Catalyzing innovation and change in agricultural research in Africa: The role of the Forum for Agricultural Research in Africa (FARA)

FARA's STRATEGY DOCUMENT

2002 –2012

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Executive summary

Africa's basic industry is agriculture-based, not only in supporting the rural masses in their quest for food but also providing a large share of the GDP, contributing 30-40% of exports and 70% of employment. Recognizing agriculture as pivotal to Africa's development, FARA's strategy is to advocate for agricultural research and development by forging strategic alliances among its major partners and clients, the sub-regional organizations and the national agricultural research systems and other stakeholders including the International Agricultural Research Centers (IARC), NGOs, universities, policy-makers and farmers' organizations. The vision is 'to enable Africa to achieve at least 6% annual growth rate in agriculture by the year 2020 through enhanced research and value adding to its products, consequently increasing food security, poverty alleviation and economic growth in a sustainable way'. The mission of FARA is 'to enhance and add value to the effectiveness and efficiency of agricultural research systems in Africa in order to contribute to agricultural development and economic growth and sustainable use of natural resources'.

FARA is not a research implementing body. FARA will serve as a *catalyst* for agricultural development by enhancing and implementing new ways of doing agricultural research and development in Africa. To achieve this major task, FARA will play a lead role in bringing the various stakeholders together; encouraging them to negotiate and cooperate on matters of common interest with regards to agricultural research. It will play advocacy and coordination roles for agricultural research, while the NARS and the IARCs (working on priorities defined jointly with the SROs) will develop improved technologies along the research-to-development continuum in their respective countries and coverage areas. FARA will focus on advocacy for support to agricultural research, improving communication and information exchange, capacity building and training, and helping to promote issues that cut across sub-regions, particularly with respect to agricultural policy, market access, and scaling-up of technology dissemination. The stakeholders and partners of FARA will include SROs, NARS, NGOs, farmers' organizations, private sector, donors, the CGIAR and other advanced research institutions.

The strategy of FARA is driven from an aggregation of the priorities and aspirations of the SRO's, which is a reflection of the NARS. FARA will take the lead in guiding other partners working in/and for Africa in optimizing agricultural research results, technology development and information dissemination. By analyzing the various aspirations and objectives of the three SRO's, FARA has formulated five cross cutting themes to provide value added services for the SRO's, i.e.: (i) advocacy of the role of agricultural research; (ii) promotion of functional partnerships and strategic alliances; (iii) development and dissemination of new technologies and methodologies; (iv) sharing and exchange of information; and (v) capacity building.

FARA will strengthen its support base by the recruitment and allocation of top-class personnel to contribute to advocacy for agricultural research support and promote programmatic integration at the sub-regional level. The sensitive issue of genetically modified organisms (GMOs) and its potential application to agricultural development in Africa needs to be carefully assessed over the coming decade.

FARA will strengthen its position as the knowledge hub for agricultural research and development in Africa. FARA will explore the development of collaboration and division of tasks, or pooling of resources with other institutions functioning in Africa. Alliances with advanced research institutions in developed and developing countries in other continents will be extensively used to speed up strategic research within Africa. FARA will explore ways and means to promote SRO and NARS collaboration with the private sector, while ensuring that research outputs remain accessible to the farmers. FARA will advocate upgrading of ICT capacity (electronic library, web-site) to compile existing literature sources for wide dissemination to partners in the region.

The main goal of the financial-resources mobilization strategy is to provide a framework for increased stability and flexibility of funding, with optimum resource allocation. To overcome the limited traditional funding base, the financial-resource mobilization strategy will be three-pronged, i.e. consolidating and sustaining existing funding sources; exploring and expanding new funding sources; and pooling and leveraging of resources.

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1. Background

At the turn of the millennium, Africa was home to over 700 million people with nearly 50% of the population below 18 years old. With an annual growth rate of 3%, Africa's projected population by the year 2020 is more than one billion people and the population is expected to steady at 2.5 billion by the year 2050. In contrast, India's population will steady at only 1.6 billion by the year 2050 [(2)]. The development trends over the last 40 years show that Africa has lagged behind in nearly all fronts of development, and continues to do so even when other regions have continued to record steady growth.

If current trends continue in Africa, the number of poor people is expected to increase steadily through the middle of the current century. The per-capita GDP share in the continent has declined steadily over the last four decades, which equates to the post-independence period for most African countries [(1)]. The available calories per capita are still around 1800 per day; worse still, the per-capita availability of calories continues to slump[(5)] in Africa, leading to severe malnutrition and consequent physical and cognitive stunting[(4)].

Overall life expectancy is still low, averaging below 50 years before the arrival of HIV/AIDS, which has reduced the life expectancy further by an average of 5–10 years [(6)]. The literacy rate is still below 80% in most countries of the continent, with the exception of seven countries—Zimbabwe, South Africa, Mauritius, Lesotho, Botswana, Equatorial Guinea and Kenya, which all have mean literacy rates slightly above 80% [(3)]. The quality of life in rural Africa continues to slump; the availability of basic amenities like water and nutrition is steadily worsening, consequently so is people's health.

These are depressing figures and one wonders if the trend can be reversed. However, there are examples of success that give a ray of hope in the midst of this grossly hopeless picture. The cases of Botswana and Egypt are contrasting and worthy of note. They both provide hope and an encouragement that it is possible to achieve developmental objectives with national impact. In both cases, agricultural development has enabled this phenomenal transformation.

Agriculture: the backbone of economic growth in Africa

Africa's basic industry is agriculture-based, not only in supporting the rural masses in their quest for food, but also in providing a large share of the GDP, contributing approximately 30–40% of exports and 70% of employment [(1)]. Small-holder farmers have, however, fared very badly in rural Africa. Their productivity remains low, and they lack adequate and stable off-farm employment opportunities. The very weight of this poorly developed agriculture sector in the economies of most of the countries of the region means that without rapid growth in this sector, these countries will not prosper, and without income growth among small-holder farmers, poverty will continue to deepen**.**

For most African countries, there really has not been a truly viable alternative to agriculture as a basis of development. Many African governments have declared that agriculture forms the basic engine of growth. Unfortunately, those pronouncements are often not backed by clear policy or economic support/guidelines. African governments

and future investors in Africa need to be encouraged through the provision of information-exchange platforms, as well as the formation of functional partnerships (Strong 1999). These partnerships need to do things differently both in terms of agenda setting and in their approach to resolving the identified problems.

Increased agricultural productivity in Africa cannot be achieved without the benefits of cutting-edge science and without the advances in technology development, capacity building, technology dissemination, and policy research to promote the development, adaptation and dissemination of new technologies and without improving the policy environment in which farmers operate.

Asian examples, India in particular, illustrate that the rate of return on agricultural research and development make for a worthy investment (Fan *et al*. 1999), and even in Africa itself there is adequate evidence that investment in agricultural research is potentially a gainful engagement (Thirtle *et al*. 2000; Evenson 2001).

FARA is convinced that agriculture is critical to Africa's economic, social and rural development. This document is meant to shed light on the tasks that lie ahead for FARA in the coming 10 years to ensure that agricultural research does have an impact on food security and poverty alleviation in Africa and that research and development programs are truly demand driven, addressing the needs of the poor.

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2. Vision and mission statements

The role of agriculture is pivotal to African development, and FARA will play a major advocacy role for agricultural research and development by forging strategic alliances between African national agricultural research systems (NARS), sub-regional organizations (SROs), the International Agricultural Research Centers (IARCs), among which the Consultative Group on International Agricultural Research (CGIAR), and other partners, for improved food security and poverty alleviation, while safeguarding the natural resource base.

FARA's **vision** is:

> **to enable Africa to achieve at least 6% annual growth rate in agriculture by the year 2020 through enhanced research and value adding to its products, consequently increasing food security, poverty alleviation and economic growth in a sustainable way.**

The projected growth rate of 6% by the year 2020 will allow African farmers to prosper and not just survive. The target is within reach if African agriculture is allowed to realize its full potential by further expanding the sources of technological innovations and having more impact, improving agricultural policy regimes, and taking a broader and longer-term view of the context in which agricultural development takes place.

The **mission** of FARA is:

> **to enhance and add value to the effectiveness and efficiency of agricultural research systems in Africa in order to contribute to agricultural**

development and economic growth and sustainable use of natural resources.

FARA will complement, at the pan-African level, the innovative activities of the national and sub-regional research institutions to deliver more responsive and effective services to their stakeholders. The stakeholders and partners of FARA will include NARS, SROs, NGOs, farmers' organizations, private sector, donors, the CGIAR and other advanced research institutions (ARIs).

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3. Research strategy

FARA is not a research implementing body. It will play advocacy and coordination roles for agricultural research, while the NARS and the IARCs (working on priorities defined jointly with the SROs) will develop improved technologies along the research-to-development continuum in their respective countries and coverage areas. The NARS and IARCs will address the technology generation and dissemination elements, from upstream strategic research targeting specific constraints to the application and integration of different technology components and validation in farmers' fields. They, therefore, address the overall environment in which the proposed technology will be disseminated and used, from the farm level up, including higher aggregation levels such as watersheds, markets, agro-ecological zones and nations. FARA, therefore, will focus on advocacy for support to agricultural research, improving communication and information exchange, capacity building and training, and helping to promote issues that cut across sub-regions, particularly with respect to agricultural policy, market access, and scaling-up of technology dissemination.

FARA will serve as a *catalyst* for agricultural development by enhancing and implementing new ways of doing agricultural research and development in Africa. To achieve this major task, FARA will play a lead role in bringing the various stakeholders together; encouraging them to negotiate and cooperate on matters of common interest with regards to agricultural research. The transformation of SPAAR and the consequent formalization of FARA consolidated this process, giving FARA more structure and defining the roles and functions of the body. During this long transition process, other events that have bearing on FARA's function have taken place. For example, the formation of GFAR by the CGIAR, and the encouragement of change of approach in the IARCs by the CGIAR management and sponsors. During this period, the African NARS have also been going through a gradual renaissance from within, while at the same time looking beyond their own national programs for additional resources.

FARA has taken stock of these developments and has determined that its focal role will be to support the three SROs—ASARECA, CORAF/WECARD and SACCAR—in their endeavours to promote agricultural development within their spheres of influence specifically and in Africa in general. The strategy of FARA therefore is a synthetic one driven from an aggregation of the priorities and aspirations of the SROs, which in turn are a reflection of the NARS, notwithstanding the fact that there will be times for the FARA management/secretariat to bring in new ideas as and when they are applicable and beneficial to some or all of the people of Africa. FARA

will take the lead in guiding other partners working in and for Africa on matters of optimizing agricultural research results, technology development and information dissemination. FARA's strategy will therefore of necessity be a derivative of the SROs' strategic pointers, whose strategic objectives are generally stated as:

> **"to promote regional economic growth by developing, introducing and disseminating agricultural technologies which both create markets and respond to prevailing and future economic opportunities for new technologies, as well as maintaining the long-term sustainability of the agricultural resource base" (ASARECA)**
>
> **"by the year 2020, to have made significant contribution to poverty alleviation and sustainable growth, through agricultural research and training in the SADC region" (SACCAR)**
>
> **"to facilitate the exchange of information and experiences, promote partnerships at the sub regional level, identify and formulate common research themes, identify innovative research projects" (CORAF/WECARD).**

4. Tasks ahead

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By analyzing the various aspirations and objectives of the three SROs, FARA has formulated crosscutting themes to provide value-added services for the SROs, namely:

1. Advocacy of the role of agricultural research
2. Promotion of functional partnerships and strategic alliances
3. Development and dissemination of new technologies and methodologies
4. Sharing and exchange of information
5. Capacity building

None of the topics highlighted is necessarily new; the innovation will be on how to handle the various issues with the primary purpose of enhancing regional growth, as pronounced in the vision statement. In many African research programs, people-oriented impact has not been stressed; FARA aims at ensuring that its agenda will be geared towards greater impact on African people. This will in turn require that the SRO forum emphasize the same for their structures. Ultimately, it will be necessary for FARA to set up a tracking system of its own performance and that of its hierarchical components, starting with the NARIs, NARS and SROs.

Advocacy of the role of agricultural research

There is a need to solicit support for agricultural research both in terms of policy as well as financial. In general, there is renewed support to agricultural development and agricultural research in particular, but it is not adequate. For example, FARA endorses the declaration of the USAID that, in Africa, agriculture is the key to reducing poverty through greater economic growth, increased trade and investment, and improved food security. African agricultural systems must generate increases in food, income and exports in coming years if poverty reduction is to take place, and FARA should advocate for increased support to agricultural research and development through the following:

Promotion of agriculture as the engine of economic growth
FARA endorses the argument of the World Bank [(16)] that growth in total factor productivity in agriculture—a sector traditionally assumed to be technologically backward relative to potential technical change in the manufacturing sector—has actually been faster on average than in the manufacturing sector. Because higher living standards depend fundamentally on productivity growth, these results place agriculture in an entirely new light when development strategies for poor countries are being considered. It would now seem irresponsible to call for abandoning agriculture in favor of manufactured exports as Africa's new development approach. For example, in Asia the continued importance of agriculture in many countries argues for new funding and strategic attention to the sector.

Campaign for pro-active support by African governments
Over the 20 years to 1991, the contribution of Sub-Saharan Africa (SSA) to total developing-country public expenditure on agricultural research fell from 23% to 12%, while that for Latin America fell from 17% to 12% (Table 1). Meanwhile, over the same period, the share of Asia and the Pacific (including China) increased from 44% to 62%.

Between 1971 and 1991, global public expenditure on agricultural research more than doubled from $7.2 billion to $14.9 billion per year. During this period, the developing-country share of expenditure increased from 41% to 54%. The declining contribution from OECD countries is explained by a rapid increase in privately-funded research in these countries from $4 billion in 1981 to $6.6 billion in 1991 (and $7 billion in 1993). This compares with total developing-country public expenditure on agricultural research in 1991 of $8 billion (Alston *et al*. 1998). FARA will actively pursue campaigns to obtain more support for agricultural research from African governments.

Table 1: Public agricultural research expenditures, global trends 1971–91.

	Agricultural research expenditure (1985 $PPPm)[1]			Average annual growth rates (%)		
	1971	1981	1991	1971	1981	1991
Developing countries (131)[2]	2,984	5,503	8,009	6.4	3.9	5.1
Sub-Saharan Africa (44)	699	927	968	2.5	0.8	1.6
China	457	939	1,494	7.7	4.7	6.3
Asia/Pacific, excl. China (28)	861	1,922	3,502	8.7	6.2	7.3
L. America/Caribbean (38)	507	981	944	7.0	-0.5	2.7
W. Asia & N. Africa (20)	459	733	1,100	4.3	4.1	4.8
Developed countries (22)	4,298	5,713	6,941	2.7	1.7	2.3
Global total (153)	7,282	11,217	14,951	4.3	2.9	3.6

Source: Alston *et al*, 1998.

Notes: 1. Purchasing power parity exchange rate.
2. Figures in brackets indicate the number of countries in the respective totals.

Creation of an enabling environment for agricultural research

FARA will also have to encourage African governments to play their role in supporting research. Generally, the African national governments have done poorly except for very few countries like Ethiopia. FARA will encourage national governments to develop research policy, which might address such questions as: the importance the nation attaches to agricultural research, the national research priorities, and how research will be funded. Research policy should clarify different concerns, including identification of the capacities to be strengthened, the incentives that will be offered, how research will be managed, how quality will be monitored, and how research results will be disseminated.

It will also be important that FARA is involved in the lobbying process in the regional and Pan-African bodies. Integration of FARA activities and those of others, like SADC and COMESA, is important, while its liaison role with the initiatives like NEPAD is pivotal to the success in the region.

Perhaps the most overriding support that FARA can provide to the SROs and NARS is to take up seriously the role of sustained advocacy for agricultural research in

the hierarchies of the political bureaucracies. FARA will lobby with appropriate institutions within and outside Africa to stimulate and facilitate interest and investment in agricultural research in Africa.

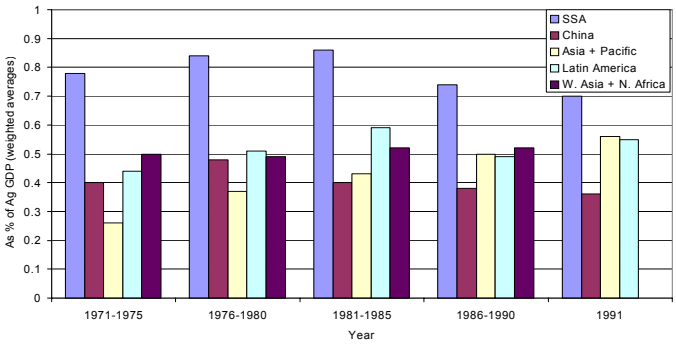
Diversification of investment in agricultural research
This is an opportune time for FARA to lobby hard for support to agricultural research, taking advantage of the change of heart for some of the key supporters of rural development. Much greater investment in agricultural research, extension, infrastructure, transport, general education, and health will be needed to enable all Africans to have access to food. However, much as agriculture is receiving support, in some quarters the portal of entry is seen as something other than the public institutions. There are some who argue that the public sector is bloated and inefficient. Throughout the continent, public research institutions have been thwarted by lack of adequate human, technical and financial capacity. Handicapped by lack of technological and scientific data, these institutions are saddled with many of the inefficiencies of the public sector. It is the role of FARA to ensure that the organs that it intends to co-ordinate are all encouraged to work towards efficiency and complimentarity, such that they all work without undue suspicion. Human-resource development, resource mobilization, and development and dissemination of information and new knowledge will be the cornerstone of the new agricultural research system.

Development of innovative methods of attracting funding
FARA's activities will require increased funding at a time when the budgets in most of Africa are strained. Generally, Africa has had the lowest per-capita investment in research and development, including agricultural research (Pardey *et al*. 2001). Hence, the demand for new methods of attracting funding for research will be required from traditional and non-traditional sources. It should be noted that a number of possibilities are emerging for innovative funding of public-sector research. All have implications for African national research institutions and should be explored. They include check-off programs, debt-for-research conversions (swaps), development foundations, and joint research–commercialization ventures (Melvin Blasé[(8)]).

Promotion of functional partnerships and strategic alliances

Promotion of partnerships with major stakeholders
Financing agricultural research has been inadequate in Africa and a solution is required. For example, comparative analysis of agricultural-research spending patterns is provided by agricultural research intensity (ARI) ratios, which show public-sector agricultural research expenditures as a proportion of Agricultural GDP (AgGDP). In developed countries, public spending on agricultural research increased from 1.4% of AgGDP in the early 1970s to 2.4% in 1991 (Figure 1). These figures are five times greater than those for developing countries, whose average ARIs increased more modestly from 0.4% to 0.5% of AgGDP over the same period (Pardey *et al*. 1998).

Figure 1. Agricultural research intensity ratios, 1971/75, 1991). Research expenditures as % of agricultural GDP of 131 developing countries.



Source: Alston et al. *1997. (Extracted from Akroyd, S., Kiome, R., and Ndiritu, C. In Transformation of Agricultural research systems: Lessons from Kenya)*

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FARA's approach of building coalitions for agricultural research is probably the most logical way forward to increase and sustain funding to agricultural research and development in Africa. However, FARA should also ensure that the political thrust is enhanced through programs like the New Partnership for Africa's Development (NEPAD) [(22)] and other initiatives that are strongly supported by most African governments.

The SROs and NARS will be the key partners and clients of FARA. However, other agricultural development stakeholders, such as the international agricultural research centers (IARCs), including the CGIAR, and others like the NGOs, universities, policy-makers and farmers' organizations, will be more actively involved along the research-to-development continuum. FARA will link up with such categories of stakeholders in Africa to further develop and diversify networks of partners.

FARA is a member of GFAR and will utlize its membership to the benefit of African agricultural research by promoting south-south collaboration and transfer of knowledge through links with, for example, APAARI, FORAGRO, ICAR and EMBRAPA. FARA will also promote collaboration with USA and European agricultural research and training institutions through links with, usaid and IFARD. This is an important means of accessing human and physical research capacity to address African priorities.

Partnership with the CGIAR

There have been wide-ranging discussions on how the CGIAR Centers are to evolve to better serve the needs and priorities of their NARS partners over the last few years (see Annex I). One factor driving this process is a perceived need among all stakeholders for the Centers to be more effective and efficient, as well as to improve cooperation and coordination with their principal partners in each region. There have been calls for regional planning and priority-setting, consistency in methodologies, program coherence, and integration of Centers' activities in the sub-regions, in order to achieve more operational efficiency and programmatic effectiveness.

Recognizing the FARA vision for agricultural research in Africa and the need for the CGIAR Centers' activities to be driven by the African research agenda when

addressing the agricultural challenges in Africa, FARA will work closely with the Centers to ensure that the Centers and their partners are committed to the integration of research activities in Africa based on the work currently undertaken at the SROs. Programmatic integration will be developed in the context of established sub-regional priorities and must be based upon partnership between NARS, SROs and Centers. FARA will play several roles in this process, including further development of the strategic action plan for the CGIAR in Africa. FARA will also help to strengthen the participation of various stakeholders through supporting their participation in relevant meetings. FARA will provide a link with broader regional priority-setting exercises, including those of other stakeholders. It will also help identify potential areas of synergy within the broadest context of institutions and programs in the region.

Expanded partnerships with the NGOs

FARA will have to work hard to consolidate the partnerships and expand them, this will have to go beyond agri-based organizations to encompass the social-care groups like the NGOs based in rural areas. In the words of IFAD, which works with over 800 NGOs, they have become part of a "dynamic partnership in fighting rural poverty" (18). The advantages of NGOs are that they are flexible, innovative and strong advocates for the social, economic and political advocates for the poor.

Not everybody agrees with the unconditional claim of efficiency of the NGOs (Eicher, 1999), but there is evidence to suggest that the NGOs can and have been useful in supporting the rural poor, especially as the role of government diminishes in the democratization process. The NGO model renders itself to decentralization of services through delegation and devolution at the village and community levels (Chuta)[19]. Historically, the public-sector research organizations have not worked closely with the NGOs, and this is an area that FARA will indeed have to try and improve the NGO/NARS relationship for the good of the rural people.

Expanded partnership with the private sector

If Africa is to grow at the accelerated rate of 6% per annum within the next two decades, it will be necessary not only to involve the current private sector, but also to seek for ways and means of expanding the private-sector base and reach. Traditionally, Africa has had a pro-public sector approach with its entire burden on the people of Africa, often regarding the private sector as capitalistic and exploitative. Even when private-sector effort was made, most of it turned out to be the quasi-private organizations, commonly called the parastatals. Most likely, the next decade belongs to countries that will be able to attract private interstate and/or out-state investors. The role of governments will be more on the policy reforms such that the investors feel secure and therefore encouraged to plow back the profits into the country or region. The private sector is generally self-driven and it will thrive where the business guidelines are clear. It is therefore important for FARA to take a clear position of supporting private sector for rural development and creating the appropriate partnerships between the public sector and private sector. FARA, like the CGIAR, should finally form both an NGO and a private sector committee so as to enhance the partnership with these two organs of development.

Development and dissemination of new technologies and methodologies

FARA will help to promote participatory research activities to include end-users and other stakeholders in technology development and dissemination to ensure that specific technologies are relevant and adapted to their target environments. FARA will also assist in promoting direct interaction between scientists and non-traditional stakeholders, including NGOs, private sector and farmer organizations, each of whom can provide critical contributions to the Research to Development (R-to-D) continuum.

According to Per Pinstrup-Andersen (2001) in IFPRI's 2020 vision research, modern science and technology is but one of the many factors that will determine whether, and to what extent, the poor will benefit or lose from integrating into the exchange economy. Modern technology therefore should be seen as part of a broader effort to help the poor solve their problems more efficiently and more cost-effectively. It should, however, be understood that, like most technologies, modern science carries risks alongside benefits, and it offers tremendous opportunities for improving the well-being of the current and future generations. Modern science and technology must therefore be guided in order to get maximum benefits and minimum risks.

Similar sentiments have been expressed by the World Bank in its paper on Poverty matters – focusing on knowledge on technology, the paper points out: "Given the rapid advances that are occurring in numerous fields [e.g., biotechnology, telecommunications, material sciences and long-term weather forecasting] coupled with our emerging appreciation of regional and global environmental issues it is increasingly clear that countries that are unable to access, generate and utilize relevant scientific knowledge will fall even further behind in the development process."

There are some outstanding technologies that Africa must fast-track in order to accelerate development. These include biotechnology, information/communication technology, and geographic information systems.

Below challenges for new technology and methodology development are discussed under three headings: genetic resources management, natural resources management, and socio-economic and policy issues. In reality, advances in all of these three fields will be needed to ensure agricultural development. This is illustrated for a number of food production groups and industrial crops in Annex III.

Genetic resources management and biotechnology

The past decade has been marked by significant progress in varietal improvement. FARA will promote efforts to fully exploit the available gene pool to expand the range of stresses that can be managed through varietal adoption in Africa's major food crops. Efforts will also be made to exploit the available gene pool to maintain or enhance biodiversity in farmers' fields, combining classic breeding with advanced biotechnology tools.

In her book, *Modifying Africa*, Florence Wambugu (2001) gives a convincing description of how biotechnology can benefit the poor and hungry. Using her own work in Kenya, Wambugu has been able to prove that used aright biotechnology can result in direct benefits to the farmers both in terms of better nutrition and economic improvement. She joins the sentiments of Ismael Serageldin, the immediate past and

dynamic pro-technology chairman of the CGIAR in declaring that "New approaches that mobilize both public and private resources and involve non-government bodies are needed if poor people are not to be bypassed by the revolutions in science and information technology."

Proof now abounds that these techno-innovations can make a difference. The evidence presented by Clive James of the International Service for the Acquisition of Agribiotech Applications (ISAAA) shows clearly that the trendsetters are reaping benefits (James, 2001). Promising biotechnology tools for Africa are listed in Annex 2.

For Africa to join in the current developments it will be necessary to put the structures of development together. Biotechnology requires that there is capacity both in terms of human capital and physical facilities.

FARA, therefore, will play a major role in helping the NARS/SROs to acquire this capacity using a multiplicity of approaches. Some of the most important and basic issues at FARA will be:

- Establishment of the state of knowledge on biotechnology in various regions/countries
- Establishment of needs versus technological applications
- The state of biosafety regulations/ phytosanitary structures
- Capacity for handling intellectual property rights
- Source of knowledge and information dissemination within countries and sub-regions.

FARA's position on genetically modified organisms

Genetically modified organisms (GMOs) and their potential application to agricultural research and development in Africa need to be carefully assessed by FARA in collaboration with relevant institutions in Africa. A thorough assessment of the potential benefits and risks associated with GMOs needs to be conducted with interested and other appropriate institutions to ensure a transparent and rigorous screening process. FARA will play a key role in sensitizing governments, SROs and the NARS on the need to develop the required legal framework for monitoring and controlling the flow of GMOs across the region. FARA will help to formulate and promote regional biosafety regulations for ratification by governments. Such a regional coverage would be more efficient in terms of biosafety regulations than a country-specific regulation framework in selected countries.

Natural resources management

Africa is richly endowed with diverse natural resources. Africa's forests host the largest proportion of the world's reservoir of genetic materials. For example, Africa's tropical forests harbor over 8000 species of higher plants, and its mineral wealth is legendary as the continent is one of the world's major sources of gold, diamonds, copper, tin, bauxite, manganese, uranium and crude oil. This enormous wealth in natural resources should provide potential opportunities for addressing the multifaceted challenges facing

the continent. However, past modes of exploitation and management of natural resources have engendered some problems.

The natural resources—including food crops, useful plants, animal and lands, which form the mainstay of the livelihoods of most Africans—are rapidly being degraded. This degradation is manifested noticeably in deforestation, in the productivity of soil used for agriculture and pasture, in serious distortions in the hydrological balance, the access to water resources and in the continuing loss of plant genetic resources. In extreme cases, the loss is irreversible, resulting in the extinction of races of precious indigenous food crops and other useful plants. It is estimated that about 0.7% of forests in Africa are lost each year. Degradation of cropland is severe in Africa, affecting more than 65% of cropped area. Degradation of pastureland is also severe, affecting 31%. The loss to the continent's economy from these sources is incalculable.
Soil nutrient mining, the process where more nutrients are extracted from the soil than are returned) is rampant and is rapidly depleting soil nutrient reserves in Africa. Massive nutrient replenishment programs have been proposed, especially for phosphorus, but their economic benefit and long-term sustainability need case-by-case evaluation. Integrated soil fertility management will often be the most promising approach, i.e. integrated use of locally available, organic resources and, where possible, of mineral fertilizers to maintain or improve soil organic matter status and enhance fertilizer use efficiency. Standard technology packages are inappropriate; rather, approaches must help farmers make decisions based on a combination of their own knowledge and research-based options. 'Synergistic' fertility-management packages need to be tested that include soil amendments like organic matter and rock phosphate, and wise fertilizer applications, aiming at sustainable and profitable crop production. (24)

Africa faces two challenges. The first is to ensure that Africa's natural resources serve as the basis for economic growth that would result in more active and sustainable participation in the global economy. The second is to reverse the degradation of the natural resources. These challenges are made all the more daunting by the fact that it is not sufficient to simply stop the degradation. Consistent efforts must be made in the short- to medium-term to build up the resources to levels never before attained in order to meet the demands of a population growing at more than 3% a year.

FARA will promote sustainable production systems, i.e. developing technologies that can allow intensification of agricultural practices without adversely affecting the environment in an irreversible manner. In the African region where production systems have low productivity, it is of prime importance to promote strategies that can generate technologies that are friendly to the environment and safeguard or even replenish the natural-resource base. The priority here is to contribute to raising the awareness of the SROs and NARS on this issue and to help them incorporate natural-resource management concerns in their research policies, agendas and portfolios. There will be a need to develop rules, regulations and incentives to strengthen and encourage environment-friendly agricultural practices to minimize the negative impact of these activities on the environment. Research and application of appropriate technologies and innovations for this purpose will be emphasized, and FARA will help promote the development of decision-support and monitoring systems to maintain the quality of the natural-resource base in the main agro-ecologies.

Within an integrated natural-resource management framework, system development options will be evaluated with farmers. Systems based on GIS and modeling will be developed to characterize the spatial and temporal dimensions of the driving factors for sustainable agricultural development. Such research will also provide crucial input in the prioritization process, in constraint identification, and in defining extrapolation domains. FARA will take advantage of the outputs of studies on climate change to assess, in collaboration with IARCs, SROs and NARS, the potential impact of future climate change on ecosystem performance in Africa.

A sound economic policy founded on the conservation, management and efficient use of natural resources requires effective research to increase scientific knowledge and technological learning. FARA will promote research at the NARS and IARCs aimed at combating the threats of land degradation, mismanagement of water resources, nutrient depletion and loss of biodiversity, especially of indigenous food crop species and other useful plants. FARA and the SROs will promote development of infrastructure for the training of essential research personnel, access to relevant literature, and opportunities for interaction with the global scientific community.

FARA will therefore promote the development of advanced skill/knowledge base for natural-resources conservation and management by encouraging African scientists to conduct basic research incorporating the grassroots knowledge of farmers and forest-dwellers to the laboratory and "high tech" science arena, and by focusing on education and training of young scientists in cutting-edge science. FARA will also advocate for linking natural-resource knowledge to policy, problem-solving and long-term planning process by networking scientists and policy-makers and by holding conferences, publishing (including via internet), and generally creating public awareness of the issues involved in the effective conservation management and use of African natural resources.

Socio-economic and policy issues

Impact of agricultural technologies on farmers' livelihoods

FARA will work with the SROs to update the characterization of agricultural-based livelihoods in Africa, to enhance research priority-setting capacity. There will be a need to conduct research on farmers' decision-making to predict the likely outcome of technological and institutional change. For intensified market-oriented agricultural-based systems, research will assess the scope for improving harvesting and processing technologies. Bearing in mind that a large majority of producers in Sub-Saharan Africa are women, this research will take into account gender impact on technology development and adoption. FARA will contribute to the development of national and sub-regional monitoring and evaluation systems to allow for more systematic impact assessment.

Impact of HIV/AIDS on agricultural development

HIV/AIDS is a problem in all countries in Africa. The disease hits hardest on people aged 15–49, i.e. the most economically productive segment of the population. HIV/AIDS goes beyond a health issue. It directly or indirectly undermines key sectors of human development, including food security, environment, education, health, agriculture and economic development. FARA will contribute to the assessment of the impact of the pandemic on food security in Africa, and will ensure that emphasis is on the development of labor-saving technologies, and the reduction of labor-intensive agricultural enterprises and agricultural-based production systems providing additional nutritional value that could mitigate HIV impact on the welfare of the rural population.

Enhancing competitiveness and profitability in agriculture

Enhancing competitiveness and profitability in the agricultural sector will require focus on the development of a competitive outlook within the sector and an export culture with commitment to provide what the market wants at competitive prices. The competitiveness of the sector will be enhanced through productivity improvement by generating new and innovative technologies. FARA, in collaboration with the SROs, NARS and the IARCs, will endeavor to monitor agricultural and macro policy changes to assess their impact on the competitiveness of the respective farming systems through the characterization of selected national agricultural economies, with emphasis on market development, an issue critical for the future of African producers. Quality management along the agricultural marketing chain will be analyzed in order to assist in designing appropriate policy options to further improve African agricultural competitiveness against imports.

In the past two decades, most African countries have pursued economic reforms and have seen some degree of improvement in their economic performance. However, economic growth rates are still far below those required for poverty reduction—5% or more depending on the population growth. Domestic savings remain low, limiting investment and the rate at which the private sector can develop. Though foreign direct investment is on the increase, business environment and African competitiveness are sufficiently limiting not to attract enough of it. The manufacturing sector is not sufficiently developed to compete effectively in the global market. To overcome these weaknesses, there is a need to further improve the private-sector environment and to address constraints that presently thwart private sector advancement in Africa.

It is also important for African governments to initiate and implement policies that promote and sustain a market-oriented, private-sector-led, highly competitive (both internally and internationally), technology-driven open economy. Elements of such policies include strict budget discipline, stabilized, market-responsive exchange rate, trade liberalization, positive legal environment ensuring the sanctity of contracts, and speedy adjustment and protection of investments.

In addition it is of crucial importance that a) a much higher level of public resources be allocated to agricultural research than the present case in most African countries, and b) to ensure that these expenditure are of high quality in terms of structure and utilization. The financial and banking system should be organized to make them more supportive of the expansion and diversification of the agricultural sector. Market forces should determine the prices of agricultural products and inputs, while

support is given to investments and other interventions that remove structural and institutional constraints, which hinder the private enterprise, such as provision of market information, transportation and other services. FARA will help facilitate these processes through the following:

- *Advocacy for the development of input markets:*

Competitive agricultural production depends on the efficient use of external inputs such as fertilizers, agricultural chemicals, seeds, planting materials, feeds, and agricultural machinery and equipment. In recent years, the prices of these inputs have increased, leading to higher cost of production, and this has affected the competitiveness of African agriculture. Efforts will be undertaken to improve the efficiency of the input industries and to minimize the increase in prices of these inputs. To this end, the African governments will be encouraged to continue to provide an attractive and conducive environment, including incentives for the development, expansion and modernization of these input industries.

- *Promotion of business support services*

The capacity and quality of support services are vital in increasing the efficiency and strengthening the competitiveness of the agricultural sector. Efforts will be undertaken to further strengthen support services in the areas of agricultural marketing, extension, advisory and consultancy, credit, insurance, information and logistic services such as warehousing, distribution and transportation.

- *Promotion of institutions collaboration*

Currently, the African governments play a leading role in the agricultural research and development through the provision of various support services and infrastructural facilities. Notwithstanding government commitment, the private sector should be encouraged to contribute significantly towards sector development, especially in the plantation sub-sector. Both the public and private sector institutions involved in agricultural development need to further strengthen their collaboration and co-operation towards making the sector more resilient and competitive to meet the challenges of globalization and the liberalization of agricultural trade.

Sharing and exchange of information

A comprehensive and reliable assessment of constraints and opportunities affecting agricultural research and production development will depend upon the quality of biophysical and socio-economic data available. FARA will enhance its communication facilities (i.e. direct access to Internet), to provide a venue for the compilation and exchange of information on agricultural research and production in Africa, and will improve its data management systems. FARA will enhance its capacity to collate, store and disseminate information on agricultural outputs from its partners on past and on-

going research, to improve institutional memory. It will advocate the development of national agricultural information centers with centralized and electronically linked databases to support agricultural research, decision-making and marketing activities. More emphasis will be placed on database development and use of systems-analysis approaches (modeling, GIS) for research priority-setting, impact assessment and monitoring and evaluation studies.

Particular attention will be devoted to the maintenance and upgrading of research facilities in the key research areas, to strengthen the SROs and NARS capacity to exploit modern scientific tools, and to improve communications systems. The further development of research tools and support for technology generation will attract high-caliber staff at the NARS and SROs to produce world-class science. FARA will further develop and reinforce genuine/functional partnerships to address the complexity of rural development challenges. FARA will promote partnership with new categories of agricultural development stakeholders. Particular attention will be given to further develop partnerships with NGOs, farmers' organizations, universities and the private sector in technology testing and dissemination. Networking is not only viewed as a vehicle for the dissemination of research outputs, but it is also considered as a mechanism to expand the scope and the geographic coverage of our research, and as a critical tool in obtaining feedback on technology performance and research priority-setting.

FARA will promote awareness of regional and global issues, such as genetically modified food, intellectual property rights, biosafety regulations, globalization and available technology.

Use of information technology will be emphasized in general, to enhance the acquisition and dissemination of new knowledge and technologies, and to motivate greater participation in technology development and transfer. FARA will play a catalytic role in improving the technology and information exchange capacity of its partners through the compilation and update of a sub-regional database on promising technologies and stakeholders. FARA will emphasize the participatory evaluation of baskets of technologies within a system perspective. It needs no gainsaying to state that information and communication technologies (ICT), driven by convergence of computers, telecommunications and traditional media, are crucial for the knowledge-based economy of the future. Powerful new technologies can also give African countries direct access to the world's knowledge-based enterprises, markets and financial resources.

ICT has reduced the time it takes to identify and improve opportunities for trade, investment and finance. Unfortunately, most African countries have not joined the information revolution, with the notable exceptions of South Africa, Egypt and Kenya. Africa, therefore, has the least developed communications networks in the world and if the continent is to develop it will require an increase in its communication capacity many times over. There are encouraging signs that this might occur with the advent of the cellular/satellite telephone systems and the Internet, but the current statistics are still grim. Sharing of information is essential for researchers and therefore investment in communication should be seen as basic minimum to research systems.

A review done in year 2000 revealed that Africa is left out of the global information society. Africa has

- 13% of the world's population, but only 2% of the world's main telephone lines and 1% of Internet hosts
- the lowest annual growth in telecommunication of any developing region
- 35% of the world's 49 least telecommunication developed countries
- fewer telephones than the city of Tokyo.

To join the information revolution, African countries need to develop the capacity to tap into the global system of information knowledge, and adapt it to solve problems. This calls for public policies to address a range of serious impediments, including inadequate telecommunication systems, restrictive laws and regulations, and a shortage of trained professionals in computer data management, science, engineering and business.

FARA will help to develop capacity in ICT in terms of both personnel and facilities to promote communication among researchers in the region through creation of awareness, and advocacy for implementation of policies and programs that will encourage investment (public/private, domestic/foreign) in the telecommunication industry.

FARA will seek a link with the FAO World Agricultural Information Centre (WAICENT) with a view to influencing its content and improving the means of delivery to suit the African agricultural community. FARA will utilize its limited resources in collaboration with FAO on abstracting and presenting key information emerging from research to the critical decision makers such as Ministers of Finance, leaders of NEPAD, OECD governments etc. in forms that are useful to them.

Capacity building

Capacity building is a cornerstone for capitalizing on scientific knowledge. FARA will promote degree and non-degree short-, medium- and long-term training programs in agricultural research, production and management to promote skilled manpower development in the SROs and NARS. Such training is also expected to speed up the validation of research outputs in farmers' fields, and ensure spillover in terms of knowledge diffusion (training of trainers).

Capacity building in Africa is a crowded field. Recently, the African Governors of the World Bank developed an initiative for "Partnership for Capacity Building in Africa (PACT)". It is clearly understood by both African governments and their development partners that the chronic lack of human, organizational and institutional capacity is a major constraint to sustainable development in Africa. Building human-resources capacity at the SROs and NARS is therefore a primary task of FARA. The ultimate goal is to develop national research capacity through training by promoting a combination of individual degree, networking and group training activities aimed at strengthening NARS' capacity to effectively develop collaborative research with the IARCs and other external partner institutions, and to disseminate the results of this research more effectively and rapidly. The aim is to ensure the development of a critical mass of skilled research scientists in order to reinforce decentralized technology development, and increase regional agricultural productivity in globally competitive

systems through effective development of appropriate technologies for resource-poor farmers in Africa.

FARA would help to seek funds for capable NARS scientists to pursue MSc and PhD training in specific fields in developed and developing countries. FARA will seek graduate courses in selected universities that will provide knowledge of the theory and practice of the 21st century, with focus on the application of new approaches and emerging tools such as in biotechnology and ICT. This will result in the development of a cadre of well-qualified agricultural scientists that would take leadership in research and technology generation in their respective countries.

FARA will also promote individual short-, medium- and long-term training attachment of research scientists and technicians to relevant institution of excellence within and outside Africa. The attachment training will expose the scientists and technicians to new approaches and facilities, thereby enabling national program scientists and technicians to develop familiarity with the new skills.

FARA will also promote group-training programs for scientists and workshops of relevant stakeholders to review the status and future plans for agricultural research in Africa. Importance will also be attached to networking mechanisms to establish effective working relationships with African academics, scientists, technologists and their institutions, as one of the means whereby FARA can raise the quality of work of its partners.

FARA will work with relevant institutions and government to promote infra-structural development, including provision of facilities that would promote high-technology agricultural research and production systems that will use the latest or frontier technologies in agriculture. Investors will be encouraged to fund infra-structural development projects of the NARS.

5. Management strategy

Met opmaak: Engels (V.S.)

FARA will strive to recruit a small team of core staff and allocate top-class personnel to its operations. The quality of FARA's output is determined by its capacity to engage in broad and effective consultations with all stakeholders, including private sector, policy-makers and donors, to seek recognition and support for agricultural research and development and to develop partnerships for the exchange of information and expertise, and by its ability to integrate strategic research outputs from different IARCs, sub-regions and national programs into comprehensive technologies/solutions that respond to ultimate beneficiaries' needs. FARA will put emphasis on the recruitment of technical advisers/officers that are able to contribute to its advocacy role, information and technology exchange, and promote public awareness and research integration in key priority areas in the sub-regions. Career development opportunities will be pursued to ensure that technical and support staff keep abreast of new technologies and techniques, thereby maintaining a high standard and competitiveness within the international and regional market. Given its size and recognizing that it cannot do everything itself, FARA will leverage the necessary and needed additional expertise from its collaborators and partners in the SROs, NARS and donors through its *modus operandi* of partnerships.

Financial resources mobilization

The main goal of the financial-resources mobilization strategy is to provide a framework for sustainability of institutions necessary to meet the regional challenges in agricultural research and development, and for increased stability and flexibility of funding, with optimum resource allocation. Sustainable financing of agricultural development and dissemination requires (i) the diversification of funding sources based on forging partnerships of mutual interest; (ii) securing long-term public funding; (iii) increasing the share of domestic funding (from government, farmers, NGOs, agribusiness, industry); and, (iv) developing innovative mechanisms for resource allocation, such as competitive and contractual mechanisms, as well as linking resource allocation to performance and field impact. New opportunities should be identified for greater access to resources, either directly by FARA or through partners and/or collaborators based on comparative advantage. In this regard and to overcome the limited traditional funding base, the financial-resource mobilization strategy will be three-pronged.

Consolidation and maintenance of traditional funding sources
Donors and the international development community will be expected to adapt a new culture of short-, medium- and long-term financial and technical support to agricultural research and development in Africa. A strong focus will be given to documenting, analyzing and publishing the impact and relevance of past achievements and on-going activities with respect to FARA's mandate, in order to sustain donors' interest in the research agenda of NARS, SROs and FARA. Particular attention will be given to show impact and explicit linkages between the research agenda and its implication for agricultural development and eventual economic growth in Africa.

Diversification of funding sources
An array of partners will be necessary to achieve impact from agricultural research. These should include support from non-traditional donors (NGOs, foundations and private sector) and through the development of collaboration with other research institutions. Equally important is funding commitment from the African governments and a supportive policy environment necessary for agricultural research to contribute successfully to the productive goals, notably by empowering local communities and preserving the natural environment. The African Development Bank and the World Bank would be expected to use their influence to sensitize Africa's political leadership to the need to establish sustainable financing initiative to support national, sub-regional and FARA research and development initiatives. FARA will advocate for increased support of 1% of the AgGDP to agricultural research from African governments.

Pooling and leveraging of resources
FARA will strengthen collaboration with other initiatives in the region, like the NEPAD, the African Rice Initiative (ARI) and the FAO's Special Program for Food Security (SPFS) in Africa through joint project development and implementation,

thereby pooling and leveraging necessary funds from institutions with comparative advantage in a given research area. In addition, the enhancement of FARA monitoring and impact-assessment capacity will improve its efficiency in resource allocation and prioritization.

6. Implementation

Met opmaak: Engels (V.S.)

FARA will strengthen its position as a knowledge hub for agricultural research and development in Africa by establishing an efficient technology and knowledge exchange system with the world agricultural research community. FARA will coordinate donor efforts and input in African agricultural research through identification and interaction with key players in the donor community and their programs and grant conditions, and through the development of strategies for effective dealing with these key players. FARA will also advocate African needs and aspirations at international meetings and at organizations in developed countries that conduct research in Africa on problems of Africa. Therefore, FARA will build coalitions with key stakeholders and advocacy groups on African agricultural research. It should be vigilant and sensitive to foresee issues likely to affect African agriculture and develop strategies or mobilize capacity to deal with them.

FARA's function is to integrate specific knowledge to ensure that the most promising technical solutions are thoroughly assessed. FARA will establish a process to identify and engage with potential partners within the continent and internationally who can make a positive contribution towards the attainment of its strategy goals and objectives. Alliances with IARC will be extensively used to speed up strategic research within the SROs and NARS research centers.

With the increasing importance of privately funded research on advanced agricultural technology (e.g. rice genome mapping), FARA will explore ways and means to develop collaboration embracing the broad experience of community-based organizations and people—particularly drawing on indigenous knowledge systems, non-governmental, private and public organizations with interest in African agricultural research and development, while ensuring that research outputs remain accessible to the farmers. In order to fulfill its mission as a knowledge hub for agricultural research, FARA will negotiate facilitating measures and agreements for increased markets access for African products in the world. This will further require assistance in capacity building of the private sector, as well as strengthening country and sub-regional capacity in trade negotiations, implementing the rules and regulations of the World Trade Organization (WTO), and identifying and exploring new trading opportunities that emerge from the evolving multilateral trading system. FARA will upgrade its information and communications technology (ICT) capacity (electronic library, web-site) to compile existing literature sources for wide dissemination to partners in the region.

FARA will explore the development of collaboration and division of tasks, or pooling of resources with other institutions functioning in Africa. Priority will be given to developing resource-sharing mechanisms with other institutions. This type of alliance will be useful for research support and training, and research management, and it will

play a critical role in analyzing, understanding and further improving agricultural systems.

FARA will extend its partnerships with research institutions outside Africa to mobilize complementary expertise to assist the SROs and NARS address strategic research issues, including advanced research institutes (ARIs) and universities. FARA will also play a catalytic role in promoting complementarities within the research community and in this regard will design a framework for the facilitation of policy dialogue on African perspectives on international agricultural issues.

FARA's secretariat will be based at the FAO Regional Office in Accra, Ghana. During the period of 2002–2012, FARA will need a total of about US$30 million, and will spend1400 man-years of quality work from a core of 7 internationally recruited staff comprising the Executive Secretary, three technical advisers—responsible for research, networking and food security programs, and agricultural policy and marketing—, a special assistant to the executive secretary to assist him with issues related to the FARA plenary, Management Committee, donors, international collaborators and conferences, an editor and public awareness officer, ICT manager and 7 general support staff. These staff will be based at the FAO Regional Center in Accra, Ghana.

FARA will explore the Sustainable Financing Initiative of the World Bank, AfDB, EU and the USAID for supporting and disbursing funds for agricultural research and development in the coming decade. The financing strategies being explored include: (1) obtaining grants from foundations; (2) securing contracts for research; (3) greater 'Southern' participation, (4) increased private philanthropy; (5) co-financing projects with private firms, producer groups, NGOs, and investment agencies; and, (6) increasing governments' contributions from domestic revenues.

FARA will try to realize high potential through continuous monitoring for increased and sustainable effectiveness and efficiency of its management systems, facilities, material, services, processes and policies. A simple structure with extended participation in decision-making more broadly across a larger number of staff will be put in place. A mechanism for consultation with the IARCs, SROs and NARS will also be developed. However, the overall structure must be appropriate, cost-effective and must spearhead its own efforts to respond to the agricultural research changes taking place in Africa. FARA will maintain the lean administrative structure prescribed in Figures 2 and 3, with the understanding that it is sensitive to the changing agricultural research environment in Africa. This structure will be monitored and will be adjusted whenever needed for cost-effectiveness and management efficiency.

Figure 2. FARA management structure

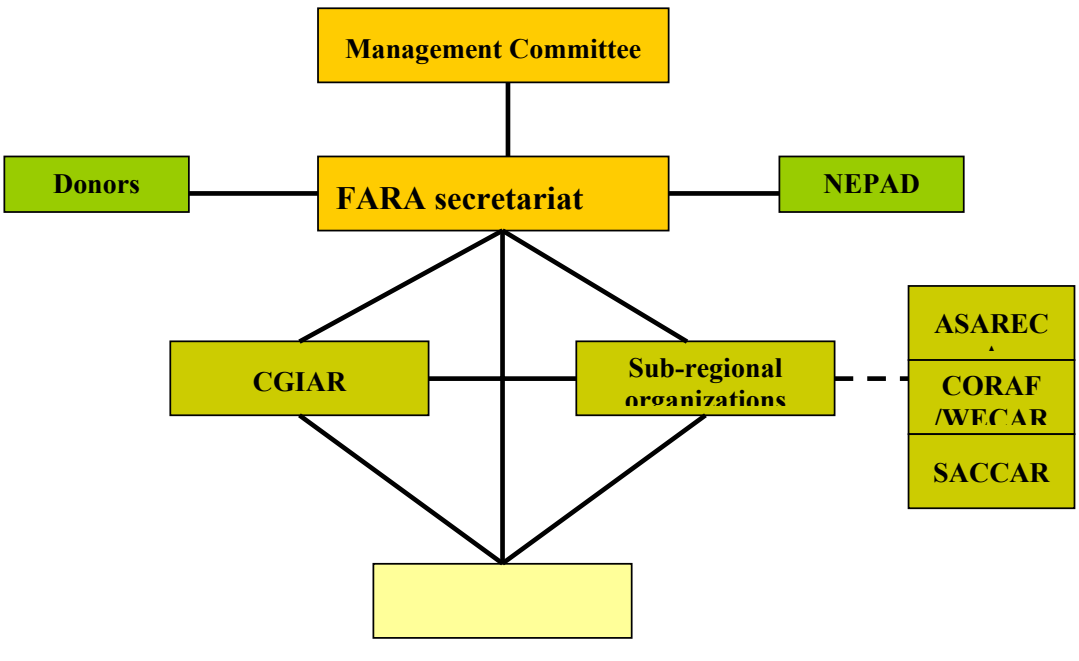
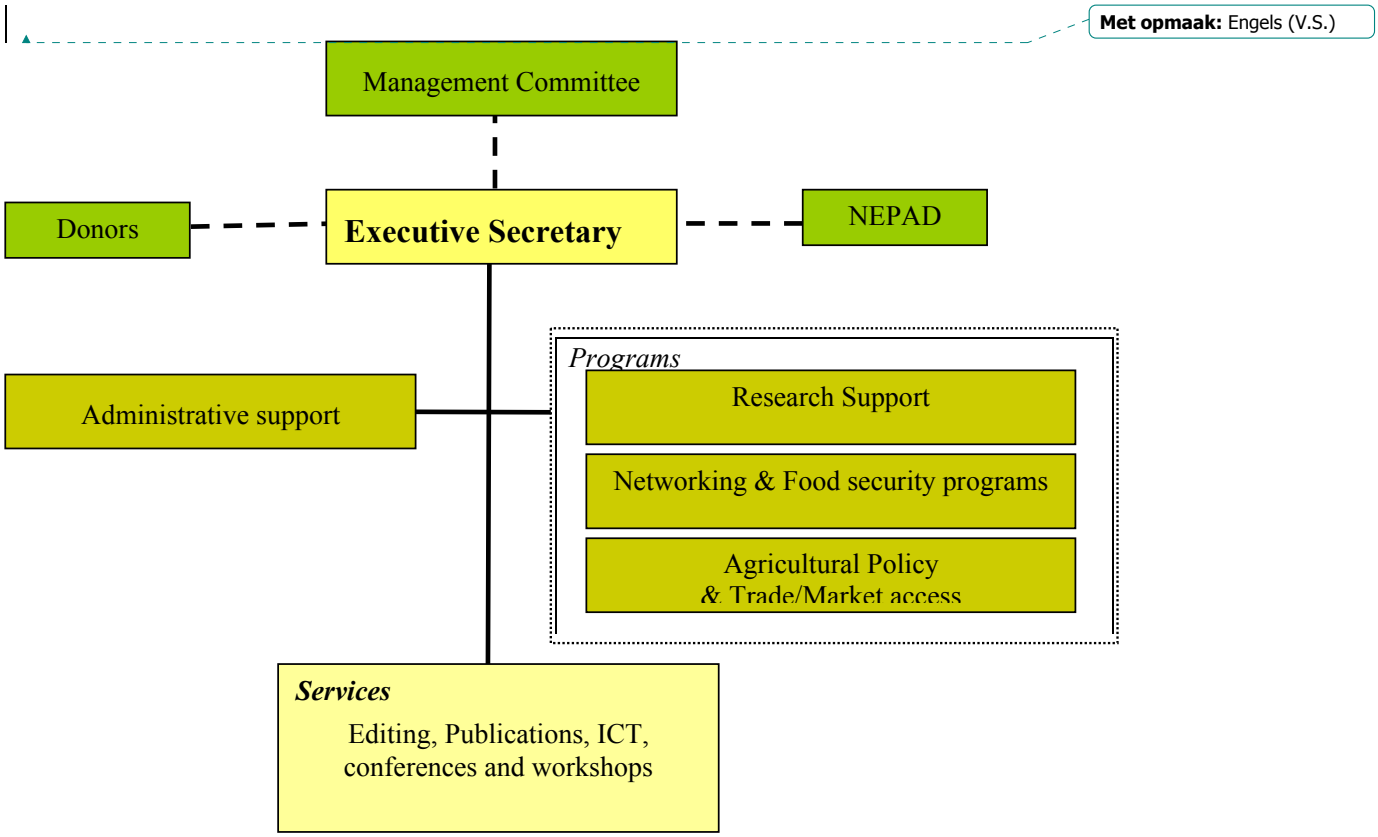


Figure 3. FARA's secretariat structure



7. Conclusions

The vision is for Africa to attain 6 percent annual agricultural growth rate over the next twenty years to enhance household food-security, increase productivity and competitiveness of the agricultural sector by reducing production risk, enhancing income and averting natural-resource degradation. FARA will contribute to Africa's poverty alleviation by supporting integrated sustainable development of the agricultural sector, particularly through strengthening the SROs and NARS to develop coordinated programs in support of research to promote food security in Africa. FARA's immediate beneficiaries are the SROs and NARS and other R&D collaborators, such as the IARC, NGO, private sector and farmers' organizations.

The strategy of FARA is driven from an aggregation of the priorities and aspirations of the SRO's, which is a reflection of the NARS. FARA will take the lead in guiding other partners working in/and for Africa in optimising agricultural research results, technology development and information dissemination. By analyzing the various aspirations and objectives of the three SRO's, FARA has formulated cross cutting themes to provide value added services for the SRO's, such as: (i) advocacy of the role of agricultural research; (ii) promotion of functional partnerships and strategic alliances; (3) development and dissemination of new technologies and methodologies; (4) sharing and exchange of information; and (5) capacity building.

The quality, relevance and impact of FARA's outputs will rely on the enhancement of an appropriate environment for research and delivery of results to immediate and ultimate beneficiaries, the farmers. The institutional environment for promotion of research development and impact will be further developed along the following lines:

At the secretariat level, FARA will strengthen its support base by the recruitment and allocation of top-class personnel to contribute to advocacy for agricultural research support and promote programmatic integration at the sub-regional level. The sensitive issue of genetically modified organisms (GMOs) and its potential application to agricultural development in Africa needs to be carefully assessed over the coming decade.

At the regional level, FARA will reinforce its catalytic role for regional integration of agricultural research and development. The diversity of agricultural production environments in Africa requires that particular attention be given to the reinforcement of benchmark areas, specific to agro-ecological zones.

*At the international level, F*ARA will strengthen its position as the focal point for agricultural research and development in Africa. FARA will explore the development of collaboration and division of tasks, or pooling of resources with other institutions functioning in Africa. Alliances with advanced research institutions in developed and developing countries in other continents will be extensively used to speed up strategic research within Africa. FARA will explore ways and means to promote SRO and NARS collaboration with the private sector, while ensuring that research outputs remain

accessible to the farmers. FARA will advocate upgrading of ICT capacity (electronic library, web-site) to compile existing literature sources for wide dissemination to partners in the region.

The main goal of the financial-resources mobilization strategy is to provide a framework for increased stability and flexibility of funding, with optimum resource allocation. To overcome the limited traditional funding base, the financial-resource mobilization strategy will be three-pronged, i.e. consolidating and sustaining existing funding sources; exploring and expanding new funding sources; and pooling and leveraging of resources.

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Met opmaak: Engels (V.S.)

9. List of acronyms

APAARI	-	Asia Pacific Association of Agricultural Research Institutions
ARI	-	Advanced Research Institute
ASARECA and	-	Association for Strengthening Agricultural Research in Eastern Central Africa
AU	-	African Union
COMESA	-	Common Market for Eastern and Southern Africa
CD-ROM	-	Compact Disk - Read Only Memory
CORAF	-	Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles
ECOWAS	-	Economic Community of West African States
EMBRAPA	-	Empresa Brasileira de Pesquisa Agropecuària
FANR	-	Food, Agriculture and Natural Resources
FAO	-	Food and Agricultural Organization of the United Nations
FARA	-	Forum on Agricultural Research in Africa
FORAGRO	-	Regional Forum for Research in Agriculture
GFAR	-	Global Forum on Agricultural Research
GMO	-	Genetically Modified Organism
GOB	-	Government of Botswana
HIV/AIDS	-	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HRD	-	human Resource Development
IARC	-	International Agricultural Research Center
ICAR	-	International Committee for Animal Recording

Met opmaak: Engels (V.S.)

Met opmaak: Engels (V.S.)

Met opmaak: Frans (standaard)

IFAD	-	International Fund for Agricultural Development
NARI	-	National Agricultural Research Institute
NARS	-	National Agricultural Research System
NEPAD	-	New Partnership for Africa's Development
NGO	-	Non-Governmental Organization
OECD	-	organization for Economic Cooperation and Development
SACCAR	-	Southern Africa Center for Co-operation in Agricultural Research and Training
SADC	-	Southern African Development Community
SWOT	-	Strengths, Weakness, Opportunities and Threats
TCART	-	Technical Committee for Agricultural Research and Training
WAICENT	-	World Agricultural Information Centre

Met opmaak: Engels (V.S.)

Annex I: History of CGIAR and NARS partnership in Africa

Prior to 1994, the African NARS felt somewhat isolated, particularly in relationship to the CGIAR partnership. The SPAAR played a key role in improving the NARS/CGIAR interface. As a concept of approach, the NARS/CGIAR partnership is not new. Partnership was mentioned in the very early *modus operandi* for the CGIAR (Carsalande, 1998). Indeed. the Centers have always tried to incorporate some degree of joined activities with the NARS. The formation of commodity/factor Networks by the CGIAR in collaboration with the NARS was an effort in this direction. In countries with more developed NARS like India and Brazil, partnerships developed fast and many field activities were shared. In the African continent, where the NARS were nearly all nescient, partnerships were not very strong or even structured. By the mid-1980s, however, a few African NARS were getting reasonably strong and they began to literally demand that they be considered as part and parcel of the research–extension spectrum (Ethiopia, Nigeria).

Their basic argument was that they were not included in the priority-setting process and therefore there was no true joint ownership of the programs. The NARS asserted that the CGIAR Centers were detached from them and, even when they worked together in one-off projects mode, the NARS' role went unrecognized. Feeling disappointed by the CGIAR, particularly the African countries, turned over to the World Bank supported Special Program for African Agricultural Research (SPAAR). The SPAAR's role in heightening the discussions cannot be downplayed. It was during the SPAAR meetings that the African group strategized on how to bargain for meaningful partnerships (Toure, 1996).

The CGIAR leadership began to notice what the NARS wanted, took these views seriously and, in 1994, a meeting to specifically consider this dilemma was convened in Rome under the auspices of IFAD. The deliberations were candid and forthright and out of that forum the NARS' role in the CGIAR work was emphasized. It would be fair to say that the meeting was in a way the precursor for what came to be the GFAR (Global Forum for Agricultural Research). These deliberations made the NARS feel that they were finally gaining recognition as partners. The next step was to try and define the rules of partnership. In one way, the CGIAR was keen to promote functional partnerships, but on the other hand the question of equality began to arise.

Many in the CGIAR felt that if the NARS wanted to be considered as equal partners they also had to contribute materially towards the financing of the CGIAR budget. A few examples from Latin America and Asia existed. The African NARS were requested to initiate deliberations with their governments, exploring the possibility of joining the CGIAR as members. At the CGIAR MTM of 1994 held in Nairobi, the topic was discussed fully and the CGIAR decided to hold a special meeting in Lucerne, Switzerland in 1995. This meeting was mainly an exposition of CGIAR work to the Ministers of Agriculture, Rural Development and Finance from Africa. The CGIAR felt this was important if discussions of membership of the developing countries are put in action.

Following those concerted efforts, a few African countries sought to become paying members of CGIAR at a reduced minimum annual contribution of US$ 100,000. Amongst the front-runners were Kenya and Côte d'Ivoire; Nigeria having joined a little

earlier. Indeed this was momentous for Africa, because the nominated African representative from individual nations could now sit around the CGIAR table to discuss programs and modalities. Because of these novel arrangements, the topic of partnership was kept on the CGIAR agenda. The CG Centers responded accordingly with ISNAR taking the lead for the process globally. A series of consultations followed these initial bargaining meetings.

The Centers based in Africa, ILRAD/ILCA later merged and become ILRI, ICRAF, WARDA and IITA, as well as those with regional offices (which included nearly all the CGIAR family), initiated serious consultations. ILRI played a key role in coordinating a series of meetings referred to as the 'meeting of minds'. The idea was to craft an agenda that would close the gap between the NARS and the CG Centers. These generic consultations were supposed to consider the areas of collaboration and the sharing of responsibilities and recognition when pertinent.

The NARS also hoped that the process could culminate in sharing not just the work, but the resources as well. This obviously posed a problem, since the Centres had not anticipated this. A near stalemate almost occurred, but again there were those who felt that the process must be pursued and alternatives sought. SPAAR took leadership and it sponsored several consultative meetings, including the one in 1996 at Maastrecht, The Netherlands, in which a new approach referred to as the Consolidated Financing Mechanisms (CFM) was heatedly debated.

In the end, this suggestion was rejected since the donors were not willing to lose identity by sponsoring 'a pot of funds' for joint activities. It is possible that the concept was simply not well articulated or understood. The NARS interpreted its failure as reluctance by the CGIAR and donors. What was not discussed was the need for pushing a Sustainable Financing Initiative (SFI) for the NARS just as much as for the CGIAR Canters.

Met opmaak: Engels (V.S.)

Annex II: Promising Biotechnology Tools for Africa

i] Microbial inoculation of plants. This involves the selection and multiplication of microorganisms beneficial to plants and their application to plants, seed or soil. Some of these methods include bio-fertilizers, with agents such as *Rhizobium* inoculants for legumes and biological control agents such as *Bacillus thuringiensis* for control of pesticide-resistant disease vectors. Production of microbial inoculants is easy, requiring unsophisticated equipment. Application of microbial inoculants is therefore now commonplace in Africa (Sasson 1993).

ii] Plant cell and tissue culture. This technology is based on the ability of many plant species to regenerate a whole plant from tissue or a single cell. The technique is simple and straightforward, requiring only a sterile workplace, nursery, greenhouse and trained staff. Many countries in Africa have now taken up plant tissue culture production at commercial level (Wafula 1995).

iii] Embryo transfers. As a technology, embryo transfer could be quite high-cost because of the hormones involved and often embryos themselves have to be imported. The work in cows, however, has been very successful and many developing countries are now entering into use of embryo-transfer technologies in cattle and other species (Kasi 1995)

iv] Monoclonal antibody technology. The laboratory facilities required to produce monoclonal antibodies are modest, although the actual production could be laborious and costly compared with conventional production of polyclonal antisera, yet monoclonal antibody-based tests are highly relevant to African countries in plant and animal disease diagnosis and in animal reproduction.

v] Molecular-marker technology. DNA fingerprinting analysis is a very powerful tool for identifying genetic linkages to qualitative and quantitative traits in plants and animals. The technique is based on the Polymerase Chain Reaction (PCR), which is relatively simple and easy to acquire. It can be used to manage, monitor and assess genetic resources, for example, monitoring the introgression of genes and gene flow between species, identifying valuable traits like stress resistance and growth, monitoring of stability of genomes, and disease diagnosis. As breeders and agricultural scientists strive to increase the number of traits to be incorporated into new plant cultivars and animal breeds for increased yields and productivity, DNA marker technology will be an important tool.

iv] Recombinant DNA technology. This powerful technology, which includes DNA probes, recombinant DNA vaccines and transformation of plants and animals, is used for development of more stable and safer vaccines and in rapid cross-breeding of species that are too far apart for normal sexual reproduction. Recombinant DNA technologies are much more expensive than conventional methods and are only successfully performed in well-staffed, fully equipped laboratories. While genetic engineering may not improve agricultural production in Africa in a short term, the potential benefits in combating plant and animal diseases against biotic and abiotic stresses in the long term are extremely high and could be worth investment considerations.

Met opmaak: Engels (V.S.)

Annex III: Development of food product groups and industrial crops

The increasing deficit between domestic demand and local production is expected to continue in several countries in Africa. It is not in the long-term interest of countries in Africa to be increasingly dependent on external sources for food, as there is uncertainty in long-term international supply. However, economic factors limit Africa's capabilities in enhancing domestic supply to fully meet its total food requirements. Against this scenario, FARA will advocate policy formulation on domestic production and strategic issues to improve supply and accessibility to safe, nutritious and high-quality food at affordable prices. The strategic directions for specific commodity groups are as indicated below.

Cereals and tuber crops
Major cereal and tuber crops are maize, rice, sorghum, millet, cassava and sweet potato. Efforts should be undertaken to increase yields through crop production efficiency by encouraging and supporting the development of large-scale commercial operations in the form of group-farming and estate-type production systems. This will create larger and more viable production units. The involvement of the private sector in large-scale production and support industries will be encouraged. Environment-friendly good farm practices, such as precision agriculture, integrated crop management (ICM), integrated pest management (IPM), and soil and water conservation measures, will be intensified.

Livestock
Efforts will be undertaken to improve supply of poultry and eggs for the domestic market and to capitalize on export markets. The production of fresh beef, mutton and milk will be increased for the domestic market. Private-sector-led commercial enterprises will be encouraged to adopt modern approaches and farming on a large scale. Small-holder livestock activities with potential for expansion will be encouraged to transform into larger commercial operations to improve efficiency. Efforts will be undertaken to strengthen the linkages of these operations with suppliers, processors and marketers to enhance further the vertical and horizontal integration of the industry. Efforts will be undertaken to develop and exploit Africa's potential as an international food hub. Capability for inspection, monitoring, standardization and certification to maintain standards for livestock products and industrial livestock-based inputs will be strengthened and this standard will be internationally promoted.

Fisheries
FARA will advocate for the fisheries industry, particularly deep-sea fishing and aquaculture, to be further developed on a commercial and integrated basis. The development will focus on conservation and utilization of fisheries resources on a sustainable basis. It should be adequately supported with modern fisheries' infrastructure, processing, marketing network, comprehensive human-resource development (HRD) and R&D programs. Private-sector participation in commercial fishing and aquaculture through large-scale open marine-cage culture, and feed production will be encouraged. Efforts will be made to unify individual entrepreneurs, including small and medium enterprises (SMEs) engaged in processing, to form

consortia led by corporate leaders to venture into commercial fishing and develop and manage integrated processing complexes and mega-fishing ports. This will secure economies of scale, modernize operations, enhance ventures into export markets and attract foreign vessels to land their catches in African countries. It will also strengthen linkages among fishing, processing and supporting industries. Joint ventures between local and foreign private sector should be promoted.

Fruits

The fruit industry should continue to be developed to meet the expanding demand for fresh and processed tropical fruits in both the international and domestic markets. Some important fruits are banana, papaya, pineapple, watermelon, mango, citrus and guava. There will be need to upgrade institutional support, infrastructure and incentives to encourage the private sector to venture into large-scale commercial production. New processed products—such as minimally processed fruits, natural food ingredients, functional food, modified food ingredients, frozen fruits, beverages and high-fiber products—will be exploited to cater to the increasing demand in niche markets. Emphasis will also be given to human resource development (HRD) to generate highly skilled and innovative manpower in new and emerging science such as food, engineering and biotechnology.

Vegetables

Vegetable production will be expanded to meet domestic and export demand. The governments will continue to provide institutional support, infrastructure and incentives to encourage the private sector to venture into large-scale commercial production. New processed products—such as minimally processed vegetables, flour-based products, natural food ingredients, functional food, vegetarian and reformulated vegetarian food products, modified food ingredients, high-fiber products and beverages—and by-product utilization will be exploited to cater to the increasing demand in niche markets. Quality will also be emphasized through product differentiation and product brand names, such as pesticide-free vegetables and organic-farm produce. R&D efforts on cost-effective production, post-harvest handling and processing should be intensified with particular emphasis on agricultural mechanization and labor-saving techniques. The marketing system will need to be upgraded by improving efficiency of the existing marketing channels and further development of parallel marketing channels. Offshore investment will be encouraged to meet the requirement of raw materials for the processing industry.

Industrial crops, forestry and wood-based product group

This group consists of oil palm, rubber, cocoa, coffee, tea and forestry, and is the vital source of raw materials supply to the resource-based industries. It mainly serves the export market and is an important revenue earner for a good number of countries in Africa. The structure of production and marketing for most products of this group should be highly organized with advanced managerial and technological practices.

In consonance, the development of these industrial crops, forestry and wood-based products should to be encouraged and supported by appropriate incentives,

infrastructure, R&D, supporting services and HRD. A long-term action plan will be developed to ensure adequate supply of raw materials to the processing and manufacturing industries for the production of high value-added products for export. Forestry resources will be conserved, managed and utilized on a sustainable basis. Efforts will be undertaken to reduce labor inputs through mechanization and use of appropriate labor-saving techniques. Agro-forestry, involving integration of forestry and agricultural activities, will be promoted.