agriculture*
		Equity Group Foundation
		Alliance for a Green Revolution in Africa (AGRA)
2	*Education*	*Strathmore University*
		Twaweza East Africa
3	*Transport*	*National Transport and Safety Authority (NTSA)*
		Kenya Association of Manufacturers
4	*Health, Water and Sanitation*	*St. John Ambulance*
		Weltel Inc.
		National Aids Control Council (NACC)
		Africa Population Health Research Center (APHRC)
5	*Peace and Security*	*National Intelligence Service (NIS)*
		The Consulting House
		Kenya Alliance of Residents Association (KARA)
Cross-Cutting Thematic Pillars	**Cross-Cutting Thematic Pillars**	**Cross-Cutting Thematic Pillars**
1	*ICT and Innovation*	*ICT Authority*
		Infonet Africa
		iHub Research
		Kenya ICT Network (KICTANET)
2	*Inclusivity*	*Nairobi Women's Hospital & its Gender Violence Recovery Center*
		Christian Blind Mission (CBM)
		National Gender and Equality Commission of Kenya
3	*Financial Services Management*	*Social Investments Focused Agenda (SIFA)*
		Institute of Economic Affairs
		Intergovernmental Budget and Economic Council
4	*Climate Change*	*Climate Change Fund, National Treasury*
		Africa Center for Technology Studies (ACTS)

H.E. William Ruto, Deputy President of the Republic of Kenya arrives for the National Data Forum

Participants at the Kenya National Data Forum

ACTS AT COP 21!

ACTS and its partners convened a number of Side Events at the Global Climate Change Summit in Paris in December 2015. These included:

- Tackling Climate Change through Data and Community Based Adaptation (Speakers: Dr. Cosmas Ochieng (ACTS), Mr. Jonas Osore (Office of the Deputy President, Kenya) and Martin Parr (Godan)
- Climate Relevant Innovation Systems Builders (CRIBs): How to Strengthen the UNFCCC Technology Mechanism (Speakers: Dr. Rob Byrne (University of Sussex), Dr. Adrian Ely (University of Sussex), Mr. Jonah Osore, (Director of Policy and Research in the Office of the Deputy President of the Republic of Kenya), Dr. Heleen de Coninck (Radboud University), Dr. Cosmas Ochieng (ACTS)
- Looking beyond Mitigation Targets: INDCs on finance, fairness and adaptation (Hosted by German Development Institute (DIE): Speakers: Dr. Pieter Pauw (German Development Institute) Dr. Clara Brandi, (German Development Institute), Kennedy Liti Mbeva (ACTS), Dr. Anne Olhoff (UNEP Riso Centre), Manish Shrivastava (TERI), Axel Olearius (GIZ)
- Scaling Up Adaptation Action: Opportunities for Knowledge (Hosted by World Resources Institute (WRI) Speakers: Dr. Nambi Appadurai (WRI), Anand Kumar (Development Alternatives), Fiona Percy (CARE), David Jackson (UNCDF), Dr. Cosmas Ochieng (ACTS)
- Scaling Up Adaptation Action: Opportunities for Knowledge (Hosted by World Agroforestry Centre (ICRAF): Speakers: Dr. Dennis Garrity, Dr. Margaret Kroma (ICRAF), Dr. Lisa Duguma (ICRAF), Dr. Ed Barrow (IUCN), Dr. Larwanou Mahamane (Africa Forest Forum), Winnie Khaemba (ACTS).

Mr. Jonas Osore (Director of Research and Planning, Office of the Deputy President, Republic of Kenya), Dr. Cosmas Ochieng, (Executive Director, ACTS) and Mr. Martin Parr (GODAN) at the 'Tackling Climate Change through Data and Community Based Adaptation' Side Event at the Africa Pavilion in Paris.

Kennedy Liti Mbeva (ACTS) speaks at a Side Event on INDCs jointly organized with the German Development Institute (DIE).

Winnie Khaemba (ACTS) tapes an interview at COP 21

ACTS HOSTS THE FIRST FORUM OF THE SCIENCE GRANTING COUNCILS INITIATIVE IN SUB-SAHARAN AFRICA

ACTS hosted the first forum of the Science Granting Councils Initiative in Sub-Saharan Africa (SGCI) at the Safari Park Hotel in Nairobi, Kenya on the 11th and 12th of September, 2015. The SGCI is a 5-year initiative that aims to support research and evidence-based policies that will contribute to economic and social development. It is jointly funded by the United Kingdom's Department for International Development (DFID), Canada's International Development Research Centre (IDRC), and South Africa's National Research Foundation (NRF). The Initiative works with Science Granting Councils and/or organizations with similar mandates in order to enhance their ability to effectively support research and innovation in their countries and across sub Saharan Africa. The initiative's specific objectives are to strengthen the ability of Science Granting Councils to: manage research; design and monitor research programs based on the use of robust science, technology and innovation indicators; support exchange of knowledge with the private sector; and establish partnerships with other science system actors.

The Forum was attended by more than 50 participants including 34 senior management representatives from 12 Science Granting Councils: Kenya, Uganda, Tanzania, Rwanda, Ethiopia, Malawi, Mozambique, Zambia, Zimbabwe, Burkina Faso, Cote D'Ivoire and Namibia.

Participants of the First Forum of the Science Granting Councils Initiative in Sub Saharan Africa.

Dr Stephen McGurk (IDRC); Ms Lisa Philips (DFID); Dr Beverly Damonse (NRF) and Dr Moses Rugutt (NACOSTI) during the opening ceremony of the First Forum.

ACTS CONVENES A POLICY MASTERCLASS ON DATA SCIENCE AND DEVELOPMENT

In collaboration with the University of Nairobi and the Artificial Intelligence Research Laboratory of Makerere University, ACTS convened a Policy Masterclass on Data Science for Development in Africa on the 12th and 13th of October 2015. Dr Raymond Mugwanya of ACTS and Dr Fred Kiwanuka from the Artificial Intelligence Research Laboratory, Makerere University were the main resource persons.

Participants of the Data Science Policy Masterclass held at the School of Computing, University of Nairobi

ACTS CONVENES THE FIRST AFRICAN NANOTECHNOLOGY FOR DEVELOPMENT POLICY MASTERCLASS

The 1st African Nanotechnology for Development Policy Masterclass was successfully held at the University of Gondar, Ethiopia, 11-13 August 2015. The Masterclass was organised by ACTS in collaboration with the Kenya National Commission for Science, Technology and Innovation (NACOSTI) and the University of Gondar (UoG). It was attended by 65 participants from new and established universities in Ethiopia, Kenya and Nigeria as well as representatives from the African Union, UN Economic Commission for Africa and the Ethiopian Science Technology and Information Centre (STIC). Resource persons included: Prof Roger Brownsword, King's College London, Dr Guillermo Foladori, Autonomous University of Zecatecas, Mexico, Prof Erastus Gatebe, Kenyan Industrial Research Development Institute (KIRDI), Prof Teketel Yohanes, Addis Ababa University, Dr. Hailemichael Demissie (ACTS) and faculty from the University of Gondar.


University of Gondar
1st Policy Master Class on

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Knowledge for Better Livelihoods

The African Technopolitan is 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 3000 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.

Please send your submissions to:
Executive.director@acts-net.org

We look forward to publishing your article in the next Issue of the African Technopolitan!

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