Peter Doherty
Distinguished Lecture

Harnessing Technologies for Sustainable Development in Africa

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Harnessing technologies for sustainable development in Africa

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Thank you very much, Director General Carlos Seré, for your warm introduction.

It is a great pleasure to be here with a leading group of thinkers and actors working for the development of Africa, and to share my thoughts on making science and technology work for Africa. I feel particularly honoured by the invitation to participate in this Peter Doherty Distinguished Lecture for two reasons. First, I am apparently the first African to deliver it. And second, I have great admiration for the International Livestock Research Institute (ILRI) and for its dedicated work over the years. This is an institution that has tangibly contributed to poverty reduction in Africa, and I congratulate you for it.

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PERSONAL NOTE

All of this also intimidates me somewhat as well. I am not a scientist or an agriculture expert, and I know full well that members of this audience are far more learned than I am in these areas. That is why my perspective will be that of an African member of the UN family, an economist and development worker, and as someone who has the benefit of an entire organisation—the United Nations Economic Commission for Africa (ECA)—staffed with top-flight professionals who help me learn about the kind of issues before us today.

On a personal note, let me begin with a confession. I almost became a scientist, too. At least, that was what my parents intended when they sent me to the Government Secondary Technical School in Ghana four decades ago, with the idea that I would then go on to the University of Science and Technology to become a scientist or an engineer. Naturally, I disappointed everyone by instead going to the University of Ghana and then to Berkeley to study economics. But after all, my friends, none of us is perfect.

AFRICA'S DEVELOPMENT

I consider the development of Africa to be among the most pressing issues of our time. That is why we have no alternative but to speak candidly together about it. That is why there is no point in me pretending that Africa has not got very major challenges to face, or that it is going to be anything other than a very tough slog to meet these challenges successfully. I am going to spend some time outlining these problems, so we can have no illusions about them. But I am going to insist that we cannot be defeated by these problems, that the needs of our people are so great that we must move forward, and that it is still possible to see a brighter picture in which Africa takes her destiny into her own hands and designs her own future.

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What is more, I am in charge of an entire organisation here in this city that is dedicated to nothing less than helping make this future possible.

But I am here today to say that it can only happen if Africa harnesses science and technology for sustainable development.

During this lecture, I will try to convey my idea of sustainable development and why it has declined in Africa over the last 30 years. I will argue that sustainability is a direct function of institutional development, human and physical capital accumulation as well as productivity. I will indicate a few of the most critical challenges Africa must address to achieve sustainable development and a better life for its citizens. Then I will suggest how new technologies can help respond to these challenges.

I do not intend to present these technologies, formidable as they are, as panaceas of some kind. There are no panaceas for Africa, and in any event, I will show that we can do much more to address many of Africa's problems with existing and conventional technologies.

Finally, I ask the all-important question: 'Who is going to do all of the things I will be recommending?' The answer, as you will soon hear, involves all of us—African governments, civil society organisations, non-governmental organisations (NGOs), and Africa's development partners.

SUSTAINABLE DEVELOPMENT

Let me turn first to the concept of sustainable development, a phrase that is frequently thrown around but, I sense, not always grasped. In fact, from my vantage point as a development economist, sustainable development is easy to explain but substantially more difficult to realise. Basically, it is development that meets the needs of the present without compromising the ability of future generations to meet their own

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needs. It is a pattern of development that ensures a steady enhancement of well-being over time. It requires structural changes that lead to enduring widespread improvements in the quality of life of a society. So, I am not talking about the latest development fad or easy election-time promises. Sustainable development requires a systematic, carefully co-ordinated, and interconnected series of policies and strategies that will improve people's lives in a progressive, irreversible and palpable manner.

With this concept in mind, how has Africa fared in the last 30 years? Have we developed, and have we developed sustainably?

Not long ago, my colleagues at the ECA developed some indices to answer these questions. We used cluster analysis to classify 38 African countries into three relatively homogenous groups. We categorised them as high sustainability, moderate sustainability and low sustainability. Overall, I regret to report, we found sustainability in Africa to have worsened.

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Looking at the decade between 1985 and 1994, we found that no African country achieved high sustainability, only a few achieved moderate overall sustainability, but most fell into the cluster of low sustainability. What we discovered was that while significant progress had often been made in health and education in this period, these gains were offset in many countries by poor governance and conflict. At the same time, in many large African countries, population density and environmental hazards increased substantially.

Between 1995 and 2000, the number of countries with low sustainability remained about the same. In many of them, large population increases were accompanied by the deterioration of economic, institutional and environmental management. We then ranked countries by their average overall sustainability score for all of 1975–2000. Mauritius, South Africa, Botswana, Zimbabwe and Tunisia emerged as the top five, while at the bottom were Burundi, the Democratic Republic of Congo, Guinea, Chad and Burkina Faso.

We were not surprised by these results. South Africa's large industrialised economy set it aside from other African economies, while Mauritius and Botswana were the star economic performers. Both these countries also ranked as the top two in institutional sustainability. On the other hand, the entire top five ranked poorly in environmental sustainability. What does all of this research mean?

It seems to me that there are a few key lessons here. First, countries with higher sustainability also tend to have more stable governments, they have little or no conflict (with the exception of South Africa until the 1990s and Zimbabwe until recently), a military with little or no role in political matters, lower corruption, higher-quality bureaucracies, higher saving rates and higher per capita spending on health and education.

Second, it is possible for countries to do well for a while without giving consideration to environmental factors. Ultimately, however, there is no question that they will suffer the consequences of such neglect.

Third, national efforts to achieve sustainable development should emphasise productive capacity and its key determinants—institutions and human resources. All countries need the rule of law, civil and political rights, high quality government policies and agencies, and effective mechanisms of conflict management.

As you can see then, to have a chance of succeeding, the sustainable development that Africa needs must have three dimensions: economic sustainability, environmental sustainability and institutional sustainability.

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I hope the implication of this analysis is clear enough. The fact is that we know what we need to achieve the goal of sustainable development. But I do not pretend it will be easy. There are at least six critical challenges, which we must address and cure if we are to have a chance at success.

POVERTY REDUCTION

Let us begin with the most fundamental development challenge in Africa today: poverty reduction. Although they are widely known, let me remind you of some of the data. They are, frankly, both dispiriting and embarrassing. With 4 out of every 10 people living on less than US$ 1 per day, Africa is the poorest continent, despite being one of the most richly endowed. The continent includes 25 of the world's 30 poorest countries, and sub-Saharan Africa is host to 32 of the 48 least developed countries. Worse still, poverty has gained in numbers, affecting 50% more Africans over the last 14 years. The number of sub-Saharan Africans currently living below the poverty line (over 180 million people) is expected to exceed 300 million by 2020; these are people without adequate access to food, housing, education and health care. Overall, while the world may meet the Millennium Development Goal of cutting the proportion of people living in poverty from 22% today to 11% by 2015, Africa will likely be stuck at around 37%—more than three times the projected global average. The stark reality is that Africa is not even able to feed itself and must rely on 3.23 million tonnes of food aid annually to stave off starvation.

The most fundamental development challenge in Africa today is poverty reduction. The stark reality is that Africa is not even able to feed itself and must rely on 3.23 million tonnes of food aid annually to stave off starvation. The key to reversing this trend is agriculture; Africa must fight poverty through an agricultural revolution.

Without any question, the key to reversing this trend is agriculture. Yet, African agriculture displays the lowest yields in the world. Less than 6% of Africa's arable and permanent cropland is irrigated, compared to an average of 33% for Asia. The data are even worse if we look only at sub-Saharan Africa. It is only too obvious, then, that African agriculture has failed to keep pace with human population growth and, in most cases, it has actually under-performed the pre-independence period.

In fact, sub-Saharan Africa is the only major developing region where per capita food-grain output has declined over the last four decades. In the few cases where high per capita production is observed, growth is mostly a result of area expansion, with yield increases accounting for less than 2%. Overall, to underline this unhappy reality, Africa today depends on imports for 25% of its food grain requirements.

There is yet another reason Africa must fight poverty through an agricultural revolution: I refer to the very spatial distribution of population and poverty, and to the structure of the majority of African economies. Despite the exponential population growth in most African cities that we have all experienced, 75% of all Africans still live in rural areas. Some 70% of all poor Africans are rural and, despite rapid urbanisation, we expect that a majority of the poor will still be rural in 2020. Directly or indirectly, the income and livelihood of almost the entire rural population depend primarily on agricultural enterprises.

On top of this, we know that urban poverty and rural poverty are inter-linked with rural–urban migration. To sum up, then: For the majority of African households today, domestic food and agricultural production, processing and marketing remain overriding determinants of overall income and availability of, and access to, food.

THE HEALTH FACTOR

But let me make a related point that should be self-evident but is not adequately taken into account by policy-makers: Serious agriculture cannot be practised by people who are unhealthy and who must spend a large proportion of their incomes and time fighting old and re-emerging diseases that are savaging the workforce and are directly affecting food security throughout the continent. To improve agriculture, in other words, it is imperative that we also combat ill health.

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The situation is extremely disturbing. On the major health problems of our time, Africa leads the world. Fully 80% of infectious diseases are found in sub-Saharan Africa. Malaria alone kills two million people and reduces the gross domestic product (GDP) of sub-Saharan Africa by one

percent every year. Tragically, we have seen the re-emergence of tuberculosis, a disease of the poor, which is causing havoc throughout the continent, not to mention infectious diarrhoea, pneumonia, whooping cough, polio, measles, river blindness and sleeping sickness. Infant mortality in the continent stands at 103 per 1000; now compare this figure to the average of 8 per 1000 for the developed world.

FOOD SECURITY

And then of course there is the scourge of HIV/AIDS. Of the 36 million people infected worldwide with HIV/AIDS, more than 72% reside in Africa. Despite the high profile of the pandemic, I am not at all sure that we have yet begun to grasp its extraordinary impact on all aspects of development and, in particular, food security. This lethal virus has actually changed the demographic profile in many countries of Africa, particularly those south of the Sahara. Over time, population age structures in these countries are being transformed from a pyramid with a wide base to one with a shrinking base and a more rectangular shape. As older age groups grow larger than the younger age group, the pyramid becomes more like a column—call it the population chimney.

In short, the sharp rise in HIV/AIDS-related deaths among young adults of both sexes has shrunk the base of the pyramid. There are now credible estimates that the economies of southern Africa could be devastated by 10 million AIDS deaths in the next 15 years. In at least 15 sub-Saharan African countries, the population is expected to be as much as 3.8% smaller in 2005 than it would have been without HIV/ AIDS, with the working population the most affected. The disease also reduces GDP growth in Africa by an estimated annual average of between 0.5 and 2.6%, while a recent study indicates that by the end of the current decade, AIDS could reduce South Africa's GDP by

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17%—the equivalent of US$ 22 billion. These are stunning figures, almost impossible to contemplate.

In most parts of the continent, and southern Africa in particular, HIV/AIDS is not just making a severe food crisis worse; it is the main underlying cause of the emergency. Farming skills are being lost, agricultural development efforts are declining, productive capacity to work on the land is declining, and household earning is shrinking. Rural communities bear a higher burden of the cost of HIV/AIDS as many urban dwellers and migrant workers return to their villages when they fall ill. So while the number of productive family members declines, the number of dependents grows. At the same time, household expenditures rise to meet medical bills and funeral expenses. These realities endanger both short-term and long-term household food security.

THE GENDER DIMENSION/HUMAN CAPITAL

As is so often the case, the food insecurity pattern also presents a gender dimension, as the burden falls most heavily on women. Women are, after all, the ones who care for the young, the old, the sick and dying. It is women who nurture the social networks that help societies share their burdens. And it is women's expert knowledge about alternative foods that keep families going during times of drought. Yet, with HIV/AIDS rising dramatically and disproportionately among women, that lifeline is being threatened. What this means should be obvious to everyone: African women must be put at the heart of the fight against HIV/AIDS.

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Let me now move beyond the agriculture sector, because HIV/AIDS is dangerously escalating a crisis of governance as well, in ways that are just beginning to be understood. For example, although this is not widely known, it is directly impacting national security in many African countries, where the virus disproportionately affects members of the armed forces. The education sector is losing its teachers, while the health sector is losing its doctors and nurses. Commerce and industry are losing their managers and engineers, while government ministries are losing the very personnel responsible for planning and programme implementation. Seen in this regard, the loss of human resources is a

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development crisis of catastrophic dimensions, challenging all of us to unprecedented efforts.

And yet, many African countries remain ill prepared to deal with this crisis and its cross-cutting consequences, partly for economic reasons, but largely because of a lack of, or weak, governance structures. I will come back to this point in a moment.

As you have seen, I have been outlining some of the daunting challenges that confront Africa: poverty reduction, poor health, human capital development and food security. Now let me turn to the matter of meeting these challenges.

First, let me take this opportunity to let you know about a very recent development at ECA. For many years, I have personally been profoundly concerned by the threat posed to Africa by HIV/AIDS. That was why I was so gratified recently when I was requested by Secretary-General Kofi Annan to convene and chair a high-level commission to investigate the challenges to governance posed by the pandemic. I have already begun bringing together a group of experts, eminent Africans and non-Africans, as commission members, and setting up teams of leading specialists to study the impact of HIV/AIDS on the economy, the public service, food security, the military, business, and the family, especially women. You can expect to hear from us quite soon, and you can expect that technology will figure centrally in our deliberations.

SCIENCE AND TECHNOLOGY

In my view, in fact, technology holds many of the potential answers to our problems. To put it starkly, it seems to me that the situation in Africa today calls for nothing less than a new technological regime. And I

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further consider that such a response is urgently required if we have any chance at all to meet the basic Millennium Development Goals of reducing poverty, hunger, illiteracy, diseases and lack of access to water and sanitation. It is also required, it seems to me, to meet the challenges of globalisation, productivity and international competitiveness. In the real world of the globalised economic environment, African countries must improve their competitiveness not just by relying on their low labour costs, but also by improving their technological levels. In short, harnessing science and technology is the key to facilitating the transition to sustainable development.

It is hardly breaking news that as we settle into the 21st century, science and technology have become pervasive in all sectors of human endeavour. They shape the way we grow our food and eat it, the way we dress, the way we travel, the way we learn and work, the way we communicate, and the way we make war and peace. In the last century alone, science and technology generated more knowledge than in all the epochs of human existence put together. Hundreds of millions of people have already enjoyed the fruits of this explosion in enhanced health, education, life expectancy, reduced maternal mortality, labour saving and entertainment.

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And yet, it appears that this is only the beginning. The line between science and science fiction is becoming blurred, and non-experts like me can only watch with awe. In the 20th century, humans were intelligent observers of nature. In the 21st century, we are changing it. In the 20th century, we depended on natural resources for wealth. In the 21st century, we are creating wealth, by mastering the three revolutions of

physics, information intelligence and biomolecular science, and the way they converge.

Everyone knows that the quantum leaps of the 20th century will accelerate more rapidly in our own time. New discoveries (science), and their applications (technology), are going to drive agriculture, medicine, income growth and new materials in ways we can barely imagine. Fearless forecasts predict that by 2020 we will have computers that we can wear, cars that can see, precision agriculture, health implants and bionics. We will be able to create and manipulate intelligence on demand. We will have the awesome, almost frightening, ability to repair and manipulate life, rather than simply watching it. We already have crops that produce greater yields, and soon those crops will resist pests and diseases while offering positive nutritional, health and environmental attributes. In the 20th century, we found a way to curtail mother-to-child transmission of HIV/AIDS and to slow down the virus with anti-retroviral drugs. In the 21st century, it is not unrealistic to expect that a potent vaccine could soon be developed against HIV and other diseases, which decimate our human capital.

My friends, this is a perfectly plausible snapshot of the future which awaits the world through innovations in science and technology. I say 'the world'. But for us, the real question is clear: Where does Africa stand in all of this? And the answer, I fear, is that for us, the future is still too far away.

For Africa, the future is still too far away.

The United Nations Development Programme (UNDP) has produced a technology achievement index. It measures technology creation, technology diffusion and the human skills that go with harnessing technology. The index, I am sorry to report, rates Africa poorly: Of 5 categories, no African country is in the highest two. Four are in the middle category, 5 are in the second to bottom category, described as 'marginalised' technologically, and all the rest—the other 46 African countries—all land in the bottom category, dubbed 'below marginalised'.

Look what this means in practice. Compared to other developing regions of the world, African agriculture is substantially low-level and under-capitalised: As I said earlier, barely 6% of Africa's arable and permanent cropland is irrigated, compared with an average of 33.3% for Asia, 25% for India and 47% for China. Fertiliser use per hectare of

arable land in Africa stands at only 8 and 20% of the levels reached respectively in Latin America and Asia. Relative to Africa, the number of tractors per thousand hectares of arable land is nearly 3 times greater in Asia and 8 times greater in Latin America.

Let us look at some other important indices: Africa is still at an earlier stage of scientific and institutional development than India was on the eve of the Green Revolution almost three decades ago. In a typical developed country, there are about 2000 scientists and engineers in research and development per 100 thousand people. The three leaders of Africa in this category—South Africa, Egypt and Gabon—have one-half to one-eighth that ratio. In the rest of Africa, the numbers range from 3 (in Senegal) to 21 (in Uganda).

As I promised at the beginning of this lecture, I have been candid about the many tough and frustrating challenges that Africa faces. But we must not allow ourselves to despair and give up. I would argue that we are not allowed to give up. For myself, I continue to see real opportunities as well as the tools to turn those opportunities into realities. I see an Africa that learns to take advantage of new technologies without throwing away the lessons and opportunities of existing, conventional ones.

In my view, there are two aspects of modern technologies that are directly relevant to solving Africa's most critical problems. These are biotechnology for health and agriculture and information and communication technology—ICT, as it is universally called—for many aspects of sustainable development.

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BIOTECHNOLOGY

Biotechnology, as you probably know much better than I, is a mind-boggling collection of techniques or processes that employs organisms (or their units) to develop useful products and services. If I understand it properly, traditional biotechnology includes plant and animal breeding and the use of micro-organisms and enzymes in fermentation, control of pests and pres-

ervation of products. Modern biotechnology refers to the use of recombinant DNA techniques—the transfer of genetic material from one organism to another—and the detailed analysis of genetic information of organisms. I am sure you are also aware that the traditional and modern are sometimes used together, as in the use of recombinant enzymes and genetic markers in fermentation and animal breeding.

According to the latest research, in 1992 the biotech industry employed fewer than 100 thousand people and generated US$ 8 billion. By 2001, it had exploded, employing 190 thousand, and generating US$ 35 billion. The number of modern biotechnology drugs and vaccines increased from 23 in 1990 to over 130 by 2001. About 350 biotechnology-derived drugs and vaccines are in clinical trials targeting over 200 diseases. The genetic material of a number of organisms, including mosquitoes and other malaria-causing organisms, have been either sequenced or decoded.

Biological catalysts or enzymes, I am told, are now used in almost every industry, especially in food processing, leather and textile, personal care, pharmaceuticals and cleaning; about 600 catalyst-products and 75 enzymes are presently used. At the same time, the area of farmland planted with transgenic crops has increased from about 3 million hectares in 1996 to about 53 million hectares in 2001.

Micro-organisms and plants that either remove or degrade toxic compounds have also been used to reclaim wastelands, while many firms have successfully used biotechnology techniques to decrease energy and water consumption, improve productivity and reduce the time involved in processing. All of these techniques can lead to an improved environment, sustainable use of resources, and increased productivity. And that is the basis of my personal fascination with biotechnology.

Unfortunately, however, while the realities of agriculture and health in Africa make the case for urgent use of biotechnology, the region is still seriously lagging behind on the biotech map. In fact, the main beneficiaries of the current biotechnology revolution are developed countries which of course have nothing like the food security and health problems that face Africa. The United States, Canada and Europe, for instance, account for about 97% of global biotechnology revenues, 96% of persons employed in the industry and 88% of the total biotechnology firms. I do not mean that the case for developing countries is entirely hopeless. For example, in the last six years, the areas planted with transgenic crops in developing countries grew from 1.2 million

hectares to 14 million hectares. But the truth is that as of 2001, of 7 developing countries growing these crops, South Africa was the only African country.

But I do not want to concentrate here on biotechnology alone. Let me also indicate my continuing faith in older, conventional technologies. While we are no longer in doubt about the benefit of biotechnology for Africa, the fact is that many of these technologies may not be readily available for a long time to those who need them most—the farmers and those suffering from HIV/AIDS, malaria and tuberculosis that I have been discussing. There are also, I want to emphasise, legitimate concerns about several important aspects of biodiversity, including biosafety, which I do not for a moment want to underestimate.

Successful use of biotechnology techniques can lead to an improved environment, sustainable use of resources, and increased productivity. Unfortunately, however, while the realities of agriculture and health in Africa make the case for urgent use of biotechnology, the region is still seriously lagging behind on the biotech map. The main beneficiaries of the current biotechnology revolution are developed countries.

In a way, these are the best arguments for sticking with what works in existing technologies. As aptly demonstrated by Gordon Conway in his lecture to this body in 1999, agro-ecological technologies work. There are well-established technologies that successfully enhance soil productivity. We have bio-control strategies that can get rid of many of the bugs that destroy cash crops and we have seeds that are resistant to the bugs.

I do not mean, of course, that all older technologies are as effective as they can be, and in fact we know that many of them can be complemented with new biotechnologies to make them substantially more productive. These are common sense ideas that should be possible to implement.

ICT

Let me turn now to another form of technology that points to light at the end of the tunnel for Africa. I refer again to ICT—information and communication technology—with its remarkable capacity to help tackle problems ranging from poverty to economic stagnation and from good governance to environmental degradation.

Another form of technology that points to light at the end of the tunnel for Africa is ICT. In the information society, the information-poor are also the resource-poor, while countries with the highest incomes are also the most information-rich and ICT-developed.

There is increasing evidence showing a correlation between communications, on the one hand, and GDP, investment and growth on the other. While it is not possible to establish a direct causal link between ICT availability and increased income, it is now beyond question that a positive association exists between ICT and economic growth.

Put it another way: The research amply establishes that the absence of information and information technology correlates directly with the world's highest instances of poverty. The equation is quite simple: information brings access to resources as well as to opportunities that generate resources. In the information society, the information-poor are also the resource-poor, while countries with the highest incomes are also the most information-rich and ICT-developed.

That is why increases in information resources should also lead to poverty reduction, and why poverty reduction strategies must involve increasing access to information for the poor. And I am pleased to be able to report to you today that there are countless African success stories related to ICT. Obviously, I do not pretend for a moment that we are there yet; but real progress has been made in many countries. Consider the following specific examples: Manobi-Senegal, a commercial partnership between French and Senegalese entrepreneurs, allows farmers to avoid middlemen and check food and goods prices by mobile phones before going to the market. Nakaseke Telecentre in Uganda uses custom-made CD-ROMs to help rural women with limited literacy to raise their incomes. In Budalangi in Kenya, through a project

called CyberHost, women operate a successful Internet-based village post office 45 kilometres from the nearest government post office. Virtual security guards in Cape Verde are guarding office buildings in Boston and Sole Comfort, through ecosandals.com, employs the poorest of the poor in Kenya, using the Internet to sell sandals made from tires. Truthfully, I could expand these examples many times over. But I am sure the point is clear enough.

There is also great ICT potential to promote good governance in Africa. E-governance, as it is naturally being called, can help in streamlining the delivery of public services, improving internal management, and increasing citizen participation in governance and public forums. We know that ICT can help African countries to reform their public sector and to democratise initiatives aimed at transparency, efficiency, accountability and better resource management.

WAY FORWARD

That is the way we can move forward. There is no hidden agenda; this prescription is becoming pretty familiar. So now we come to the really hard question: Who's going to do all of this? Who's going to take the initiatives and design the necessary strategies? Let me answer by telling you a short story. It is the story of some mischievous young boys who set out to embarrass the village wise man.

They wanted to prove that the old man was just as foolish as all the others. They went to him with a bird, and asked him if it was dead or alive. If he said it was dead, they would let the bird fly; if he said it was alive, they would wring its neck and kill it. One way or another, the old man had to lose.

'Old man,' they said, 'is this bird dead or alive?'

The old man took a good look at the boys, paused for a long time, and said thoughtfully: 'Young men, it is in your hands.'

So, my friends, it is in our hands, all of us. The sustainable development of Africa is in our collective hands.

Last year, our ECA team published a report called *'Harnessing technologies for development'*. In it, we called on African governments to take a number of specific steps. Let me mention a few of them:

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- Promote African-focused biotechnology research that emphasises 'orphan crops', particularly cassava, millet, sorghum, sweet potato and yams and other cereals such as maize, rice and wheat
- Develop African-owned biotechnology policies that involve all relevant stakeholders, including civil society, the private sector and farmer organisations, in the formulation of national plans
- Establish national regulatory institutions for risk assessment and management
- Increase investment in modern biotechnology research
- Promote public/private sector partnerships in modern biotechnology research
- Strengthen the linkages between modern crop biotechnology and its use in practical plant breeding and
- Promote regional approaches to biodiversity as a way of maximising scarce resources.

If Africa is not to miss the biotechnology revolution (as it missed the benefits of the earlier Green Revolution), then governments have to take the lead. Governments throughout Africa simply must refocus attention on agriculture.

From the experience of African countries that have deployed genetically modified (or GM) crops, we know that success depends on the extent to which countries have pursued these options. And that means an active facilitating role for governments. If Africa is not to miss the biotechnology revolution (as it missed the benefits of the earlier Green Revolution), then governments have to take the lead. Governments throughout Africa simply must refocus attention on agriculture.

The same is true for ICT. Careful government intervention is required to realise its great potential to help meet the problems of poverty, economic stagnation and environmental degradation. Governments must compensate for the lack of technological capability, skill capacity and supporting infrastructure that characterise so many African countries. It is up to governments to provide the enabling environment through policies that encourage innovation, investment, access and skills development, strategies and transparency.

It is important to establish ICT national strategies and to promote policies that stimulate direct investment. These policies must be capable of enhancing private sector investment in infrastructure, promote technology transfer, create jobs, build capacity and enhance international partnerships. Education policy should be geared to providing students not only with an appropriate understanding of technology, but also with applied skills and market-specific technological knowledge.

Governments should also integrate innovation, science and technology with overall development policies—in other words, to mainstream it. There are many practical examples of this happening in various African countries, and they can easily be emulated. As in so many other areas, the issue is not how to do, but having the will to do it.

Let me spell out clearly what I am trying to say, so it is unmistakable. What Africa needs is nothing less than leadership and democratisation. If we are going to truly mobilise science and technology for sustainable development, all key stakeholders must be involved in both policy formulation and implementation. That is the way we avoid academic and elitist policies. That is the way we define and strengthen the role of public institutions, international partners, universities, NGOs, women's organisations, civil society and the private sector. And that is the way we ensure that policies are tailored primarily with a view to meeting the specific needs of end-users and clients.

If we are going to truly mobilise science and technology for sustainable development, all key stakeholders must be involved in both policy formulation and implementation. That is the way we avoid academic and elitist policies. That is the way we ensure that policies are tailored primarily to meet the specific needs of end-users and clients.

INTERNATIONAL PARTNERSHIP

Finally, I must not fail to add here the very important role in all this for international partners. To give this issue the weight it deserves would take an entire speech by itself, and this is certainly not the time to begin that speech. So let me try in a very few words to make a very big point.

In the 1960s and 1970s, agriculture and agricultural research was a growth industry for partners. But it was then jettisoned, a very serious error. We must now urge our partners to give it the very highest priority once again. We need to make our partners realise that support for poverty reduction strategies and the Millennium Development Goals rightly begins with aggressive support for agriculture and agricultural research. They need to understand that Organization for Economic Co-operation and Development (OECD) agricultural subsidies must not be allowed to stifle, discourage or kill productivity in Africa altogether. They should increase support for international research institutions such as ILRI itself, International Institute of Tropical Agriculture (IITA) and International Water Management Institute (IWMI) as well as centres of excellence in African countries. They should pay greater attention to the HIV/AIDS pandemic, and invest far more funds in research related to the diseases of the poor.

This litany is long, and I could go on at very great length. But for the moment, let me merely re-emphasise that in the pursuit of sustainable development for Africa, our international partners have an indispensable role to play.

Those are my thoughts this afternoon, and I thank you for your attention. I do not need to add much in conclusion, beyond saying this: The truth is that Africa cannot afford to miss the opportunities that science and technology are now offering it. It is all there in front of us. The time for speeches is past. As Secretary-General Kofi Annan said only last month in his World Water Day message, 'We must move from promises to practice, from commitments to concrete projects, from intentions to implementations'.

It is, in the end, in our own hands.
I thank you.

K.Y. Amoako

Since 1995, K.Y. Amoako has been Executive Secretary of the Economic Commission for Africa (ECA), the regional arm of the United Nations in Africa, with the rank of Under-Secretary-General of the United Nations. Dr Amoako also serves as a board member of the Development Gateway Foundation and Chair of its Editorial Committee and as a member of the Global Information and Infrastructure Commission. He has served as a member of the World Health Organization's high-level Commission on Macroeconomics and Health.

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