

Research Application Summary

**Never sail by someone else's star: Agricultural education for Africa**

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**Abstract**

There is a continent wide recognition that a productive agriculture is a key driver of national growth. But skilled professionals in agriculture are in short supply. Africa's fastest-growing and fastest-urbanising population is creating a "demographic dividend", which can be cashed in to produce a virtuous cycle of growth. Africa's young people are its biggest asset. With quite modest but sustained investment, but involving reform and a refocusing of the higher education sector, Africa's agriculture could be transformed. Evidence from Latin America and Asia shows the payback could be fast and substantial.

Key words: Africa, Agricultural transformation, demographic dividend, tertiary education, university reform

**Résumé**

Il y a une reconnaissance largement continentale qu'une agriculture productive est un facteur clé de la croissance nationale. Mais les professionnels qualifiés dans l'agriculture sont rares. La population de l'Afrique croissant le plus rapidement et s'urbanisant le plus rapidement crée une «dividende démographique» qui peut être encaissée dans la production d'un cercle vertueux de croissance. La jeunesse Africaine constitue un plus grand atout du continent. Avec des investissements assez modestes mais soutenus, mais impliquant la réforme et une réorientation de l'enseignement supérieur, l'agriculture en Afrique pourrait être transformée. Le témoignage de l'Amérique latine et de l'Asie montre que la période de récupération pourrait être rapide et substantielle.

Mots clés: Afrique, transformation agricole, dividende démographique, enseignement supérieur, réforme de l'université

**Background**

**Africa's Development Challenge.** The title of this paper is an old Swahili proverb and it is used here to guide a critical examination of the role of faculties of agriculture and of agricultural education in transforming the continent of Africa. Start by remembering the world of half a century ago. The author of this paper was then just embarking on a university degree in agriculture; much of Asia was on the brink of

disastrous famine, with China in chaos; Latin America was the preserve of rotating military *juntas*, each (to the outsider) more comical than its briefly lived predecessor although leaving a dreadful trail of 'disappeared' dissidents. The focus in Africa was on freedom and independence, a struggle that was to continue until the final release of Nelson Mandela in 1994. Then look at today. Poverty remains widespread in South Asia – there are more poor people there than in the whole of Africa – but the threat of famine has largely disappeared (except following natural disasters such as the recent floods in Pakistan). Latin America has grown prosperous. A new group of powerful, formerly mainly developing, nations have emerged – the BRICS (Brazil, Russia, India, and China) – as a strong counterbalance to the hegemony of the Western nations. But famine and poverty have grown and taken root over large parts of the African continent.

These massive changes have taken place in barely half a lifetime. Africa is struggling today to feed its people and break out of poverty. What we can learn from the past half century is that change is possible, it is affordable even by poor nations, and that outsiders can help, but cannot create, change. The needed policies and programmes will emerge from African peoples themselves. It is to one of the most fundamental of these policies that this paper is devoted – providing a high quality education to the youth of Africa, with an emphasis on what is arguably Africa's most important business – that of agriculture.

Independence came to most of southern and eastern Africa in the 1960s and 70s. In terms of agricultural technology development and extension, there were two main foci. The first was on increasing agricultural production; the second on building national capacity to undertake the tasks of agricultural development (an activity which previously had largely been the occupation of expatriate scientists and extensionists). The overall objective was to build viable economies based on increased agricultural production, to earn foreign exchange earnings and savings, and to encourage the movement of labour out of agriculture into the modern industrial sectors (Lele *et al.*, 2010). There were two central assumptions. First, agriculture could lose labour without compromising productivity and food supply. Second, improving agriculture was easy. There was adequate knowledge or technology internationally which merely needed adaptation to local conditions – relying on crop variety trials, local verification of fertiliser and pesticide recommendations. These would then be transferred to farmers in a largely

prescriptive manner by trained extension workers whose role was to pass technology messages to farmers, and not to question the validity of those messages to farmer circumstances.

This was the colonial model – the colonial ‘star’. A network of research centres around Ministries of Agriculture was established (or further developed), and staffed by professional scientists. In the early days, most scientists were expatriate (often previously colonial officials) with the brief to train and mentor national staff to take over their positions. Extension was typically also organised under Ministries of Agriculture, but often with a very different reporting structure. Research scientists reported to the head of station, and then up through the levels of the Ministry of Agriculture. By contrast, extension workers often faced a system where local government officials played a significant part in their work plans and reporting structures.

These arrangements led to a number of problems. First, formal and informal links between the research and the extension arms of the Ministries of Agriculture were poorly developed, so scientists received little feedback on farmer response to technology choices being developed. Second, as much scientific research training was done overseas (national universities were typically also at a very early stage of development and were focused on putting together initial undergraduate degrees), the opportunities for working directly with African farmers were limited. Many scientists were given excellent laboratory based experiences without exposure to farmer review. Thirdly, as noted previously, the wisdom was that the role of the African scientist was to adapt international experience for answers to perceived farmer constraints as opposed to direct problem solving. And finally, as we have already noted, another policy element was that African agriculture had a labour surplus which needed to be moved into the modern industrial sector in order for national development to take place.

This basic structure has been modified at the margins over the years – mainly through efforts to provide greater autonomy at local level in decision making and to release technology development and promotion from bureaucratic inertia and political interference. Research has been decentralized into semi-autonomous public research institutes or research councils. Extension has been even more decentralised and placed under local government administrations which are deemed to be more attuned to local needs (Lele *et al.*, 2010). Faculties of agriculture have been established in most African universities.

There is today a continent wide recognition of the importance of a productive agriculture as a key driver of national growth, with ambitious targets for a reinvigorated sector. African countries are planning for major increases in agricultural productivity, employment, and profitability. But consideration of the human resources necessary to implement these plans is typically based on unrealistic and highly optimistic assumptions. Investment in human capital development overall has been constrained in the past several decades by public sector hiring freezes, eliminating an important avenue through which young graduates gain experience in the sector. The private sector has largely focused on attracting the more experienced and competent public employees that meet its mandate. Civil society has also poached heavily from the best of public sector agriculturalists, albeit often at a more junior and less experienced level. Many graduates of agriculture join other industries, seeing better opportunities there. The outcome is a large (and expanding) deficit of young people gaining experience in the sector – a recruitment ‘black hole’ for the not very distant future when the current generation of experienced African agriculturalists reach retirement (Cabral and Scoones, 2006).

In addition, the continent fails to retain many of its skilled and professional personnel, an issue which the African universities have to address. Ndullo (2007), analyzing a series of international data, shows that at least a third of African skilled professionals are lost to the OECD countries. The emigration of technically skilled people has left 20,000 scientists and engineers in Africa servicing 600 million people (Ndullo, 2007). Of African PhD graduates in the US over the period 1986-1996, 36% stayed in North America, and the remaining 2% went to Europe and elsewhere. Variations in rates of repatriation across countries were conditioned by a number of factors, including political instability, lack of job opportunities, weak or absent universities and independent research centres at home, and fear of professional atrophy.

## **Opportunities for Africa**

Fortunately there are opportunities. There is an Africa whose people are living longer, having fewer children, and in which more of their children are surviving infancy. Importantly, Africa has a major resource that can, with skill and without unreasonable cost, transform the agricultural industries of the continent. Africa is the fastest-growing and fastest-urbanising continent with a high fertility rate: the average woman born today in Africa can expect to have five children in her child-bearing years, compared

with just 1.7 in East Asia. The share of the working-age population will rise in 27 of 32 African countries between 2005 and 2015, creating a “demographic dividend”, which can be cashed in to produce a virtuous cycle of growth. Africa’s young people are its biggest asset (Bloom *et al.*, 2007).

Using this dividend will not be easy; with poor direction and policy, the demographic dividend could become a burden, as unemployed youth turn to crime and civil unrest in desperation. Delay will certainly turn the dividend into a curse. Asia and Latin America have already harvested the benefits of their changing population patterns and have made the demographic transition to smaller, more prosperous families. Investment in high quality science education enabled Asia and Latin America to use their demographic dividend productively and to start the long walk from poverty. Both used the energy and creativeness of the young to build prosperous economies. To transform their agricultural industries, they drew heavily on international science but made it their own. They built sustainability into their economies through investing heavily in indigenous science and in science education (Eicher, 2009).

**The case of Brazil.** Let us look at Brazil. The current higher education system in Brazil was developed in the 1930s and 1940s based largely on the very formal Portuguese model. In the 1960s, the then military government introduced landmark reforms to revitalise agricultural research and education (Carvalho de Mello, 2006). Comfortable elderly professors and senior researchers found themselves facing forced retirements and dismissals, but Brazilian universities were rapidly brought into line with modern practice (Carvalho de Mello, 2006; Sequeira, 2009). To fill the gaps in skilled professional manpower, the government invested heavily in building local training capacity and human capital. A focused national initiative involved formal linkages with top United States universities. Eicher (2009) finds that these agreements, which included exchange programmes for Brazilian scholars, have been crucial in the country’s agricultural development.

There were problems. Too rapid expansion of Brazilian universities came at a cost in terms of quality (World Bank, 2001). This was corrected through involving the private sector more actively in university education so that today, some 40% of tertiary education students are supported by the private sector (Carvalho de Mello, 2006). Stability was ensured through consistency of national funding. The federal government of Brazil

spends 4.5% of GDP on education, and is required by law to spend at least 17% of tax revenues on education. Higher education benefits significantly from this, as funding for primary and secondary education is the responsibility of individual states. Brazil also built quality through another strategy – developing strong postgraduate programmes at the major universities through investment in university research and postgraduate education. Carvalho de Mello (2006) reports that the considerable and effective research output in Brazil can be directly attributed to the sustained investment in research and postgraduate education that began with the 1960s reforms. Brazil has over 5000 full time researchers compared to around 550 in Tanzania (Pardey *et al.*, 1995; Pardey *et al.*, 2004). The country now awards around 9000 PhD and 30,000 MSc degrees per year – increases of around 10 and 7 times (respectively) the numbers awarded in 1987, and is responsible for close to half of the international publication output for Latin America. The universities are fully integrated into the national research system, with 20% of publicly funded research conducted by universities, compared to an average in subSaharan Africa of under 10% (Bientema *et al.*, 1998).

Agriculture has featured heavily in this: in 1989, 20% of postgraduate enrolments were in agricultural sciences, rising to over 40 % in 2003 (Schwartzman, 1991, Carvalho de Mello, 2006). This support is directly responsible for driving local innovation that has had significant benefits for Brazil. Pardey *et al.* (2004) estimate that publicly funded research into new rice, bean and soya varieties yielded Brazil \$16 of benefit for every \$1 invested. In particular, a focus on local innovation and development of crops and techniques suited to local conditions, in partnership with farmers and the private sector, was fundamental to the transformation of Brazilian agriculture. This has, according to Pardey *et al.* (2004) and Gasques (2006), been the key factor in allowing Brazil to develop new varieties and to expand into previously non-cultivable areas, and to maintain yields under conditions where they would otherwise have fallen. The results from the Brazilian reforms were exceptional. In less than 30 years Brazil has turned itself from a food importer into one of the world's great breadbaskets. It is the first country to have caught up with the traditional "big five" grain exporters (America, Canada, Australia, Argentina and the European Union). Between 1996 and 2006, the total value of the country's crops increased 365%. Brazil increased its beef exports tenfold in a decade, overtaking Australia as the world's largest exporter.

### **Implications for Africa**

It is also the world's largest exporter of poultry, sugar cane and ethanol. Brazil supplies a quarter of the world's soyabean trade on just 6% of the country's arable land. And this has been achieved without needing significant government subsidy. State support accounted for 5.7% of total farm income in Brazil during 2005-07, compared with 12% in America, 26% for the OECD average and 29% in the European Union. And Brazil's agriculture has been remarkably benign in ecological terms - the great expansion of farmland has taken place 1,000km from the Amazon rainforest (anon, 2010).

Africa has a substantial pool of smart young people, desperate to get ahead and to improve their lives and those of their families. With quite modest but sustained investment, but involving reform and a refocusing of the higher education sector, Africa's agriculture (like that of Asia and Latin America) could be transformed through releasing the potential and the energy of youth. The payback could be fast and substantial. The tools are there; they need to be used. The leapfrogging of decrepit state telecoms by profitable mobile telephone companies is one example of the power of new technology to create change. With revitalised universities, firmly linked to the business of agriculture, and inhabited by energetic young professionals eager to establish their careers, farming in Africa could become a business that benefits the whole society and creates the broad-based growth needed to break out of poverty. Demography provides the opportunity. As an outcome of advances in hygiene and health care, Africa has a population bonus – a cadre of young, enthusiastic people who, with the right incentives and opportunities will produce the answers to our current problems.

Today smallholders are recognised as the potential innovators of the desperately sought after African Green Revolution. What they require is access to improved, reliable, and economically viable technology options. Agricultural development is focused beyond production to address the entire value chain so that farmers participate fully in market opportunities. This requires graduates with a firm grasp of the practicalities of farmer training, implementation of adaptive or on-farm demonstrations or trials, financial management, and understanding agricultural value chain addition. Many graduates will need to create their own employment and some will require business start-up advisory and entrepreneurial skills, combined with the aptitude to participate from the outset as potential innovators in the system (Blackie *et al.*, 2009).

The private sector and NGOs are increasingly playing an important role in agricultural extension (and, in some cases, even replacing government services). Key elements in this changing demand pattern are an emphasis on practical skills, and good quality agricultural education. This requires universities to build strong partnerships with both employers (connecting actively with traditional employers in the public sector and the ‘new’ employers amongst community based and private sector organisations). Courses need to be refreshed with the latest knowledge from international and regional science, and to be informed by farming practice and constraints. Particular attention needs to be paid to ‘over the horizon’ issues (for example, climate change and the role of biotechnology) so that graduates are able fully to engage in these important debates (Blackie *et al.*, 2009).

Amongst agricultural graduates at all levels, women are seriously underrepresented. While gender issues are widely accepted and many agricultural specialists are fully attuned to gender sensitivity, an understanding of how to mainstream gender issues and, importantly, to engage fully women at all levels of agricultural development is less evident. Girls are typically not encouraged to take sciences in secondary school, and agriculture is not a favoured subject amongst graduating high school students of either sex. Enlightened and focused programmes, such as those introduced by Sokoine University of Agriculture in Tanzania, can substantially increase female enrolments in agricultural education.

It is widely recognised that there are major issues with the quality and focus of undergraduate training in agriculture available in much of Africa. In a recent analysis of the demand for graduates in the eastern, central, and southern Africa region, employers and farmers consistently observed that most agricultural graduates were weak in terms of problem analysis and solution skills (Blackie *et al.*, 2009). Graduates also expressed their dissatisfaction with the quality of their training – they were provided with at least some of theory in their coursework; rarely did they get the chance to put the theory into practice.

The demand for skilled young agriculturalists is high as African countries seek rapid growth in their agricultural economies. This provides an opportunity both to revitalize the farmer support services (both public and private) through the rapid introduction of fresh thinking, and to encourage the evolution of new business enterprises.

Particular efforts are required to broaden access to agricultural education overall. Firstly, greater numbers of female students need urgently to be recruited. Secondly, it is fact that too many children in Africa do not have adequate access to quality schooling – which restricts the pool of conventional entrants into the university system. The universities need urgently to develop and expand opportunities for this category of student to gain ready access through the university system at all levels. Importantly this would also at the same time increase female opportunities for advancement.

The universities are changing but the pace is slow. African universities need to learn from the experiences of countries such as Brazil and Malaysia. Young professionals, learning new skills in strong graduate schools, linked firmly to farmer organisations and agribusiness, provide the catalyst needed to create the integrated powerful agricultural innovation systems needed in Africa. These graduate schools need distinct and real autonomy, with producers and stakeholders having effective and significant representation on their governing bodies so as to link training and research with market demand. A key growth area is the NGO and private sector involvement in agricultural development. There is a real opportunity, and considerable mutual benefit, to a coordinated effort where the universities, together with the private sector and the NGOs, plan and implement an initiative to develop a high quality agricultural educational system for Africa. The cost is reasonable – a graduate at an African university can be trained at a fraction of the price of overseas training. Each MSc graduate can influence and guide more junior colleagues, providing a strong multiplier effect. The key element is quality – no compromises are possible. But by building strong stakeholder involvement (and investment) in graduate education, the evidence is clear that rapid impacts on the agricultural industries of poor countries can be made. These changes will require careful and tactful intervention, and support from experienced regional and international agriculturalists. There is a real opportunity for the regional university networks such as the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)<sup>1</sup> and research networks to provide leadership and vision to this change.

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<sup>1</sup>RUFORUM is a Network of 25 African universities mobilised to provide quality graduate training in Agricultural Sciences in Africa. It is a highly successful model for developing quality human resource for African agriculture and for integrating universities in the development process (see [www.ruforum.org](http://www.ruforum.org) for details)

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