

# **REGIONAL REVIEW OF AFRICA'S AGRICULTURAL RESEARCH AND DEVELOPMENT.**

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## ACRONYMS AND ABBREVIATIONS

AARINENA:	Association of Agricultural Institutions in the Near East and North Africa
ADP	Agricultural Development Projects
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
AKIS	Agricultural Knowledge and Information Systems
ARC	Agricultural Research Center
ASARECA	Association for Strengthening Agricultural Research for Eastern and Central Africa
BASIC	Building Africa's Institutional and Scientific Capacity
CAADP	Comprehensive Africa Agricultural Development Programme
CGIAR	Consultative Group on International Agricultural Research
COMESA	Common Market for Eastern and Southern Africa
CORAF-WECARD	West and Central African Council for Agricultural Research and Development
DONATA	Dissemination of Agricultural Technologies in Africa
DRC	Democratic Republic of the Congo
ECA	East and Central Africa
ECOWAS	Economic Community of West African States
ECOWAP	Regional Agricultural Policy for West Africa
FAAP	Framework for African Agricultural Productivity
FANR	Food, Agriculture and Natural Resources
FARA	Forum for Agricultural Research in Africa
FASEDEP	Food and Agriculture Sector Development Policy
FSR	Farming Systems Research
GDP	Gross Domestic Product
GOANA	Grande Offensive Agricole pour la Nouriture et l' Abundance
GPRS	Ghana Poverty Reduction Strategy Paper
IAC	InterAcademy Council
IARC	International Agricultural Research Centers
IAR4D	Integrated Agricultural Research for Development
ICARDA	International Center for Agricultural Research in Dry Areas
ICT	Information and Communications Technology
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
MAPP	Multi-Country Agricultural Productivity Programme
MDG	Millennium Development Goals
MTP	Medium Term Plans
NARO	National Agricultural Research Organizations
NARS	National Agricultural Research Systems
NASRO	North African Sub-Regional Research Organization
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
PAEPARD	Partnership for African-European Agricultural Research for Development
RAILS	Regional Agricultural Information and Learning Systems

REC	Regional Economic Community
ReSAKSS	Regional Strategic Analysis and Knowledge Support Systems
RISDP	Regional Indicative Strategic Development Plan
R4D	Research for Development
SADC	Southern African Development Community
SCARDA	Strengthening Capacities for Agricultural Research for Development
SRO	Sub-Regional Organization
SSA	Sub-Saharan Africa
SSA-CP	Sub-Saharan Africa Challenge Programme
T&V	Training and Visit
WCA	West and Central Africa

## Executive Summary

In 2008, Africa's population, which is mostly rural, topped the 976 million mark. For the majority of these inhabitants, agriculture is the main source of livelihood. The underperformance of this important sector especially in Sub-Saharan Africa (SSA) is borne by the facts that between 1990 and 1992, the number of chronically undernourished people in SSA was 173 million. By 1997-1999, this number increased to 250 million. In 2000, Africa spent USD 18.7 billion on food import. The desire to eliminate the pervasive hunger and malnutrition in Africa as well as the necessity to reduce the high outlays for food import became the driving motive for the adoption of the Comprehensive Africa Agricultural Development Programme (CAADP) by Africa's Heads of State and Government. The basis for CAADP was that "agriculture-led development is fundamental to cutting hunger, reducing poverty, generating economic growth, reducing the burden of food imports and opening the way to the expansion of exports". CAADP is thus the key platform for food and agricultural development in Africa. The coordination, monitoring and implementation of CAADP are the responsibilities assigned to Africa's Regional Economic Commissions (RECs).

In order to implement CAADP, countries are in the process of identifying priority areas and programmes for agricultural research and development. These priorities have formed the basis of the Strategic Plans of the Sub-Regional Organizations (SROs) and, finally, the priorities that define the activities of the regional coordinating body, the Forum for Agricultural Research in Africa (FARA). Other research and development organizations working in Africa such as the Centers of the CGIAR have also aligned their priorities with those of the regional and sub-regional priorities in order to conform to the requirements of CAADP. The product is an agreement to concentrate on **staples** but with the work on staples concentrating on issues such as conservation, use and enhancement of genetic resources, integrated natural resource management, markets, institutions, information and up-scaling challenges, and improving livelihoods in high stress/unstable environments. Thus, the conditions are optimal for coherence between the principal actors in Africa's agricultural research and development.

For a rapid growth in African agriculture, especially south of the Sahara, the need for enhanced capacity in agricultural research and development has been emphasized. The integration of Africa's universities with the research institutions and extension organizations (perhaps in the order of the Land Grant systems in the US) is suggested. The Centers of the CGIAR must once again become more active in capacity development. Capacity building should emphasize value-chain research and development.

Failure to make the investments that would develop and nurture the capacity for technology dissemination and adoption has plagued the development of agriculture in Africa. Agriculture-led growth envisaged by CAADP calls for market-driven agricultural development. This means that architects of agricultural research and education must find ways to make extension more pluralistic and less expensive. An innovation systems approach involving an "Impact Pathway Approach" which argues that acquisition of knowledge by farmers is insufficient without the availability of credit and market infrastructure is seen to be a practical approach for Africa.

For agriculture-led growth to be effective, it should concentrate on smallholder farmers that are in potentially productive areas and have access to markets. However, if this growth is to affect the maximum number of the poorest of the poor, actions must be taken to broaden this class of smallholder farmers as rapidly as possible. An improved governance structure which includes genuine

decentralization will promote gender equity and give voice to those who are marginalized in the rural communities.

Finally, new skills in science and technology especially in biotechnology and ICT are needed. The magnitude of investments required to successfully implement CAADP is enormous. Domestic mobilization of resources is inadequate. Africa's development partners must keep faith with the region by fulfilling their pledges of support in a timely manner.

## **I. Existing Needs and recommendation**

### **a. Development priorities as expressed by governments of the region and regional political bodies:**

In 2008, Africa's population topped the 976 million mark. Most of these people live in rural areas and for them, agriculture is the major source of livelihood. For most of the African nations, Agriculture is by far the dominant sector as it employs at least 60 % of the total labor force, accounts for 20 % of the merchandise exports and contributes up to 17% of the Gross Domestic Product (GDP). In parts of the region such as Africa south of the Sahara (Sub-Saharan Africa, SSA) this contribution is as high as 30%. But that this all-important sector is underperforming is attested to by these facts:

- Data for 1997-1999 showed that more than 28% (over 250 million) of the African population was chronically hungry
- Africa is the only region of the developing world where the absolute number of the poor and people facing hunger is increasing;
- In 2000 alone, African countries spent USD 18.7 billion on food imports. In 2002, Nigeria alone spent USD2.8 billion on food import.

2000 also marked the year that African countries joined the rest of the world in declaring war on poverty and the deterioration of the environment. The adoption of the Millennium Development Goals (MDGs) was followed by the adoption by African Heads of State and Government of the NEPAD-inspired Comprehensive Africa Agricultural Development Programme (CAADP). CAADP has become the key platform for food and agricultural development in Africa. The driving motive for CAADP was two-fold: 1. eliminate the pervasive hunger and malnutrition in Africa and, 2. improve Africa's food independence by substantially reducing the amounts spent by each country on food imports. Thus, the basis for CAADP was that "agriculture-led development is fundamental to cutting hunger, reducing poverty, generating economic growth, reducing the burden of food imports and opening the way to the expansion of exports".

The four "pillars" of CAADP signify the four priority areas for improving food and agricultural production in Africa. These four pillars are:

1. Extend the land under sustainable land management and reliable water control systems
2. improve rural infrastructure and trade-related capacity for market access
3. increase food supply and reduce hunger, and
4. Agricultural research, technology dissemination and adoption.

The first three "pillars" would result in "gains in the short term" while the benefits from the fourth "pillar" were of the long-term nature.

The coordination, implementation and monitoring of CAADP are the responsibilities of the Regional Economic Communities (RECs). In carrying out their responsibilities, the various RECs have developed relevant policies. An example is ECOWAP, the policy instrument developed by the Economic Community of West African States (ECOWAS) to define the priorities for the sub-region. ECOWAP defines six priority areas for "contributing in a sustainable way to meeting the food needs of the population, to economic and social development, to the reduction of poverty in the Member States and thus to reduce existing inequalities among territories, zones and nations" The document stresses that activities and programmes should

- Reduce food dependence and achieve food sovereignty
- Involve producers in markets
- Create jobs with guaranteed incomes

- Intensify production systems in a sustainable manner
- Reduce the vulnerability of West African economies by limiting factors of instability and regional security
- Adopt appropriate funding mechanisms.

Another example is from the priorities of the Food, Agriculture and Natural Resource (FANR) Directorate of the Southern African Development Community (SADC) which are derived from the 15-year regional development framework (RISDP). These priorities include:

Development, promotion and harmonization of agricultural policies and the promotion of gender-sensitive development strategies and programmes;

Ensuring sustainable food security policies and programmes;

Development, promotion and harmonization in biodiversity, phytosanitary, sanitary, crop and animal husbandry policies;

Development of measures to increase agricultural output and the development of agro-based industries;

Development, promotion and harmonization of policies and programmes aimed at effective and sustainable utilization of natural resources such as water, wildlife, fisheries, forestry, etc;

Development and harmonization of sound environmental management policies; and,

Promotion of trade in agricultural products.

At the national level, the “2<sup>nd</sup> generation” Poverty Reduction Strategy Papers are being used as instruments to aid in the implementation of CAADP. Thus, Ghana’s Growth and Poverty Reduction Paper (GPRS 2) prioritized “modernization of agriculture and strengthening of infrastructure”. Like Malawi, Ghana recognized that allocating disproportionate resources to basic pro-poor services such as primary education, water supply and public health would not reduce poverty. The majority of Ghana’s working population continues to depend on agriculture for their livelihood and typically, these farmers cultivate small acreages. It stands to reason therefore that “no significant progress can be made on raising the average real incomes of Ghanaians as a whole without significant improvements in the productivity of small-scale farmer and farm labourer” In fact, data by the World Bank showed that African countries that performed well in terms of per-capita food and agricultural growth performed better in other economic sectors as some of the proceeds from the growth in food and agriculture could be used to promote investments in health, education and improved infrastructure. In Egypt, although agriculture is practiced in only 4% of the land, 50% of the population is engaged in this sector and the national objectives are anchored on the improvement of food security by improving the productivity of land and water and by using a value chain approach to ensure that farmers have access to markets.

What is key in this section is the importance of CAADP in providing the framework for regional, sub-regional and national food and agriculture growth priorities.

## **b. Synthesis of existing research priorities:**

The very complex nature of African agricultural production systems led the InterAcademy Council<sup>1</sup> to conclude that a range of “Rainbow Revolutions” that differ in both nature and extent among the many types of farming systems and institutions rather than a single “Green Revolution” would be needed for a sustained growth in African agriculture. However, even though priorities are best set at the national level, social and ecological circumstances often extend beyond national boundaries. Therefore, there are opportunities for collaboration and task sharing so as to make better use of limited resources. Such realization motivated the establishment of the sub-regional organizations (SROs) to promote collaboration and sharing of tasks between national research systems in neighboring countries. On the regional level, this opportunity for task sharing and collaboration led to the establishment of the Forum for Agricultural Research in Africa (FARA). As the lead institution for CAADP Pillar IV, the vision and mission of FARA emphasize its commitment to both the MDG of eradicating extreme hunger and poverty and CAADP’s goal of agriculture-led development in Africa. The development of the Framework for African Agricultural Productivity (FAAP) by FARA and NEPAD provided guidelines and criteria to encourage CAADP implementers and investors in African agricultural research and development to work in harmony at the scale sustained over time to achieve the African vision.

The research priorities that guide FARA’s work reflect the priorities of its constituent SROs and are formulated to produce the following results:

- Appropriate institutional and organizational arrangements for regional agricultural research and development established
- Broad-based stakeholders have access to the knowledge and technology necessary for innovation
- Strategic decision-making options for policy, institutions and markets developed
- Human and institutional capacity for innovation developed
- Platforms for agricultural innovation supported.

By producing these results, FARA fulfils its mission to support the SROs in strengthening Africa’s capacity for agricultural innovation. In this way and, applying the subsidiarity principle, FARA’s objectives are congruent with the priorities and strategic objectives of ASARECA for East and Central Africa (ECA), CORAF-WECARD for West and Central Africa (WCA), SADC/FANR for southern Africa and for the North African members of AARINENA (NASRO)

At the sub-regional level, the SROs have designed research priorities aimed at satisfying the needs of the constituent national agricultural research systems (NARS). The SROs recognize that because of ecological, social, economic and other variations between and within their member nations, research priorities are best set at the national level. In spite of this limitation, the SROs, were able to establish guidelines on investment options that cut across national boundaries. “Agricultural Development Domains” were established within their mandate sub-regions. For example, in ECA, inputs from this exercise and those that came from: a study of strategic priorities for agricultural development and agricultural R4D in the sub-region; a survey of NARS priorities and researchable constraints in five sectors: crops, animal agriculture, natural resource management, socio-economics and policy and post-harvest; two strategic planning retreats between ASARECA and its constituent NARS, strategic planning and priority setting within ASARECA’s networks, programs and projects; the development of an overarching strategy for the five National Productivity Programmes (NPP) oriented to natural

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<sup>1</sup> InterAcademy Council. 2004. Realizing the promise and potential of African agriculture. Science and technology strategies for improving agricultural productivity and food security in Africa

resources management; and consultation and interaction with the Committee of Directors, key partners, and broader initiatives such as the Common Market for Southern and Eastern Africa (COMESA) and NEPAD, were used to develop ASARECA's Strategic Plan 2007-2016. The result of this exercise is that research for development is concentrated on improving the productivity of basic staples as well as commodities with a growing domestic market such as cereals, livestock, dairy products and edible oils. The priority assessment exercise also identified three thematic areas for strengthening: applied social sciences in agricultural research, integrated natural resources management and technology uptake and up-scaling.

A similar process was followed in West and Central Africa by CORAF-WECARD. Guiding this exercise also was the recognition that in spite of a large pool of higher yielding technologies and improved farming systems, a large gap exists between farmers' yields and potential yield. Therefore research and development priorities focused on raising the output of a majority of small farmers while paying attention to the status of the natural resource base. The priorities also took note of the result of an IFPRI-commissioned study<sup>2</sup> that showed the following:

- ✓ Because rice has the highest potential for growth across the sub-region and would generate the greatest producer benefits for many countries, joint investments in rice research and development would be beneficial,
- ✓ The livestock sector dominates agriculture in the Sahel. Investment in livestock improvement would be beneficial,
- ✓ Growth in root crops in the coastal countries has the potential to contribute substantially to overall agricultural growth.

In the SADC region, research on management of natural resources for greater sustainability, promotion of market access, policies, capacity building and institutional change at all levels is prioritized.

Specifically, SADC-FANR is tasked with:

- Promoting and coordinating cooperation among SADC's various NARS and facilitating information sharing
- Promoting partnership between the public and private sectors in agricultural research and training
- Promoting capacity building in agricultural research and development taking into consideration, gender dynamics
- Helping to mobilize human, financial, technological and information resources to implement demand-driven activities.

### **c. Summaries of recent global agricultural development/agricultural research reviews:**

By the turn of the 21<sup>st</sup> Century, the less than satisfactory nature of African agriculture as demonstrated by the high degree of food insecurity and level of poverty (in spite of more than 40 years of intervention) encouraged the CGIAR to set up two Task Forces aimed at studying the rationalization of CGIAR operations across the System starting with sub-Saharan Africa. In the report issued in 2005<sup>3</sup> the Task Forces highlighted the absence of credible mechanisms for effective interaction among Centers, high level of competition among Centers leading to duplication of efforts and failure to ensure that the programs of the Centers are aligned with the priorities of the sub-regions.

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<sup>2</sup> Johnson, et al. 2008. Regional Strategic Alternatives for Agriculture-led Growth and Poverty Reduction in West Africa. ReSAKSS Working Paper No. 22. International Food Policy Research Institute (IFPRI).

<sup>3</sup> Report of the CGIAR Sub-Saharan Africa Task Forces-The Tervuren Consensus- 2005. CGIAR Secretariat

The major outcomes from this study are the on-going efforts in West and Central Africa and East and Southern Africa by the CGIAR Centers and their partners (FARA, SROs, NARS) to develop a coordinated program of agricultural research that would show economies of scale and scope at low transaction costs and that would successfully address regional priorities.

The study undertaken by the panel of the InterAcademy Council was another milestone in attempts to highlight how effective science and technology strategies may be used to improve agricultural productivity and food security in Africa. The panel, in addition to proposing greater attention being paid to four farming systems that show promise for increasing African agriculture, emphasized the adoption of a **“production ecological approach”** that would make it easier not only to identify problems but also to find the potential solutions for increasing productivity. Such an approach “examines the factors defining, limiting and reducing crop yield as well as those that interrupt the distribution of foods after they have been grown”. In addition to the adoption of this approach, the Panel recommended that the following actions are needed for improving agricultural productivity and food security through science and technology strategies:

1. Pursue a strategy of integrated sustainable intensification
2. Adopt a market-led productivity-improvement strategy to strengthen the competitive ability of smallholder farmers
3. Reduce land degradation and replenish soil fertility
4. Recognize the potential of rainfed agriculture and accord it priority
5. Explore higher-scale integrated catchment strategies for natural resource management
6. Enhance the use of mechanical power, and
7. Embrace information and communication technology at all levels

Some of these themes such as the huge size and agroecological diversity of Africa, poor soil health and the importance of rainfed agriculture show up in the background papers for the 2008 World Development Report by Wik et al. (2008)<sup>4</sup> and Staatz and Dembele (2008)<sup>5</sup>. These background papers emphasize that Africa should adopt agriculture-led growth strategies because productivity-led agricultural growth is more effective in spurring GDP growth and poverty reduction. Such strategies must deal with the production of staples as well as traditional export crops. If the agriculture-led growth strategies are to be successful, cognizance must also be taken of the following:

- The low average population density of most African countries which leads to increases in transaction costs in agriculture
- The fact that nearly 40% of Africa’s population live in land-locked countries
- The preponderance of countries (27) with populations under 10 million
- The eroding Human Capital Base in agricultural science especially in SSA. Apart from high attrition due to HIV/AIDS, 40% of all active scientists in SSA are found in only 5 countries while 25 countries share 20% of the active scientific work force

In a changing world of reform and globalization, there are various challenges and opportunities that face African agriculture. Economic and political reforms that have characterized the African scene for the past twenty-five years such as the structural adjustment programs (resulting in the 1994 devaluation of the CFA franc), the shift from one-party states to more open and democratic regimes, and increased

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<sup>4</sup> Wik, M. P. Pingali and S. Broca. 2008. Global Agricultural Performance: Past Trends and Future Prospects. Background paper for the World Development Report, 2008.

<sup>5</sup> Staatz, J.M. and N.N. Dembele, 2008. Agriculture for Development in Sub-Saharan Africa. Background Paper for the World Development Report, 2008.

regional collaboration have created opportunities for the private sector including the farming population. However, challenges still lie in the following areas that any research and development program must take note of:

- The HIV/AIDS and Malaria pandemic—these have affected such factors as the mean education level in the community, the wealth levels, population density, farm size, and the number of child or female-headed households.
- Increased population pressure which, in the first instance has reduced the amount of arable land per capita as shown in Table 1.

**Table 1. Ratio of Cultivated Lands to Agricultural Populations, 1960-99**

	1960-69	1970-79	1980-89	1990-99
Ethiopia	0.508	0.450	0.363	0.252
Kenya	0.459	0.350	0.280	0.229
Mozambique	0.389	0.367	0.298	0.249
Rwanda	0.215	0.211	0.197	0.161
Zambia	1.367	1.073	0.896	0.779
Zimbabwe	0.726	0.664	0.583	0.525

Note: *Land to person ratio = (land cultivated to annual and permanent crops)/population in agriculture)*

Source: Staatz and Dembele, 2008

- Rapid urbanization which can, among others, result in a shift from staples to imported food
- Increased energy prices. Much of the food price rise during 2007/08 was primarily the result of the increase by 90% of the price of US maize as this product was needed for the production of ethanol
- Water shortages. Even with limited use of irrigation, water scarcity has become a fact of life in parts of Africa. In Egypt which depends overwhelmingly on irrigated agriculture, water quantity and quality are issues of great concern to the nation.
- The worldwide spread of zoonotic diseases such as the avian influence and H5N1 virus poses a serious threat to African agriculture.
- Global climate change: projections for Africa are for higher temperatures, lower rainfall especially in the Sahel and greater weather instability.

#### **d. Coherence and gaps**

The NEPAD/CAADP has spelt out the vision for Africa’s agricultural development agenda. The interpretation of this vision with respect to agricultural research, technology dissemination and adoption is embodied in the FAAP which was jointly developed by NEPAD and FARA. In fact, FAAP was developed to provide guidelines and criteria that would encourage implementers and investors in African agricultural research and development to work in harmony and at the scale sustained over sufficient time to achieve the African vision. As has been observed, the strategies of the SROs are based on the national plans of their constituent Member countries and the strategy of FARA is congruent with those of the

SROs. Therefore, the conditions are optimal for coherence between the principal players in African agricultural research and development.

On their part, the CGIAR Centers have responded to the criticisms embodied in the Task Force Reports by developing two Medium Term Plans (MTPs), one for all Centers working in East and Southern Africa (ESA) and another for all Centers working in West and Central Africa (WCA). The development of the MTPs was a three-stage process. First, there was the *alignment* of programs being carried out by each Center. Such programs were those originally conducted by each Center with or without collaborators including the NARS. The purpose of alignment was to make the programs respond better to systemic concerns of producers while reducing the burden of multiple communication and interaction on NARS. The second step dealt with the *integration* of projects or programs. This step involved a shift from individual Centers pursuing single-purpose projects/programs to coordinated, multi-purpose programs. Integrated programs therefore involve joint activities by the Centers, the NARS and other partners. The third and final step is the development of a common MTP for all Centers active in the sub-region. It should be emphasized that the MTP does not detail all the programs and activities that either the Centers or their partners are carrying out in the respective sub-regions. By design, the MTP describes programs that answer to a subset of regional priorities of paramount importance to all stakeholders in the sub-region. Maximum synergies are supposed to be gained through the implementation of these programs. The programs and projects are then further grouped into research programs to meet the requirements of the CGIAR System Priorities. This way, the programs and projects respond to both the sub-region's and the CGIAR System's Priorities.

In the ESA, there are four flagship programs:

1. Integrated natural resource management
2. Markets, institutions, information and the up-scaling challenge
3. Conservation, use and enhancement of genetic resources
4. Improving agricultural livelihoods in high stress/unstable environments.

In the WCA, there are five programs:

1. Fostering conservation and sustainable use of genetic resources in WCA
2. Producing more and better food at lower cost through genetic improvements
3. Reducing rural poverty through agricultural diversification and emerging opportunities for high-value commodities and products
4. Poverty alleviation and sustainable management of water, land and forest resources
5. Promoting domestic and regional market development and improving access to international markets.

Looking at the situation (at least on paper), one can say that *coherence* has never been better as all the plans and activities of the regional, sub-regional, national and international actors seem to pursue the twin goals of the MDG and NEPAD/CAADP.

Every major review of agricultural research and development has highlighted the importance of increasing the capacity of African agricultural scientists. Staatz and Dembele (2008) noted that of 48 countries in SSA for which data was available, half of them had fewer than 100 scientists (full time equivalents) while 40% of the scientists were working in just five countries. A study commissioned by FARA (FARA, 2007<sup>6</sup>) found that a major cause of Africa's slow progress in agricultural growth is a poor capacity for innovation. However, African governments continue to give little support to capacity building for agricultural research for development. This weakness in the capacity of the NARS reduces the ability of the national scientists to form meaningful and productive partnerships with scientists from

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<sup>6</sup> Africa's capacity to build human and institutional capacity for the agricultural industry. FARA, 2007.

either the CGIAR or advanced research institutions. What is missing is a strategy by national governments, their development partners and the CGIAR System to direct investments into building and retaining a new generation of agricultural scientists.

Another gap in the system is the lack of coordination between research (the production of technology) and extension (the transmission of knowledge and information to the farmers). In many African countries, the research institutes and the extension organizations do not belong to the same ministries. More often than not, staffs of the research institutes receive higher compensation than those of the extension services. This situation leads to minimum interaction between the two important components of the NARS.

Many well-informed policy makers actually discourage spending more scarce resources on agricultural research because of the proverbial “huge amounts of information on the shelves” of both the national and international research organizations. Unfortunately, scientists are still content to look at the production of “research outputs” as the logical goal of their research activity.

The challenges that limit African agricultural productivity and production are so overwhelming that, at all levels, there is a tendency to concentrate too much on the challenges while overlooking the opportunities. The recent upsurge in the price of food because of the production of bio-fuel is an example. Virtually no African research system has thought of promoting activities that would take advantage of increased income from the increase in maize prices. Especially at the national level, the “problems of tomorrow” such as water scarcity, population pressure and climate change are either completely off the radar<sup>7</sup> or are not looked at in terms of their effects on the growth of agricultural production. Issues related to climate change are often assigned to the Ministry of the Environment.

Coordination of research remains an unresolved issue in the African agricultural scientific community in spite of the existence of FARA. Africa needs a more comprehensive approach to address many of the challenges that require coordinated actions by different actors in order to spur productivity and income growth. Experience to-date suggests that neither top-down approach nor a decentralized approach has actually worked. In the developed regions of the world where the private sector plays a major role in funding research and development, this sector has the power to “play the role of the referee”. After all, only research that is demand-driven receives funding. The African private sector on the other hand contributes about 2% to research support. This gives this important sector very limited leverage to coordinate agricultural research. Still not well defined are the roles of FARA, SROs, National Research Organizations (NAROs) in research.

Promoting national, regional and international markets has become recognized as the way to enable the smallholder farmer to “farm her way out of poverty”. However, it would appear that Africa’s NARS are depending on the International Research Centers (IARCs) to provide all the information that RECs and national policy makers need to promote access to markets.

As much as NEPAD/CAADP was a ground-breaking initiative, the implementation of the four “pillars” seemed to have taken different routes. There is a need to keep emphasizing the interlinked nature of these four “pillars”.

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<sup>7</sup> A notable exception is the work programme of the Agricultural Research Center (ARC) of Egypt. In addition to having a viable programme of work on water quality and use efficiency, the Center has a staff of 8,000 full-time research scientists of which 6,600 have the Ph.D degree.

The efforts to reduce food insecurity should not simply be efforts to increase crop production. There is no emphasis on research by the NARS on reducing undernourishment. Research that links food security to human health has often been downplayed by agricultural research scientists.

There are two areas that seem to suffer from a deafening silence. Due emphasis has been placed on research to promote access to markets. The success of the Presidential Initiative on Cassava in Nigeria was due, in part, to the effort by IITA, to provide leadership on research on the processing techniques for cassava roots. The proliferation of processors provided ready markets for the cassava producers. In SSA, research on processing of farm produce is missing in the agenda of all the programs. Related to this is the absence of research to find ways to attract increased participation of the private sector in African agricultural research. In the Nigerian cassava case, research on processing attracted the private sector and became the main vehicle for their involvement.

#### **e. New needs/priorities**

The need for capacity for agricultural research and development is not new but is the number one priority if agriculture is to play its expected role in promoting sustainable growth in Africa's economies.. Problems with diseconomies of scale are numerous in countries with less than the critical mass of human resource capital for agricultural research and development. As the first generation of trained personnel after independence<sup>8</sup> retires, the systems have been further weakened by the scourge of HIV/AIDS pandemic. African governments must double their investment in university education for science and technology. These governments must once more appeal to their development partners to halt the decline in funding for overseas graduate training for agricultural scientists. In addition to African governments, the CGIAR Centers must become more active in capacity strengthening. The old practice of setting aside core funds for "training" must be restored. It is time to retransform the former dormitories from being "hotels" for paying guests to hostels for "trainees". The Centers would be the ideal locations for strengthening the capacity of African agricultural research and development scientists to learn to use the full capabilities of Information Communications Technology (ICT) to promote agricultural growth in Africa.

The InterAcademy Council panel noted that agricultural extension services that link timely agricultural research directly to farmers is currently moribund in many African countries. In addition to capacity strengthening, the structure of the extension services needs to be radically changed. It is time for African countries to install the US-style Land Grant systems. This system has successfully been tested in Nigeria<sup>9</sup>. The Egyptian experience<sup>10</sup> can also be a good example for most of the countries in SSA.

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<sup>8</sup> Beginning in 1961, the US Government, through the USAID, helped Nigeria to train 125 students a year for five years in Engineering and Agriculture. With just one University at independence in 1960, Nigeria needed to develop its human capital base. It is noteworthy that this generation of scientists has played a major role in raising the number of universities in Nigeria today to above 100 and Nigeria continues to be one of the few African countries with more than 2,000 agricultural research scientists (full-time equivalents). There are examples of the success of this effort in other countries.

<sup>9</sup> At the Ahmadu Bello University, the "Agricultural Complex" is made up of the Faculty of Agriculture, the Institute for Agricultural Research and the National Agricultural Extension Research Liaison Service. As members of the same university community, there is greater collaboration and communication between research scientists and extension specialists.

<sup>10</sup> Under the Ministry of Agriculture and Land Reclamation, Egypt's Agricultural Research Center has combined the work of research scientists with the work of the extension workers. Under the President of

Although the SROs were established to promote the better integration of universities into NARS, this has not happened. The SROs might begin by changing their governance structure from being a “club” for Directors of research institutes to include Deans of Faculties of Agriculture.

To be fully functional as part of the NARS, the universities must, in turn, change the ways that students are trained. The current quality of training is not providing the knowledge and skills graduates need to secure fulfilling careers in agriculture and related industries. In addition, special efforts must be made to encourage more women to train as agricultural scientists as more women than men are involved in agriculture in Africa.

Too much emphasis is still being paid by research scientists to “production” while neglecting value-chain approaches. The success of the Presidential Initiative on Cassava in Nigeria in which the International Institute of Tropical Agriculture (IITA)<sup>11</sup> played a leadership role should serve as an example of the type of activities that promote agricultural growth.

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the Center are three Vice-Presidents, one of which is responsible for Extension and Training. Each of the Research Institutes has an equivalent Unit within the Central Administration for Extension Services. Results from the research institutes are passed on directly to the relevant Central Administration Units.

<sup>11</sup> IITA, working with National Root Crops Research Institute of Nigeria (NRCRI) coordinated the production research and research on processing and marketing of cassava products. IITA imported and tested prototype processing machines and encouraged Nigerian engineers to produce local versions that could be used in Nigeria. Today, some of those Nigerian made processing machines such as the “Flash Dryer” for cassava flour are exported to other African countries. These efforts have made Nigeria the number one producer of cassava in the world.

**Fig. 1. Land and Labour Productivities in crop production for African countries, Average 2000-2002**

Land Productivity	High	Rwanda	Egypt	Mauritius
	Moderate	Kenya, Tanzania, Uganda, Malawi, Guinea, Liberia, Sierra Leone	Benin, Ghana, Nigeria	
	Low	Central African Rep., DRC, Ethiopia, Botswana, Zambia, Zimbabwe, Burkina Faso, Gambia, Niger, Senegal, Togo	Algeria, Morocco, Tunisia, Cameroon, Gabon	South Africa
		Low	Moderate	High
		Labour Productivity		

Source: Adapted from Wik et al.

*Note: Land productivity is defined as output ( in international dollars) divided by units of land (hectare)*

*Labour productivity is defined as output (in international dollars) divided by economically active population in agriculture.*

There is need to conduct research that would improve BOTH land and labour productivities. As shown in Fig. 1, densely-populated poor countries such as Rwanda tend to have low labour productivity but high land productivity. Many of the poorest countries in Africa have both low land and labour productivities. This is a sign of the lack of diligent application of a range of technology options that can increase crop and animal production while making more effective and efficient use of land and labour capital. There is need for research to move these countries from the bottom left corner of the figure.

## **II: Current Implementation Strategies.**

### **a. Overview of current institutional and infrastructural arrangements:**

As has been noted, the NEPAD-CAADP initiative provides the strategic framework for the various plans to promote agricultural growth in Africa. At the continental level, the African Union initiative, Regional

Strategic Analysis and Knowledge Support Systems (ReSAKSS), provides the strategic analysis and knowledge support to agriculture-led growth in order to attain the MDG 1 and the target of 6% growth in agricultural production. Included in the analysis by ReSAKSS is the monitoring of the commitment by Africa's Heads of State and Government (The Maputo Declaration, 2003) to allocate at least 10% of the annual budget to agriculture and rural development. The CAADP agenda is being implemented at the sub-regional level by the RECs such as ECOWAS and COMESA. For example, in West Africa, the CAADP programme is well integrated within the ECOWAS Common Agricultural Policy (ECOWAP). Each country is also expected to have a national team for implementation. Individual countries are being supported by the RECs to develop their CAADP Country Compacts and this process is on-going. Malawi is one of the countries developing its Country Compact with support from COMESA. However, it should be borne in mind that the main thrust of Malawi's Growth and Development Strategy (2005) is the Agricultural Input Subsidy Programme. This programme marked a shift from "poverty reduction for economic growth" principle of the first generation of PRSPs to "economic growth for poverty reduction" which is the main theme of the CAADP agenda. The Grande Offensive Agricole pour la Nouriture et l'Abundance (GOANA, 2008) launched by the Government of Senegal to increase the production of rice especially along the Senegal River Valley is another example of the national institutional and infrastructural arrangements that are being put in place to support agricultural development in Africa.

With respect to Pillar IV (agricultural research, technology dissemination and adoption), FARA, as the lead institution, has, in addition to developing the FAAP, launched the Multicountry Agricultural Productivity Programme (MAPP). The programme aims to help identify, focus and make available the resources required to implement the Pillar's activities. As at now, MAPP is being actively followed in many ECOWAS, COMESA and SADC countries. The RECs are also collaborating with the SROs not only in the implementation of Pillar IV but also in ensuring that there is cohesion between the four pillars. Some North African countries such as Egypt are already participating in the existing RECs<sup>12</sup>. Involvement of the other North African countries will evolve with the full establishment of NASRO.

FARA has also developed a number of "time bound" activities that are implemented by the SROs in support of the CAADP agenda:

- The Regional Agricultural Information and Learning Systems (RAILS) is an African Development Bank (AfDB)-funded project that is designed to fill current gaps in the rural community-NARS-regional-continental-global information chain.
- The Dissemination of New Agricultural Technologies in Africa (DONATA) project is also an AfDB-funded project that aims to "capture relevant lessons and develop effective trans-boundary partnerships and investments for the dissemination of high-potential technologies".
- The Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA) is a DFID-funded project that aims to overcome weaknesses that affect the capacity of NARS to conduct and manage agricultural research.
- Building Africa's Scientific and Institutional Capacity (BASIC) is aimed at strengthening African Universities' capacity to build the scientific manpower that Africa requires for endogenously-driven innovation systems.
- The Sub-Saharan Africa Challenge Programme (SSA-CP) is a multi-donor-funded programme that uses the Integrated Agricultural Research for Development (IAR4D) approach in place of

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<sup>12</sup> Egypt is a member of COMESA

the traditional ARD approach that relies on a linear research-extension-adoption approach. IAR4D draws upon innovation and uses a systems perspective as its organizing principle.

- The Partnership for Africa-European Partnerships for Agricultural Research and Development (PAEPARD) seeks to strengthen African AR4D stakeholders' capacity to participate in European-led development initiatives for Africa and to create more responsive development for Africa.

FARA is also working with several Civil Society Organizations (NGO groups, Farmers Associations, the PanAfrican Agribusiness Consortium—a network of networks involving national and sub-regional associations of producers, input suppliers, marketers, transporters, processors, research systems, financiers and exporters as well as corporate enterprises to improve agricultural productivity and the competitiveness of Africa's agriculture) to implement its programmes.

Over the last many years, several initiatives and coordinating bodies have sprung up to promote African agriculture. Over a 20-year period, the Sasakawa Global 2000 partnership has sponsored country technology transfer projects in 15 African countries. In assisting with implementation of the CAADP initiative, it has formed viable partnerships with the CGIAR Centers and the NARS. The “newest kid on the block” is the Alliance for a Green Revolution in Africa (AGRA). AGRA is an initiative jointly sponsored by the Rockefeller Foundation and the Bill and Melinda Gates Foundation. The AGRA initiative has at the moment three programs; the first one on Seed Systems, the second one on Soil Health and the third one on Markets. This initiative is laying a platform for both research and extension.

The Centers of the CGIAR are also playing a pivotal role in support of CAADP. The CGIAR Regional Plans for Collective Action in West and Central Africa (WCA) and East and Southern Africa (ESA) are based on the shared interests, among the Alliance Centers and African partners to increase the impact of agricultural research in SSA. In both regions, the agreed overriding goal of the Regional Plans is to “foster the emergence of a coordinated, cohesive program of agricultural research that produces clear economies of scale and scope at low transaction costs, in order to successfully address regional priorities” Three interlinked outcomes guide the programmes and these are: (1) A clear picture for all stakeholders of the research undertaken in each region by the CGIAR Centers and their partners, (2) A program of work that bridges “disconnects” among on-going research and adds value in terms of regional goals, as outlined in CAADP Pillar IV, FAAP and by the SROs in their strategies, while delivering international public goods that comply with the CGIAR System Priorities, and (3) A result-based culture founded on shared information. NASRO members have strong collaborative programmes with ICARDA.

The common thread running through all these efforts is the desire to take advantage of a favourable climate in Africa in which African policymakers and Africa's development partners are anxious to make agricultural growth the cornerstone of Africa's economic growth.

## **b. Overview of main research uptake and innovation pathways operating in the region:**

Failure to develop and nurture the capacity for technology dissemination and adoption has plagued the development of African agriculture. Apart from inadequate capacity, lack of state resources to perform their functions reduces the impact of extension workers in Africa. The IAC panel took note of the fact that although there were 12,000 extension agents in Kenya, there were no funds to buy fuel for their motorbikes. There have been numerous interventions in the past including the testing of the now infamous T&V Model in many countries. The call for market-driven agricultural development means that architects of agricultural research and education must find ways to make extension less costly, and

more pluralistic. In the face of this demand for a more efficient adoption of new technologies, agricultural extension is back on the development agenda.

At the country level, there is realization that agricultural extension must go beyond transferring new food technologies to farmers. This awakening is the result of the successes of NGOs who were active in the rural communities. When NGOs were initially established in Africa, their primary function was to act as providers of food aid and humanitarian assistance. But it did not take long for them to realize that advantage could be taken of their contact with the poor people at the grassroots to diversify their activities. The NGOs soon established food and community development projects that were primarily funded by bi-lateral donors. It has become clear to planners and practitioners at the national level that successful extension systems result from building capacity of the extension agents as well as the farmers and their organizations. In addition, successful extension must involve women, youth and the most vulnerable people in the rural communities. The result of this increased awareness is the existence of many extension models in Africa including the modified T&V model (Nigeria's ADPs and the extension service in Zambia) and the commodity extension and research model (cotton in Mali). In the main however, the national public extension model still prevails in many countries and a substantial amount of the less than adequate resources that national governments invest in agriculture and rural development goes to support the extension service.

The establishment of the IITA in 1967 marked an effort by the CGIAR to gain a better understanding of the complex nature of the farming systems in tropical Africa. Exploring the concept of Farming Systems Research (FSR) was put into high gear. One of the principles of FSR was that if farmers fully participated in the development of new technologies, their understanding would improve and their adoption of such technologies would also increase. However, the full potential of FSR has never been realized and by the 1990s, the desire to find ways to increase uptake of new technologies led to the concept of Agricultural Knowledge and Information Systems (AKIS). AKIS was a simple concept that highlighted the importance of developing a *system* of education, technology and extension institutions that can function as drivers for transforming traditional agriculture. Put simply, education, technology generation and extension must be linked. It was found that this simplistic model could not work as a stand-alone in situations that involve primarily smallholder farmers. Today, the innovation systems approach, a modified version of AKIS is in vogue. This approach is driven by the fact that increase in knowledge alone by the farmer is insufficient to promote technology adoption in the absence of such other factors as credit and markets. Many of the NGOs and new organizations in Africa have adopted this approach.

A review by FARA (2008<sup>13</sup>) of selected multi-country agricultural and natural resource management programmes and projects in Africa pointed out that in various forms, the CGIAR Centers working in Africa had been experimenting with the innovation systems approach since the 1980s. Value chain research and development characterizes the current CGIAR's Regional Plan for Collective Action in SSA. In addition to the use of their institutional manpower, the two sub-regional plans are estimated to involve the investment of USD 38.2 million for implementing the first three years for the West and Central African plan and USD 7.73 for the first year of implementation of the plan for East and Southern Africa. This is in addition to the traditional expenditure by the 15 Centers in SSA which, in 2008, amounted to USD 247 million, equivalent to 49% of the total expenditure by the CGIAR Centers world-wide.

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<sup>13</sup> FARA, 2008. A review of selected multi-country agricultural and natural resource management research programmes and projects in Africa: Lessons for the future.

AGRA's projects support research and technology dissemination and adoption as well as capacity building. The five-year combined budget for the Seeds Program and Soil Health Program amounts to USD 330 million. Additional investment is planned for the program on Markets when the business plan is formulated. AGRA is also leading efforts to make credit available to farmers. Efforts are underway to replicate the successful work with the banking sector in Kenya in other African countries.

National policies are changing on investments that support agriculture. For the success of the Presidential Initiative on Cassava in Nigeria, the Federal Government ensured that the private sector was involved and that the producers and processors were organized so as to take advantage of the subsidies and other forms of credit introduced into the initiative. Involvement of the private sector is also a major point in the ongoing GOANA initiative on rice in Senegal. There are efforts to discover ways to "make subsidies work" without hurting the private sector. The government of Egypt adopts the practice of establishing a "floor price" for agricultural commodities, especially staples and this guaranteed "floor price" varies from season to season. These are but a few examples that show that African policymakers have come to recognize the importance credit and access to markets. Support for credit on agricultural inputs especially fertilizers was strong at the 2006 African Fertilizer Summit.

The activities outlined in FARA's 2007-2016 Strategy Plan, which, in addition to the five "Networking Support Programmes" also include the time-bound projects on information and learning systems capacity building, technology generation and adoption are designed to involve all of FARA's stakeholders. Fig. 2 illustrates the basic IAR4D's research-to-impact pathway adopted for the SSA-CP and which approach FARA hopes will become the standard for agricultural research and development in Africa. FARA estimates that an investment in the amount of USD 97 million will be required to implement the programmes for the Plan Period.

# The Impact-Pathway Approach

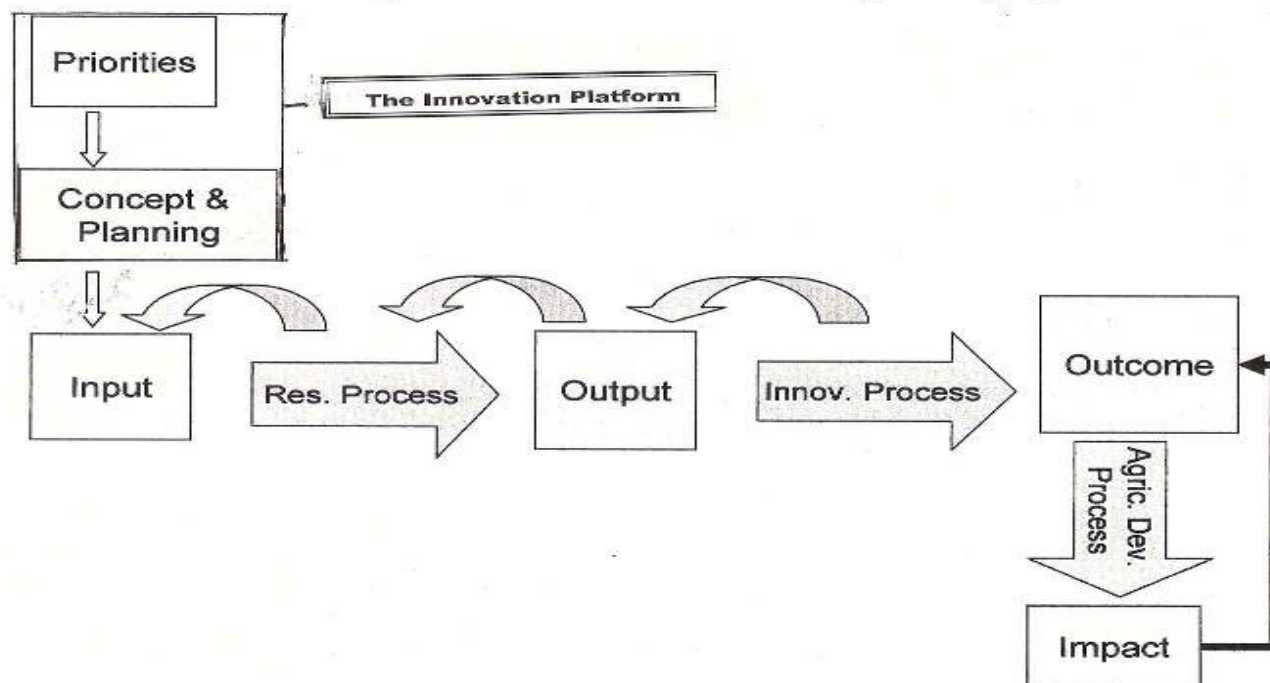


Fig. 2. The basic impact pathway approach used for the SSA-CP

### III Ensuring that the needs of the poor are met:

Well before the World Development Report of 2008, African leaders had realized that agriculture is the most important and relevant sector when addressing the needs of the poorest. Agriculture employs more than 67% of the population and the majority of these people live in rural areas. It is also in these rural areas that more than 250 million undernourished people live. Nearly half of this population lives on less than USD 1/day. An agriculture-led growth would thus affect the large absolute numbers of the poorest people. There is ample data to support the fact that African countries such as Ghana, Mali, Benin and Malawi that performed well in terms of per capita agricultural growth also performed well in other economic sectors. In fact, in many of the fastest growing economies in SSA, agricultural growth rates were highly correlated with overall GDP growth ranging from  $R^2 = 0.92$  in Mali for the period 1980-1999 to 0.77 in Uganda for the period 1991/92 and 2004/05. The formulation of the NEPAD/CAADP initiative was thus an acknowledgement of the important role that agriculture plays in reducing hunger and poverty.

Agriculture's capacity to contribute to poverty and hunger reduction has often been hindered by massive underinvestment by African governments in agriculture and, in some cases, by mis-investment. The Maputo Declaration was a major step taken by African Heads of State and Government to invest, each year until 2015, at least 10% of the nation's annual budget on agriculture and rural development. The national policies that were to result from the application of this declaration were meant to reverse the

underinvestment in both physical and human capital which has resulted in a huge cost to Africa in terms of forgone progress and wellbeing.

In order for African countries to address the challenges that constrain agricultural growth, the following guiding principles must be taken into consideration in developing:

- Strategies that reflect the stage of development of the country: for the poorest countries, policies must emphasize increases in production
- Strategies that prioritize agricultural development in places where significant productivity gains are possible and the potential links to the wider economy are strongest
- Strategies that focus on staples<sup>14</sup> and smallholder farmers since their practices are labour intensive
- Strategies that focus on demand market opportunities with special emphasis on the domestic markets
- Strategies that complement agricultural growth with social protection measures
- Strategies that ensure the sustainable use of the main productive resources such as land and water.

As was noted by DFID<sup>15</sup>, adherence to these guidelines would lead to:

- Policies that support agriculture
- Policies that target public spending more effectively
- Policies that prevent market failure
- Policies that fill the agricultural finance gap
- Policies that spread the benefits of new technologies
- Policies that improve access to land as well as secure property rights

Policies at the sub-regional level that promote agricultural growth include those that (i) lead to widespread economic and political reforms, (ii) lead to increased regional cooperation and (iii) lead to reduction in conflict.

Elements of these aspects are present in the various sub-regional agricultural policies. The Regional Agricultural Policy for West Africa (ECOWAP) is an example of the sub-regional agricultural policy instruments. Guided by the African Vision as expressed in the CAADP initiative, the vision of ECOWAP is “a modern and sustainable agriculture based on effective and efficient family farms and the promotion of agricultural enterprise through the involvement of the private sector”. Its general objective is “to contribute in a sustainable way to meeting the food needs of the population, to economic and social development, to the reduction of poverty in the Member States, and thus reduce existing inequalities among territories, zones and nations”. To enable the Member States to operationalize this Policy, six priority fields of action, on the basis of their capacity to reduce poverty and food insecurity, were adopted. These are:

- ✓ Improved water management by (1) promoting irrigation and (2) integrated water resource management
- ✓ Improved management of other natural resources through (1) organized transhumance and rangeland development, (2) sustainable forest resources management (3) sustainable fisheries resource management

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<sup>14</sup> Diao, X et al. 2006. The Role of Agriculture in Development: Implications for Sub-Saharan Africa. International Food Policy Research Institute, Washington DC.

<sup>15</sup> DFID, 2005. Growth and Poverty Reduction: The Role of Agriculture. A DFID Policy Paper.

- ✓ Sustainable agricultural development at the farm level, through (1) integrated soil fertility management (2) better support services for producers (3) dissemination of improved technologies
- ✓ Developing agricultural supply chains and promoting markets by (1) developing the different supply chains (foodcrops, peri-urban agriculture, export crops, short cycle livestock rearing, agro-forestry food products, artisanal fishing and fish farming), (2) developing processing operations, (3) strengthening support services for operators, (4) promoting national, international and regional trade
- ✓ Preventing and managing food crises and other natural disasters by (1) promoting early warning systems, (2) developing crisis management systems, (3) assisting recovery of crisis-hit areas, (4) formulating mechanisms for disaster-related insurance and compensation
- ✓ Institutional building through (1) gender-sensitive approaches, (2) support to capacity building in the formulation of agricultural and rural policies and strategies, (3) long-term funding for agriculture, (4) capacity building in steering and coordination, (5) capacity building in monitoring and evaluation.

At the national level, several countries have developed policies that address the needs of the poorest by promoting agricultural growth. In Kenya, the policy on Fertilizer Market Reforms has succeeded in creating a secure environment for the private sector investment in the development of marketing systems for inputs and outputs. Staatz and Dembele report that where market reforms have increased competition in wholesaling and milling of staples as well as reduced barriers to intra-country and intra-regional trade in countries such as Zambia, Mali and Kenya, retail prices have declined thus bringing down the prices of food. Ghana's Food and Agriculture Sector Development Policy (FASDEP I) was formulated to "provide a framework for modernizing the agricultural sector and making it a catalyst for rural transformation in line set for the sector by the Ghana Poverty Reduction Strategy I". The revised Ghana Poverty Reduction Strategy II goes further to actively accelerate sustained and shared growth, poverty reduction, gender equity protection and empowerment of the vulnerable and the excluded within a decentralized and democratic environment. FASEDEP II seeks to enhance the environment for all categories of farmers while targeting poor risk-prone and risk-averse producers.

#### **b. Key areas where agricultural research is being proposed..**

The adoption of the NEPAD-CAADP initiative by African governments is an acknowledgement that agriculture remains the most important sector in the struggle to reduce poverty and hunger. CAADP laid out the African Vision for an agriculture-led growth and development. Regional, sub-regional and national bodies (and their partners from outside Africa) have responded by developing strategies and policies for achieving the vision through agricultural research for development. The issue of agriculture-led growth is not limited to improvement of food security. It must also be remembered that nearly 250 million people in the region are malnourished and eliminating this scourge is an equally important goal.

Bearing in mind that priorities for research are best developed at the national level, all research activities must attempt to find solutions to the problems created, among others, by:

- The huge size and agroecological diversity of Africa resulting in a wide range of farming systems and different staples

- The prevalence in Africa of very old soils that are susceptible to erosion and that contain very limited plant nutrient reserves
- Africa's overwhelming dependence (95%) on rainfed agriculture
- The preponderance of countries with populations under 10 million and the low average population density in SSA which exacerbate the problems of establishing viable markets
- The fact that nearly 40% of the African population live in land-locked countries
- The fact that African agriculture is predominantly smallholder, but those smallholders vary tremendously in terms of their access to resources such as land and market access
- The fact that most of these smallholders are net buyers of staples
- The fact that of 48 countries in SSA, 40% of the agricultural scientific manpower resides in just five of the countries

It is generally accepted that research on productivity improvement should concentrate on staples. In addition to the reasons provided by Diao and his colleagues, staples in Africa remain semi-tradable goods and thus face limited competition in local markets. With staples in mind, proposed research is on such themes as 1). Management of Natural Resources especially Land and Water, 2) Policies, Institutions and Information for achieving impact at scale, 3) Conservation and Enhancement of Agricultural Biodiversity for improved Agricultural Production, 4) Producing More and Better Food at Lower Cost through Genetic Improvements, 5) Reducing Rural Poverty through Agricultural Diversification and Emerging Opportunities for High Value Commodities and Products, 6) Promoting Domestic and Regional Markets, 7) Improving Impact of Emergency Response on Agricultural Livelihoods in Highly Stressed and Unstable Systems. A holistic approach is recommended so that, for example, where a "productive landscape" is identified, work on genetic improvement is integrated with natural resource management. Two other guiding principles are that there should be a balance of bottom-up approach with the needs for institutional innovation that responds to stakeholders expectations and initial focus should be on research that has both utility and probability of success. In the three sub-regions of SSA, the problem of agroecological diversity is being handled by **the identification of development domains** so as to gain better understanding of the composition of the smallholders who can "farm their way out of poverty". Actions can then be taken to broaden this group as much as possible using careful empirical analysis. It is also recognized that intra-household gender inequalities represent a significant constraint to the growth of agriculture. Therefore, gender equity and the plight of the most vulnerable in the rural communities are taken into serious consideration in implementing the research programs and projects.

Economists (DFID, 2005, Staatz and Dembele , 2008) agree that for the diversity and uniqueness of African agriculture, a strategy that focuses on promotion of growth among "higher-potential" smallholders (family farmers) is the best. The argument is that, given the magnitude of investments needed to spur growth in SSA and the necessity to concentrate efforts, it is highly likely that concentrating on the better endowed smallholders will lead to both higher growth and more poverty reduction than a strategy that focuses on improving the farming operations of the poorest of the poor. What happens to the more than 50% of the smallholders who farm less than one-fifth of an hectare or who are virtually landless is less clear. Included in this class are the African women, the youth, the disabled and other vulnerable groups in the rural communities. This group constitutes more than 50% of the rural poor. These households are frequently also most constrained in terms of access to capital and inputs. Given the limited resources of these smallholders, it will be absolutely impossible for them to "farm their way out of poverty" particularly when relying solely on the production of lower-value staples. These "poorest of the poor" are unlikely to be reached by the products of the current slate of research themes. Governments must come up with investments and policies that promote better sharing

of the benefits that accrue from growth resulting from the concentration on the better-endowed smallholders.

There are issues that are recognized as being important for an agriculture-led growth but for which no readily discernable research activities at the national level have been developed. They include how to develop coping mechanisms for:

- Effects of rapid urbanization: In West Africa, 60% of the population is projected to live in the cities by 2020. The implication will be that poverty will no longer be a rural phenomenon.
- Increased population pressure: Although Africa contains many countries with current populations less than 10 millions, data shows that between 1985 and 2003, the population of SSA increased by 63% resulting in reduced arable land from 0.33ha to 0.25ha (see Table 1). The implication is that the need to develop technologies that improve the productivities of BOTH land and labour is very urgent.
- Climate Change: All predictions indicate that SSA will be one of the worst hit areas. While the research agenda of the International Agricultural Research Centers (IARCs) make references to work in this area, there is relative silence from the African NARS with the exception of the NARS from North Africa. It is obvious that the effects of climate change will be hardest on the poorest of the poor.

### c. Main development barriers and forms of new knowledge, capacities and skills

It is true that the Green Revolution has not by-passed Africa. However, the data on Table 2 show that Africa lagged behind the rest of the developing world in reaping the benefits from the Green Revolution. For Africa to successfully implement pro-poor agriculture-led growth that would reduce hunger and Poverty, the conditions that led to Africa almost missing the Green Revolution must be reversed.

**Table 2. Impact of Modern Varieties (MV) on yield growth**

	1961-1980	1981-2000
Asia	0.682	0.968
Latin America	0.463	0.772
Middle East & North Africa	0.173	0.783
SSA	0.097	0.471
All developing countries	0.523	0.857

Source Evenson and Gollin (2003)<sup>16</sup>

#### 1. Failure to reverse gross under- and mis-investment in agriculture:

What factors were responsible for the spectacular yield gains from the Green Revolution? Yield is a function of:

- 1) Agricultural labour per hectare

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<sup>16</sup> Evenson, R.E and D.Gollin. 2003. Assessing the impact of the Green Revolution , 1960-2000. Science Review vol. 300, 758-762

- 2) Type of seeds used
- 3) Fertilizer application per hectare
- 4) Farm machinery per hectare, and
- 5) The availability of irrigation

Because African governments have grossly under-invested in agriculture over the years, these five factors do not count in favour of the African smallholder. Underinvestment has also led to the inability of governments to maintain existing infrastructure. In addition, governments have failed to provide adequate working conditions for the well-trained African scientists. The use of large portions of government allocations for ill-managed input subsidies instead of using them in areas such as adequate funding for the training of agricultural scientists and, the construction of large irrigation dams, especially in the 1970's, were cases of mis-investment. Underinvestment continues to affect the quality of the research and extension systems, the availability of credit for smallholders and the availability of infrastructure that would promote yields and improve farmers' access to markets.

## 2. Poor governance and political instability

The good news is that many African governments have chosen democracy. However, democracy alone cannot bring progress to the poor and marginalized. Decentralization of power to the grassroots will do that. Until there is genuine decentralization, the chances to broadly share the benefits of agriculture-led growth will be minimized as the local populations are denied the opportunity to organize themselves and to accurately identify the priorities while mobilizing the necessary local resources for investment in agriculture. There is evidence that countries with better internal governance (Ghana, Zambia) have more sustained growth rates while countries that have civil strife (DRC and Zimbabwe) lag behind.

## 3. HIV/AIDS

The HIV/AIDS pandemic claims its victims in the prime of their youth. The pandemic has wreaked havoc in the workforce of countries with high prevalence rates. Today, these countries have the lowest life expectancies in Africa. HIV/AIDS adversely impacts the productivity of agriculture and the losses in human capital threaten the intergenerational transmission of farming knowledge.

## 4. Inadequate capacity for research and extension

As was earlier noted, this is one of the outcomes of underinvestment in agriculture. However, the importance of a knowledgeable and active workforce to produce the technologies required for an agriculture-led growth and to disseminate and promote the adoption of these technologies cannot be over-emphasized.

## 5. Failure of Africa's development partners to honour their pledges

A study by Fan and his colleagues at IFPRI<sup>17</sup> estimated that the required investments for Africa for the implementation of CAADP were in the order of USD 32-39 billion a year. In the best of times, African governments cannot mobilize such large sums of money. But there have been substantial pledges for help from Africa's development partners. Honoring these pledges (and on time) would enhance the chances of an agriculture-led growth in Africa.

## 6. Failure to maintain gender and equity

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<sup>17</sup> Fan, S, M. Johnson, A. Saurkar and T. Makombe. 2009. Investing in African Agriculture to Halve Poverty by 2015. ReSAKSS Working Paper No. 25. International Food Policy Research Institute.

Africa-wide, women constitute more than 50% of the agricultural workforce. They also, along with the youth and other marginalized members of the rural communities, form the bulk of the poorest of the poor. While paying maximum attention to improving the productivity of smallholders with high potential to succeed, safety-net measures must be put in place to ensure that women and the vulnerable in society are not ignored.

With the exception of the Republic of South Africa and parts of North Africa (e.g. Egypt), universities in Africa have been starved of financial resources. With the ever-increasing enrollment of undergraduate students, lecturers and professors devote precious little time to research. The national research institutes have not fared much better. Participation in networks funded by donors has brought some relief but has left many scientists doing “what the donor” wants rather than what the national priority dictates. With these shortcomings in mind, it is almost out of place to discuss “new knowledge and skill” that would be needed to promote agricultural growth and reduce poverty and hunger. Capacity strengthening is stressed by CAADP. The sub-regional implementing agencies and national systems through their Country Compacts have maintained the emphasis on capacity strengthening.

There is no doubt that science and technology will anchor any strategies for agriculture-led growth in Africa. The InterAcademy Council panel recommended the “cultivation of African centers of agricultural research excellence” and the regional Plan for Collective Action for East and Southern Africa indicated that the implementation of the program would result in the establishment of centers of agricultural research excellence. The AGRA initiative is implementing capacity building activities in the two programs that are fully operational. The Plant Science Department of the Faculty of Agriculture at the University of Ghana at Legon is being upgraded to lead in the training of the new class of plant breeders that will lead Africa’s new green revolution. In the same vein, the Soil Science Department of the Kwame Nkrumah University of Science and Technology has been chosen to lead the efforts in producing the new cadre of Soil Scientists that would work to improve the health of African soils. The “new” agricultural research scientists will benefit from the skills that are being developed within the “biotechnology revolution”. Biotechnology offers the scope for Africa to attain the Green Revolution through application of the “Gene Revolution” techniques. Techniques such as gene marker technology and transgenic engineering will be needed to produce the new varieties that are more suited to the varied nature of Africa’s agroecologies and smallholder households. For the subsistence and semi-subsistence farmers, there may be more interest in staples that have multiple traits such as taste, ease of processing and storage properties. For these classes of farmers, the use of open pollinated varieties with the desirable traits might be more acceptable than the hybrids.

The application of ICT will feature more prominently in future African agriculture. African soil scientists are part of the teams currently preparing a digital soil map of Africa with the support of the Bill and Melinda Gates Foundation. The Agricultural Extension and Rural Development Research Institute and the Central Laboratory for Agricultural Expert Systems, both of the Egyptian ARC are working together to promote the use of ICT at the level of the front-line extension worker. The use of GIS technology is currently used in developing development and production domains and will be key in efforts to up-scale and out-scale technologies. Managing agricultural information using ICT will intensify. FARA’s RAILS project is designed to fill current gaps in the rural community-NARS-regional-continental-global information chain.

Most of the development barriers suggested can be removed by the development and application of the right policies. To develop these policies would require sound information. Skills in modeling will be needed to test different scenarios and make more plausible recommendations to policy makers.

African scientific organizations are currently weak in project monitoring and evaluation. Another weakness is the administration and efficient management of research projects. These skills will be needed if an agriculture-led growth that reduces poverty, decreases malnutrition and improves the overall economies of African countries can become a reality.

#### **IV. Gaps and scale issues creating key challenges**

The CAADP framework is a “marching order” for the agricultural scientific community to do whatever it takes to boost agricultural growth as an engine of broader economic development and poverty reduction. With respect to Pillar IV, response by this community at the regional, sub-regional and national levels has been swift. Where the major gap exists is in meeting the investment needs for the programmes and projects that have been developed. As Staatz and Dembele (2008) aptly noted, the investment needs for rapid agricultural productivity growth across all of SSA are far beyond current levels.

The requirement by NEPAD-CAADP that Country Compacts be developed is an acknowledgement that priorities are best set at the national level and that mobilizing financial resources at the national level is necessary for the successful implementation of the CAADP programmes. In other words, for agriculture-led growth to occur, an effective publicly-funded set of activities that promote agricultural research, extension and access to markets among others must be installed.

The study by Johnson et al (2008) for the West African sub-region suggested that if the sub-region were to attain the goal of halving the rate of poverty by 2015, agriculture would grow at an annual average rate of 6.8% and the current rate of public investment in agriculture of USD 6.6 billion would have to rise to USD 8.0 billion by 2008 and USD 31.8 billion by 2015. A faithful adherence to the Maputo Declaration would not accomplish this goal for many of the countries of the sub-region. Taking into consideration the low rate of domestic savings in Africa, dependence on the generosity of donors would be critical. The decisions taken by the Blair Commission in 2005 have as yet to be implemented. Therefore the inability of African nations to fund their agricultural growth programmes would pose a major challenge.

Most of the investments will be on smallholders in high potential areas with access to markets. It is vitally important to develop strategies that would effectively leverage multiplier effects of these investments through pro-poor growth investments and other enabling policies so as to improve the lot of the fifty-percentile, made up of women and youths, that have been left out.

For these programmes to be successful at the national level, the serious shortfalls in human and institutional capacity in SSA to carry out research and extension must be addressed. The need for a critical mass to carry out research on both biophysical and social sciences (especially policy formulation and analysis) cannot be over-emphasized. To address this situation would involve a more efficient allocation of investments to agriculture. For example, work done by Goverey et (2006)<sup>18</sup> and Jayne et al (2006)<sup>19</sup> showed that in Zambia, over 80% of the budgetary allocations to agriculture went to fertilizer

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<sup>18</sup> Goverey, J. et al (2006). Raising the Productivity of Public Investments in Zambian Agricultural Sector. Food Security Working Paper. 2006.

<sup>19</sup> Jayne, T.S. 2006. et al. Factors Affecting Small Farmers: Use of Improved Maize Technologies . Evidence in Kenya and Zambia. Gold Coast, Queensland, Australia. 2006

subsidy programmes, managing the national food reserves, personnel emoluments and departmental recurrent charges leaving very little money for programmes such as agricultural research and extension that increase agricultural production. If rapid agricultural growth must occur, adequate human and institutional capacity is needed to utilize the tools of biotechnology and ICT. In addition, skills are needed to enable the use of innovation systems approach for implementing programmes that would promote rapid agricultural growth. SROs were established to promote collaboration between countries within the same sub-region. There is need now to promote collaboration between SROs. Collaboration between the NARS in SSA and those in North Africa can be used to bring temporary relief to the problem of shortage of critical mass of scientists. Countries may be able to solve the problems of low input use and lack of improved seeds, but unless an effective system exists to translate the outputs of research into outcomes and impact by ensuring that issues of processing and marketing are tackled at the same time, the benefits of research will not be fully reaped. Only by adopting the innovation systems approach can the process of up-and out-scaling of technologies be properly handled.

Africa is currently receiving the attention of the donors because of improved democratic governance structures in many countries. These structures need to be deepened to involve genuine decentralization. The rural poor who are to be affected most by agriculture-led growth need to have a voice and this can only happen when there is genuine decentralization. A genuine decentralization also means that women and the marginalized in the rural areas are empowered. Here again, improved human and institutional capacity will enable democracy to thrive.

To sum up, the extent to which African agriculture can witness rapid growth in agricultural productivity and income depends on the ability of the countries to tackle the constraints such as poor rural infrastructure and extension services, inadequate human capital resources, high market and trade transaction costs, weak producer and market institutions. Sustained capacity building will ensure that science and technology will provide the solutions to these constraints.

## Concluding Summary

NEPAD-CAADP has provided African planners with the framework for agriculture-led growth that would reduce poverty and food insecurity including malnutrition. In response, Africa's national, sub-regional and regional institutions and their partners have developed agricultural research and development programmes based on priorities that have been developed at the national level. These research programmes call for *increased production of staples* within the context of research that emphasizes conservation, use and enhancement of genetic resources, integrated natural resource management, development of markets and institutions, the use of information and communication technologies to solve up-and out-scaling challenges. Attention is also called for improving the livelihoods in high stress/unstable environments.

Although there is a high degree of coherence in the plans put up by the different actors, there are still important areas where insufficient attention has been paid. At the NARS level, there are no obvious research programmes on such issues as market access, how to eliminate malnourishment, how to attract the private sector to get more involved in agricultural research for development, the "problems of tomorrow" such as the looming water scarcity, effects of high population pressure, climate change and linkages between agriculture and human health including the HIV/AIDS and malaria pandemic.

Because of the diversity and uniqueness of African agriculture, a strategy that focuses on promotion of growth among "higher potential" smallholders is best as this will lead to both higher growth and more poverty reduction. It is however recognized that governments should ensure that the group that benefits is rapidly enlarged through the establishment of safety-net programmes and the deepening of decentralization so that women and youths in the rural areas who constitute the "poorest of the poor" can be empowered.

Two major challenges must be overcome for the successful implementation of an agriculture-led growth. Firstly, the practice of underinvestment in agriculture, especially in agricultural research, must be reversed. Secondly, African policy makers must wake up to the fact that lack of human capital for both research and extension is the greatest obstacle to agricultural growth and Africa's capacity for innovation. The CGIAR is called upon to revive the old practice of using core funds to support capacity building in Africa.