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Emerging Issues in Science and Technology for Food Security and Sustainable Development in Africa

EXECUTIVE SUMMARY

Achieving the millennium development goals (MDGs) and sustainable development in Africa represents major challenges, given the weak science and technology capacities of most African countries In fact, meeting the various development challenges in the area of poverty reduction, food security, health, water and sanitation, globalization, productivity and international competitiveness, requires strengthened scientific and technological capabilities on the African continent

A new scientific and technological regime is needed to meet these challenges Indeed, the underlying principles of the sustainable development paradigm, which underpins development goals and strategies, command policies that are, among other things, pro-environment, pro-poor and pro-innovation Progressing simultaneously in many areas of science and technology policy in order to achieve sustainability and competitiveness appears to be the most viable strategy available to African policy makers at this particular juncture

This document captures some of the ongoing work within ECA in the area of science and technology for food security and sustainable development This work also follows up some of the recommendations of CSD-2 and CNRST-2

Section 1 addresses the issue "How can science and technology contribute to food security and sustainable development?" Food insecurity affects about one African out of three and food emergency aid is distributed in more than 25 African countries In many countries food production per capita has been decreasing since the beginning of the 1980s The problem is expected to get worse in many areas, particularly where the environment is fragile and where the population is growing rapidly In order to alleviate or eliminate the problem, food production has to increase, mostly on land already under cultivation That means that yields and productivity have to increase substantially, mainly through a more intense application and utilization of science and technology The section analyzes the current contribution (or lack of contribution) of science and technology to sustainable development in Africa and focuses on issues related to food security – one of the major requirements of sustainable development

The section clearly indicates that, at this juncture of Africa's development, a useful science and technology platform to address the challenge of food security and sustainable development is a Green Revolution for Africa The section proposes policy options that African countries can pursue together to improve their situation, in cooperation with Africa's partners in the framework of NEPAD

Section 2 zeroes in on a Green Revolution for Africa In order to address the problems of food for security and poverty elimination, CNRST-2 noted that advanced knowledge and applications in biotechnology carry particular hope for realizing a green revolution in Africa CSD-2 more explicitly recommended that ECA starts, in collaboration with African countries, a pilot project for accelerated agricultural intensification, and ensure, through policy advocacy and capacity building measures, that African countries reflect the urgency of agricultural intensification in their policies On 21 February 2003, UN Secretary General Kofi Annan urged African countries and their development partners to promote a Green Revolution in Africa The section presents the ECA's follow up on these policy initiatives It makes concrete proposals on how a Green Revolution can be designed, triggered and realized in the African context

In section 3 the specific case of biotechnology is tackled, under the challenge "How can biotechnology contribute to poverty alleviation in Africa?" Africa continues to face many technological challenges deteriorating health associated with diseases (HIV/AIDS, malaria, tuberculosis, etc) and malnutrition, degradation of environment/natural resources, including particularly forest, soil and water, increasing loss of biodiversity, poor or inadequate transformation of natural resources and agricultural raw materials, low agricultural productivity and food shortage, and a deep energy crisis coupled with increasing desertification due to the overuse of fuel wood among others Rural people, who represent 70-80 per cent the population in sub-Saharan Africa, are the most affected About 60 per cent of these people live in poverty The section highlights the possible contribution of modern biotechnology to poverty alleviation and the actions necessary to realize its full potential It deals respectively with modern biotechnology in the areas of food and agriculture, natural resources/biodiversity, and health

SECTION 1

EMERGING ISSUES AND CHALLENGES IN S&T FOR FOOD SECURITY AND SUSTAINABLE DEVELOPMENT[1]

1 Introduction

Africa faces serious food security problems – by far a lot more than any other continent in the world Two-thirds of all countries suffering food insecurity in the world are in Africa, where per capita food production has been declining for many years Inadequate technological level remains a major constraint to Africa's food security and sustainable development Limited 'technological learning', absence of appropriate technology policies, inability to fully grasp the challenges of globalization and appreciate the key issues that continue to shape world development today compound the problems

Africa is experiencing chronic food shortage as subsistence food production fails to meet consumption needs of a growing population There is variability of food supply throughout the year, inability to purchase food because of low-income and pervasive poverty among the majority of the people, and ineffective methods in using available resources due to application of inferior technologies in agricultural production

Clearly, current production methods relying almost exclusively on natural climatic conditions cannot solve the immense food insecurity problems in Africa even if more land is brought under cultivation In this regard, various science and technology issues must be tackled to enable Africa achieve food security and sustainable development

People in rural areas need the infrastructure and the means for transporting farm inputs and outputs – implements, fertilizers, seeds, wood, water and farm produce They require technological skills to start and maintain small-scale industries, such as those based on agro-processing They also need to acquire skills to sustain production systems, for example, repair of agricultural equipment, maintenance of irrigation systems, use of low cost building materials and conservation of the environment All these activities call for concerted efforts to generate, adapt and utilize specific types of technologies

2. Emerging issues and challenges

Various science and technology issues emerge in Africa's quest for food security and sustainable development The major ones are

- developing agricultural technology for meeting the increasing need for food at affordable prices

[1] Based on a study conducted by ECA with the assistance of a consultant The study is available in English only

- developing sustainable land management technologies for rangeland, forestland, grassland, swampland, marginal land, etc ,
- developing agricultural systems that conserve biodiversity within the system itself, and
- developing knowledge systems based on proper understanding of needs of households that depend on the ecosystem and indigenous knowledge of existing resources for their survival

Poor technological capability remains one of the major constraints to Africa's efforts to achieve sustainable development and food security The lack of deliberate technological learning and implementation of technological policies that are in line with domestic economic problems and the challenges of globalization is overwhelming Also overwhelming is the continent's continuous failure to learn from the Newly Industrialized Countries (NICs) and to address properly the key issues that have shaped the development paradigm in these countries

In most developing countries, semi-subsistence peasants and small-scale commercial farmers use family labour, simple technology and sometimes wage labour and minor elements of standard technology However, the associated skills of applied agronomy, planning and management, maintenance and repair of equipment are often missing Likewise, many professionals and experts trained in the field of agriculture are unfortunately underutilized and many are dissatisfied with their working conditions Additionally, lack of adequate infrastructure, suitable mechanisms for promoting science and technology for development and the requisite political will and commitment have led to poor science and technology culture in the continent

Many African countries have developed science and technology policies for development but too often these policies have not been implemented properly Likewise, legislations guaranteeing appropriate incentives to promote agricultural production and productivity (eg subsidies, etc) are woefully lacking In such a context, foreign direct investment projects in productive sectors, have been few and far in between

3. Lessons from past experiences

Science and technology have made enormous contributions to the growth of the agricultural sector in many parts of the developing world As a result, global food production has increased by 80 percent since the mid-1960s Africa, however, needs to double food production to accommodate population increase

African countries may learn from various food security programmes and agricultural related technologies experienced over time and in many countries, especially developing ones The most successful program, which may be emulated and replicated to suit specific conditions of African countries is the Green Revolution

The Green Revolution, which took place in Asia (India, Indonesia, Taiwan, Philippines, China and Japan) during the 1960s, is a major global scientific and technological achievement towards increased food production On the one hand, improved crop varieties, irrigation, pesticides and mineral fertilizer were introduced, which contributed to substantial improvement of food production With this technological advancement in agriculture it was possible to develop varieties, which have contributed to higher food production and improved the returns to costly resources used by poor farmers As a result, increased productivity has decreased food costs, in general, and thus improved food security, particularly for vulnerable sections of society

Irrigation, drainage and efficient rainwater harvesting to cope with rising water scarcity are critical in ensuring adequate food production and food security There is high potential in Africa for increasing food productivity through better control of water and increasing the use of plant nutrients The concern should be reducing irrigation costs to enable smallholder farmers to manage farms in a manner that minimises resource degradation problems such as water logging and salinity

On the other hand, a wide range of improved crop- and resource- management technologies were emphasized, which have improved environmental and resource sustainability In this regard, it was possible to bring under cultivation less-favourable lands by introducing new plant varieties (e g drought-tolerant crop varieties), which in turn has also contributed to higher food production This practice has reduced the conversion of forest, grasslands and swamplands for cultivation of food crops For example, without advancement in agricultural technology, India would have had to cultivate nearly 60 million hectares of additional land to produce the quantity of wheat currently consumed

This scientific and technological advancement went hand in hand with investment in institutional infrastructure and continued research activities to raise food production and productivity In China, for example, infrastructural investment continued alongside a remarkable effort and achievements in the area of seed improvement Consequently, the combination of a decentralized research system and successful extension services replaced the traditional varieties of rice and wheat with modern dwarf varieties by 80 percent at the end of 1970s The Chinese experience, especially the post-1978 reforms, demonstrates the importance of incentives and a conducive institutional framework in maximizing the effects of agricultural infrastructure, and of successful research on, and dissemination of, new technologies

Post-harvest technologies that encompass efficient crop handling, storage, processing, transportation, marketing and utilization need also to be promoted These kinds of technology reduce food losses, add value to the crops, facilitate efficient trade, generate employment and new products for the market and provide diversification of food

4. The policies that should be promoted

In order to enhance the contribution of science and technology to food production and security, five domains are a top priority human resources development, increased

investment in agriculture, establishment of appropriate institutions, formulation and adoption of appropriate policies and inter-country cooperation within and outside Africa Additionally, exhibitions of agricultural technologies would generate some awareness to potential buyers and users of such technologies There is, thus, an urgent need to enhance exhibition activities of agricultural technologies in the rural areas instead of limiting them to urban areas Such events are vital in improving the use of modern agricultural science and technology amongst farmers and increasing agricultural production, productivity and ultimately food security

The importance of extension services to improved agricultural outputs, productivity and food security in African countries should not be underestimated Extension services, to the extent that they aim at enabling the farmers adopt improved agricultural practices through interacting directly and intimately with the extension personnel, proves to be a most effective and efficient way of diffusing, assimilating, and absorbing improved agricultural techniques for increased production, productivity and food security There is thus urgent need to strengthen agriculture extension services to African farmers

It is important to bear in mind that there is no one single or simple solution to improving agricultural output Clearly, improving food security in Africa requires a multidimensional approach

5. Policy recommendations

At national level, innovative and committed leadership is required and called upon to take up change-management roles in order to improve food security through project and programme design, management, implementation, monitoring and evaluation Towards this endeavour, national governments should do, amongst other things, the following

- Invest in agricultural technology and rural development, including energy technology, education and research and development
- Undertake macroeconomic and financial reforms to support agriculture, the rural sector and food security
- Develop and encourage appropriate programmes and projects that will create off-farm employment and agricultural growth aimed at poverty reduction
- Expand agricultural education, communication and extension services
- Undertake measures to build regional communication and transport networks targeted at rural development
- Initiate appropriate measures for environment conservation and replenish depleted lands to enable agricultural practices that are harmonious with natural resources management
- Conduct research on and adopt technologies, which are appropriate and friendly to smallholder farmers, especially women, and embark on necessary institutional support for effective women participation in achieving food security in the countries

Research institutions at both regional and national levels need to be strengthened The East African Community Regional Agricultural Centre, for example, before 1977, proved to be a centre of excellence for agricultural technology generation and dissemination Today, the setting up of the African Fertilizer Development Centre (AFDC), an AU outfit, can help to develop and improve agricultural systems with the use of fertilizers Links, networks and alliances amongst agricultural research centres in the region need to be forged and strengthened in order to facilitate and foster modes of institutional collaboration that enhance agricultural production, productivity and food security

At continental level, the New Partnership for Africa's Development (NEPAD) offers ample opportunities for assisting, helping and supporting African countries in improving agricultural productivity and food security at a regional level NEPAD may particularly

- Assist and help African countries in their efforts towards developing food security policies, programmes and projects with financial commitments
- Interface with the international community to channel resources to those countries with promising food security programmes and projects together with adherence to good governance and principles of human right
- Promote regional science and technology centres of excellence with particular focus on agricultural research, productivity and sustainable food security
- Design practical methods by which African countries will be required to contribute to sustainable food security programmes
- Establish a mechanism for monitoring global development and, particularly, technological advances, evaluating their implications on the process of agricultural transformation, production, and food security in African countries

SECTION 2

TOWARDS A GREEN REVOLUTION IN AFRICA: HARNESSING SCIENCE AND TECHNOLOGY FOR SUSTAINABLE MODERNIZATION OF AFRICAN AGRICULTURE AND RURAL TRANSFORMATION (SMART/AGRI)[2]

Introduction: It is Africa's Turn

Agricultural development is a prime pre-condition for broad-based economic growth, food security and poverty reduction in Africa At this juncture, Africa does not have much of an alternative path to development but to pursue an agricultural revolution because of the continuous increase of the population, the widespread poverty and the structure of most of African national economies, which largely depend on agriculture

In the 1960s and 1970s, a Green Revolution (GR) took place in Asia and Latin America It involved a rapid increase in agricultural productivity, caused by mass adoption of improved high-yielding varieties of food crops, mainly cereals - wheat, rice and maize - and by mass adoption of scientific methods of agriculture, including better management of biological, chemical, mechanical and hydrological parameters on the farm It led to the elimination of hunger and mass poverty, and the transformation of rural economies Unfortunately, in Africa, the GR was delayed for 30 years It is now Africa's turn

On 21 February 2003, UN Secretary General Kofi Annan urged African countries and their global partners to promote a "GR" in Africa, to help the continent move towards self-sufficiency in food, reduction of hunger, and eradication of poverty This call to action is therefore a major UN policy imperative and a challenge for all key players and stakeholders to deliver their part of the bargain for the transformation of Africa through a GR

The ECA has undertaken some research and reflection on the promise of a GR in Africa It has pondered questions like What does a GR mean for Africa? Has Africa missed the GR? Is it possible for the continent to catch up? What are the key challenges and opportunities, options and necessary actions for a way forward?

Preliminary findings clearly indicate that Africa did not miss the GR – it was merely delayed Furthermore, a GR is the only known method for sustainable modernization of agriculture, poverty and hunger eradication, and rural transformation It is a step that cannot be missed on the way to development All major societies on all continents – including a few limited examples in Africa - underwent a GR in the 50 years from 1930s-1980s, starting with Europe and North America, then South Asia and Latin America, and most recently China Localized African examples include yield-enhancing experiments in North Africa on wheat, in Rhodesia and Kenya by colonial settlers on maize, in Zimbabwe (1980s) by African smallholder farmers with maize, and in West Africa on

[2] Based on a study conducted by ECA with the assistance of a consultant The study is available in English only

cassava and rice ECA finds that Africa is now poised at the threshold of triggering a GR It is now a question of ***how***, not ***when***, the African GR shall be designed, triggered and sustained

Why was a GR Delayed in Africa? Conditions for a GR

While a GR was taking place in other continents, Africa was also undertaking agricultural development programs and experiments using various models, including commodity-based systems, integrated rural development projects, state farms from USSR, communal farms from China and land settlement schemes from Israel The major weakness of those approaches was that they failed to design for the complex African subsistence farming systems and diverse agro-ecological zones (there are at least 7 major agro-ecological zones in Sub-Saharan Africa alone) Many initiatives also failed to include key improved commodity technologies and lacked the necessary socio-economic components like irrigation facilities, land reforms, credit and policy support for purchased farm inputs such as seeds, fertilizers and farm tools Many were capital intensive, dependent on foreign funding and foreign staffing, leaving the African farmer with little participation in planning, implementation, learning and ownership of the process Most collapsed after donor withdrawal with little sustainable impact on the ground Besides, there was political neglect of importance of science and technology for agricultural modernization

However, apart from the few examples given above, there are other current initiatives that suggest the possibility of a GR in Africa These include successful diffusion of improved technologies of maize, cotton, rice, sorghum and groundnuts in a few countries There are also successful irrigation projects and instances of redesign of traditional farming systems The adoption of national plans for modernization of agriculture and agriculture-led industrialization strategies in a few countries, the renewed international interest in African agriculture and the advent of NEPAD with its Comprehensive Africa Agricultural Development Program are also encouraging signs

Way Forward: Towards a GR in Africa

On 10-12 June 2003, an eminent group of experts met at an Ad hoc Expert Group Meeting on Science and Technology held at ECA, and

(a) *Declared* that Africa needs a GR

(b) *Affirmed* that Africa CAN achieve a GR in 5-10 years

(c) *Endorsed* a methodology (SMART/AGRI) for causing a GR in Africa

(d) *Drew up* a Road Map towards a GR in Africa

SMART/AGRI Methodology

The methodology adopted by the experts for causing a GR in Africa is dubbed SMART/AGRI Sustainable Modernization of Agriculture and Rural Transformation / African GR Initiative Developed by African scientists and agricultural economists, it identifies and distils the fundamental scientific, technological, socio-economic and political ingredients of the GR globally, and how they can be adapted to the specific African context It is a "Doubly Green" approach, incorporating both the technological components of the GR and the new, participatory approaches whereby scientists work with the smallholder farmer communities in participatory planning, technology development, technical assessment, re-design of the farming systems, and priming the communities for a GR

The methodology proposes an implementation plan that can cause visible GR results in the field at pilot sites in three selected countries in the first three years, and further results in six selected countries in five years Scaling up and replication of the African GR would then be accomplished in 5-10 years

Countries participating in the African GR Initiative will need to put in place the TIIP Technologies, Institutions, Infrastructure and Policies that drive the GR process This includes building, strengthening, mastering and working with the cascade of GR institutions that maintain the scientific pipeline and technological shelf for the farmer to reach into for GR technologies This GR cascade comprises the international GR institutions (managed by CGIAR), the national agricultural research systems (NARS) and the extension, education and communication systems for on-farm trial and adoption of the GR technologies

For its part, ECA is actively promoting a GR using the tools available within its mandate The most recent occasion to do this was the hosting by ECA of the Ministerial Roundtable of the High-Level Segment of UN Economic and Social Council (ECOSOC) in Geneva, on the theme "A GR for Africa what does it mean?" The Roundtable which attracted Ministers, Heads of Delegations, Agency Heads and members of civil society endorsed the idea of an African GR ECOSOC has posted the ECA Issues Paper discussed at the Roundtable on its internet website

Issues for Discussion

In addition to reflecting on the challenges posed above, therefore, the meeting may discuss the following issues

a) International GR Focus on Africa How can the international GR institutions (the International Agricultural Research Centers of the CGIAR) be reconfigured to serve Africa? One of the basic building blocks of the GR is the network of 16 or so International Agricultural Research Centres (IARCs), most of which are managed by the Consultative Group on International Agricultural Research (CGIAR) Established at the onset of the GR in the 1960s, they have been responsible for generation of GR science and technology, knowledge/germplasm exchange and capacity building for National Agricultural Research Systems (NARS) However, current analysis indicates clearly that

this crucial resource mainly focused on Asia and Latin America and largely neglected Africa The analysis concludes that after three decades, most of these centers have now completed their mission in Asia and Latin America, and should move their headquarters to Africa to get closer to the problems of the continent It is Africa's turn ECA is prepared to facilitate the reconfiguring process negotiation, design, and implementation

b) Community and National Level Design of the GR How can African governments take the first steps in promoting, over the next 5-10 years, the Doubly GR which has been identified as the missing link, in addition to providing the requisite technology, infrastructure, institutions and policies (TIIP), to trigger a sustainable modernization of agriculture and rural transformation (SMART/AGRI) in Africa?

c) The GR and NEPAD How can the Comprehensive African Agricultural Development Program adopted by NEPAD focus on a GR for Africa as an explicit goal, and achieve it within 5-10 years? How can NEPAD ensure the market access that will be necessary to stimulate a GR in Africa? The Comprehensive Africa Agricultural Development Program (CAADP) has four pillars and derived actions which, when fully implemented, can cause a GR in Africa For this to happen, these components have to be clearly conceptualized, aligned and focused towards the GR as an explicit goal, then rolled out in a clear sequence to achieve it This is what the ECA Road Map towards a GR in Africa proposes to contribute

d) Learning Curve How will Africa master the inter-sectoral, multidisciplinary, regional and socioeconomic issues that accompany a GR, in order to learn from others' experiences while avoiding their mistakes? How will Africa tackle issues of governance, conflict, peace and security, equity, gender, environment, land policy, education, health and regional integration that will hinder or enhance the GR in Africa?

e) Actions to be taken by African governments

- Design a Plan for Modernization of Agriculture
- Endorse the African GR Initiative (SMART/AGRI) declared by ECA
- Participate in the ECA Fast Track on the African GR Road Map
- Start a field project using SMART/AGRI methodology
- Cooperate with countries sharing similar agro-ecological zones and/or resources
- Participate, with other member states, in lobbying the CGIAR to reconfigure the GR institutions to focus on Africa This could start with moving the HQ of ICRISAT from Asia, where its mission is deemed completed, to Africa
- Participate in getting NEPAD's Comprehensive African Agriculture Development Program to focus on the GR as an explicit goal
- Participate in learning curve activities for developing the technologies, infrastructure, institutions and policies (TIIP) for causing a GR in Africa

- Mobilize renewed public, private and donor commitment for providing policy, human, scientific, and financial support to sustainable modernization of agriculture and rural transformation
- Form partnerships with neighbouring countries for networking, sharing responsibilities and information exchange with respect to suitable crop and livestock technologies
- Identify priority strategic commodities for which there is high domestic consumer demand and potential for external commercialization Such commodities should be incorporated in a GR design
- Allocate more resources for the development of infrastructure, especially irrigation, rural roads and market facilities such as post harvest handling, processing and storage

SECTION 3

BIOTECHNOLOGY FOR SUSTAINABLE DEVELOPMENT

The promise of Biotechnology

Biotechnology is "any technique that uses living organisms or substances from these organisms to make or modify a product, to improve plants or animals or to develop micro-organisms for specific uses" It is a gradient of technologies ranging from traditional technologies such as brewing, fermentation, baking, biological control, artificial insemination and embryo transfer to modern biotechnology The major components of modern biotechnology include genomics, bioinformatics, gene splicing or transformation, genetic modification, molecular breeding, diagnostics, vaccine technology and new plant tissue culture

Biotechnology is one of the leading technologies of the 21st century It can drastically reduce the period of developing products and address difficult issues, such as drought It can contribute to saving Africa's rich biodiversity, including medicinal plants The continent has a great potential to develop and sustain a commercial production of plant-based medicines, from which the war against diseases can benefit significantly

Indeed, Africa must seize the opportunities to harness both conventional ***green*** revolution as well as emerging ***gene*** revolution technologies to make significant headways to sustainable agricultural development and food security In this regard, biotechnology should be viewed as one part of a comprehensive, sustainable agricultural development, poverty reduction and food security strategy, and not as a technological "quick fix" for Africa's hunger and poverty problems Modern biotechnology should therefore be considered in complementarity with conventional green revolution technologies in boosting food and agricultural production

Biotechnology is highly applicable and holds great promise in several important sectors·

Food, agriculture, natural resources and environment where its application range from crop and animal improvement, through soil fertility and land protection, crop and livestock protection, post harvest technologies, biofertilization, etc

In health, it can help produce vaccines, diagnostics and medicines for the major human diseases of Africa, such as malaria, TB and HIV/AIDS, and also for diseases of animals and crops

In industry and energy, biotechnological procedures enhance industries dealing with plant and animal oils, carbohydrates, proteins, textiles, leather, wood, fermented products, biogas, plant alcohol, insulin and hormones

Key Constraints and Challenges to Development and Application of Biotechnology

The expected benefits of biotechnology can only be realized if a number of key challenges are addressed, including the extent to which the technologies are relevant to Africa, are pro-poor and mitigate bio-safety and related risks The challenge is to ensure that poor farmers in Africa gain from biotechnology, as the current focus of biotechnology research on crops grown and disease strains is prevalent in developed, rather than developing countries This challenge should be faced up against the reality that most African countries are not well equipped to address the potential risks of these technologies to human and animal health, and the environment

Major constraints to the use of biotechnology are the potential or perceived risks associated with its application These include genetic erosion, production of 'superweeds', antibiotic resistance, allergy reactions and bio-terrorism

Other constraints include inappropriate approach to GMO research, lack of institutional and human resource capacity, and lack of investment Others include lack of policy decision and/or frameworks related to biotechnology, poor management of controversies, inadequate infrastructure, disarticulation of the National System of Innovation, poor regional integration and cooperation and poor awareness on the advantages associated with biotechnology

ECA's Progress on Biotechnology

In recognition of the great potential of biotechnology, ECA is increasing its support to enabling African countries to realize the full contribution that modern biotechnology can yield for the region's sustainable development During the WSSD, the Commission released a report entitled 'Harnessing Technologies for Sustainable Development', which argues that new and emerging technologies, such as biotechnologies, can help Africa move towards sustainable development by lowering the incidence of disease, reducing food insecurity, and decreasing vulnerability to environmental damage by allowing more flexible crop management systems

Both CSD-2 and CNRST-2 acknowledged the challenges that Africa faces in promoting biotechnology for sustainable development CNRST2 noted that "advanced knowledge and applications in biotechnology carry particular hope for realizing a Green Revolution in Africa" CSD-2 also recognized the potential contribution of biotechnology in agricultural intensification, but also emphasised the potentially negative impacts that its application might have if the necessary precautions are not taken, as highlighted by the highly charged debate on Genetically Modified Organisms (GMOs) These challenges lie in the area of ECA's work on promotion of science and technology for sustainable development, in which it has been quite successful especially in the area of ICTs

To explore these challenges further, ECA convened an Expert Group Meeting on Biotechnology for Africa's Sustainable Development on 3-7 July 2002

The experts identified key challenges and intervention domains for each of the sectors, made specific recommendations for ECA to pursue in promoting biotechnology for development These included the following

1 Liaise with the three sub-regional Agricultural Research and Development organizations in Africa (CORAF, ASARECA and SACCAR) in order to avoid duplication and ensure prioritization of issues and effective utilization of funds for biotechnology projects,
2 Facilitate the integration of biotechnology activities in Africa within NEPAD with a view to minimizing the above-mentioned duplication and maximizing collective efforts,
3 Put emphasis on countries with weak biotechnology capacities in order to promote equity among countries endeavouring to share the benefit of biotechnology,
4 Promote generation and sharing of knowledge and information related to biotechnology by establishing a website and strengthening information exchange within regional networks to ensure effective networking and information dissemination,
5 Produce inventory documents on biotechnology by putting in place a commission of capable experts in the field,
6 Promote R & D in biotechnology by playing a facilitating role in training, resource mobilization, and sharing of methodologies and expertise, awareness creation, and infrastructure building,
7 Document and audit the available resources (infrastructure, human, activities and funding sources, stakeholders of biotechnology) on the continent,
8 Facilitate the transfer of biotechnologies through training, material transfer, Memorandum of Understanding (MoU), and field projects,
9. Help adopt and implement the AU, WHO and WIPO guidelines on intellectual property rights (IPR) and equitable benefit sharing, and
10 Promote private and public partnership

Way Forward: Strategies for African Countries

Africa must seize the day as other regions -- particularly Asia -- are rushing to catch up China, India and Indonesia are already planting millions of acres of genetically modified cotton Other Asian countries, including Japan, Thailand, the Philippines and Malaysia, are earmarking significant resources for private and government-sponsored research on biotech crops Africa, which depends heavily on agriculture, stands to benefit from technologies that can increase the production of food, enhance its nutritional quality, and minimize the exploitation of forests and marginal lands The biggest risk would be to do nothing and let the biotechnology revolution bypass the continent

Biotechnology is not a single solution to feeding the poor, but a suite of technologies to be embedded in established breeding and selection programmes A range of options are available to ensure that future biotechnology initiatives can reach their full potential for alleviating poverty and achieving food security These include, among others

1 An African-focused biotechnology research programme in which emphasis is laid on "orphan crops" particularly cassava, millet, sorghum, sweet potato and yams, and also on other cereals such as maize, rice and wheat,
2 African-owned biotechnology policies whereby all the relevant stakeholders, namely, the civil society, private sector and farmer organizations are involved in the formulation of national biotechnology plans,
3 Establishment of national regulatory institutions for risk assessment and management, since most African countries have weak human resource capacity to perform these functions,
4 Increasing investment in modern biotechnology research The current levels in most African countries are very low (hardly 2% of the total agricultural research funds),
5 Promotion of public/private sector partnership in modern biotechnology research, and
6 Strengthening the linkages between modern crop biotechnology and its use in practical plant breeding