Science Agenda for Agriculture in Africa (S3A)

Synthesis Report of Companion Studies and Emerging Implementation Strategy
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- **A critical review and analysis of agricultural extension and advisory services in Africa within a science and innovation system context**, by Dan Kisauzi and Frans Terbancle
- **A critical review of partnerships and collaborative efforts in the context of operationalizing the science agenda for agriculture in Africa**, by Ajuruchukwu Obi
- **Analysis of Agriculture Education and Training (AET) for transformative change in Africa’s science and innovation system**, by Frans Swanapoel
- **Strategic options for financing the implementation of the Science Agenda for agriculture in Africa**, by Tshikala Tshibaka
- **Lessons from the CAADP country and regional processes on ARD and entry points for the application of science in the implementation of country and regional agriculture and food security investment plans**, by Simbarashe Sibanda.

The authors would also like to thank the Executive Director of FARA for his keen support in commissioning and accomplishing the studies. We are particularly indebted to the FARA Science Agenda Team who provided oversight for the S3A companion studies: Dr Emmanuel Tambi, Dr Aggrey Agumya and Prof Adewale Adekunle. Our gratitude also goes to Mr Bernard Agyeman and Mrs Christiana for providing research and logistical support to the whole process of commissioning and finalising the S3A companion studies.
To build momentum towards operationalising the S3A, FARA has put in place several activities including commission relevant studies, synthesised in this paper, as companion documents that will contribute to the operationalisation of the S3A. FARA’s Strategic Priorities under the new Medium Term Operational Plan provide further guidance to these companion studies. The overall framework for operationalising S3A is divided into: a) short- to medium-term focus on Comprehensive Africa Agriculture Development Programme (CAADP) Level 2 results of increasing production, productivity, competitiveness, regional integration and sustainable natural resources management; and b) medium- to long-term CAADP Level 3 results priorities of building systemic science capacity.

The short- to long-term priorities, however, both rely on the same over-arching strategies for the S3A: a) integrating; b) connecting; and c) strengthening science. There is need to redress the poor linkages between research, extension, agricultural education and the end-users and impacts. Integrating sciences at national level is a key strategy to the acceleration in implementing CAADP, building a long-term science capacity and connecting science and technology to farmers, producers, entrepreneurs and consumers in the agri-food value chain.

It is important to recognise that institutions that drive and support science and technology in Africa (NARS, SROs, FARA, CGIAR, as well as education and extension institutions) tend to be directly or indirectly involved in the implementation of CAADP, which is the main framework and vehicle for operationalising S3A. This is done by collaborating with the CAADP country implementation partners. Moreover, even though RECs are at the forefront of CAADP implementation, they hardly invest in science and technology for agriculture. Herein lie the implications for FARA as the custodian, strategist and coordinator of S3A and its operationalisation.

The Malabo Declaration on Accelerated Africa Agricultural Growth and Transformation (A3GT) has two distinct implications for FARA and the operationalisation of S3A: a) commitment to CAADP Results Framework as an instrument to measure, track and report progress on the S3A commitments; b) the need to participate effectively in the design of an implementation of a strategy and roadmap, with emphasis on the role and process of S3A in the translation of the 2015 vision and goals of 2AGT. Further, the HoS&G called on AUC and NPCA to develop an implementation strategy and roadmap that facilitates translation of the 2025 vision and goals, and to report to the January 2015 Ordinary Session of the Executive Council for its consideration. FARA is expected to participate fully.

A review of NAIPs suggests that most do not explicitly articulate the role of science and technology in the transformation agenda. S&T seems to be getting little attention in terms of NAIPs. Sub-regional Research Organizations are promoting regional initiatives that support the CAADP processes and are in line with the
Science Agenda although they are not directly part of the REC agenda on CAADP. External partners fund most agricultural research. NAIPs indicate low uptake of technology by end users ascribed to out-dated technology dissemination frameworks and systems. NAIPs for countries such as Rwanda, Ghana, Mali, Uganda, Kenya, Liberia, Malawi and Gambia outline the importance of increasing private sector participation but the approaches are not clear. Innovation Platform and the IAR4D approach provide the viable option for adoption in the NAIPs, to be promoted and used to improve the technology adoption process at the national level.

**A review of the National Agricultural Investment Plans (NAIPs) identified the following entry points for operationalising S3A in implementing CAADP:** Application of existing and novel technologies to:

- Increase efficiency and competitiveness in commodities of comparative advantage (improved inputs, germplasm, pest and diseases control, reduction of post-harvest losses, mechanisation etc).
- Maintaining and improving the management of the production base (land/soil, water, forestry, fisheries and wildlife).
- Market research and development (market information, food safety and standards; mechanisms to reduce transaction costs, post-harvest handling and processing, PPPs and inclusive business models).
- Value chain studies, product development and support for local small scale agro-processing.
- Promotion of private sector investment through catalytic public investments. FARA is in the process of developing guidelines to mainstream science into CAADP processes, specifically NAIPs.

**There is need for a strategy to promote improved inclusive and participatory Agricultural Extension and Advisory Services (AEAS) as part of a science and innovation system.** FARA, AFAAS and related partners need to develop, sustain and deploy an AEAS facilitation team for CAADP technical planning and review. There is need to facilitate the emergence and institutional development of country fora that bring AEAS actors together with one of their objectives being to advocate for AEAS policy implementation. Reforms and development are to be guided by the evolutionary experience with AEAS. The early steps in reforming the AEAS was the introduction of Farming Systems Extension and Research approaches (FSE/R). The Participatory Extension Approaches (PEA) further enhanced the FSE/R methodologies by introducing social sciences in the AEAS. The integration of AEAS into agricultural innovation system was strengthened mainly from the perspective of enhanced farmer-extension-research linkages.

**FARA, SROs and REC will develop a special initiative for enhancing financing of the S3A.** It can be assumed that African countries have domestic resources that could be mobilised, and more funding for S3A should be mobilised from the private sector. Countries should explore several nonconventional sources of funding for science such as: Special government grants, local philanthropy, special levies tied to extractive commodities like minerals and petroleum products. Income through sale products and services where effective market exists; competitive funding mechanisms especially targeting AET institutions; levies on commodities that have gone sufficiently commercial. African Governments are encouraged to invest at least 1% of GDP to agricultural research and technology transfer.

**Tertiary Agricultural Education and Training (AET) system and institutions need reforms and strengthening so that these play a more effective part of Africa’s Agricultural Science and Innovation System.** The AET institutions lack staff with PhDs, have an aging academic workforce, and have a limited number of researchers, and curricula that are obsolete and dissociated from the requirements of the economy. Realising the potential role of AET, FARA and partners (specifically, networks such as The African Network for Agriculture,
Agroforestry and Natural Resources Education (ANAFE) and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), have worked to bring the issues of mainstreaming education into the implementation of the CAADP to the fore, culminating in the formation of a Tertiary Education for Agriculture Mechanism in Africa (TEAM-Africa). More recently, the NEPAD Agency has supported these efforts and is now hosting TEAM Africa and the Agriculture Technical and Vocational Education and Training (ATVET) initiative to develop the Agricultural Education and Skills Improvement Framework (AESIF); the current Africa Human Capital in Science, Technology and Agri-preneurship for Food security Framework (AHC-STAFF) initiative is working to provide the underpinning studies and evidence for strengthening the AESIF.

**Partnerships and collaborative efforts in the context of operationalising the S3A will build on FARA experience.**

FARA needs to build on experiences with partnerships moving forward to include: Dissemination of New Agricultural Technologies in Africa (DONATA); Strengthening Capacity for Safe Biotechnology Management in sub-Saharan Africa (SABIMA); Sub-Saharan Africa Challenge Programme (SSA CP); Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA); Regional Agricultural Information and Learning Systems (RAILS) Universities, Business and Research in Agricultural Innovation (UniBRAIN); Africa-Brazil Programme Platform for African-European Partnership; and the CGIAR Challenge Programme in support of IAR4D approach. S3A foresees a major role of RECs that, to date, have had insignificant direct interest in science and technology for agriculture. The CGIAR has been a key partner of the NARS and SROs over the last four decades and with FARA since its inception. The recent reform of the CGIAR with its new CGIAR Research Programs (CRPs) targeting collaboration on specific themes is expected to improve alignment with CAADP, especially in forging a partnerships to support the implementation of the S3A.

In conclusion, the S3A must be operationalised to directly link institutions that drive science and technology in Africa to those institutions and structures that drive the implementation of CAADP including; the Agriculture Sector Wide Groups (ASWGs), CAADP Country Teams, various oversight structures, including the CAADP PPs, Joint Sector Reviews, and APRM activities, and especially RECs who, though at the forefront of CAADP implementation, hardly invest in science and technology for agriculture. FARA will work closely with AUC, NEPAD and RECs in fleshing out the S3A operationalisation strategy in line with the Malabo Declarations, and especially through implementation of the Sustaining CAADP Results Framework.
The Forum for Agricultural Research in Africa (FARA) has been leading the development and operationalisation of the Science Agenda for Agriculture in Africa (S3A). The S3A document has been prepared by an African-led Expert Group through a consultative process involving the broader agricultural science community and rural development professionals in Africa, as well as high-level decision-makers on the Continent. The Science Agenda articulates the science, technology, extension, innovation, education, training, policy and social learning that Africa needs to apply in order to meet its agricultural and overall development goals. The strategic thrusts of the S3A in the short- to medium term are the implementation of CAADP; increase in domestic public and private sector investment in agricultural research; create an enabling environment for sustainable application of science for agriculture; and to double the current level of Agricultural Total Factor Productivity (ATFP) by 2025 through application of science for agriculture. In the medium- to long-term, it is to build systemic science capacity at national and regional levels, capable of addressing evolving needs for farmers, producers, entrepreneurs and consumers, especially given strategic and foresight issues such as climate change and urbanisation.

To build momentum towards operationalising the S3A, FARA has put in place several activities to deepen buy-in and ownership as well as to enrich the contents of the Science Agenda for implementation. One of these activities was to commission relevant studies as companion documents that will contribute to strengthening the Science Agenda document for operationalisation. These studies provide levers and entry points for operationalising and implementing the Science Agenda at country and regional levels. FARA’s Strategic Priorities under the new Medium Term Operational Plan have been providing oversight responsibility for the studies. FARA’s mission is to create broad-based improvements in agricultural productivity, competitiveness and markets by supporting Africa’s sub-regional organizations in strengthening the capacity of the NARS for agricultural innovation. FARA is currently implementing its new Medium Term Operational Plan (MTOP) from 2014-2018, which has three Strategic Priorities (SPs):
SP1: Visioning Africa’s agricultural transformation through foresight, strategic analysis and partnerships
SP2: Integrating capacities for change by connecting and learning
SP3: Creating an enabling environment for implementation through advocacy and communication.

The five commissioned S3A companion studies are:

• A critical review and analysis of agricultural extension and advisory services in Africa within a science and innovation system context, by Dan Kisauzi and Frans Terbancle

• A critical review of partnerships and collaborative efforts in the context of operationalizing the science agenda for agriculture in Africa, by Ajuruchukwu Obi

• Analysis of Agriculture Education and Training (AET) for transformative change in Africa’s science and innovation system, by Frans Swanapoel

• Strategic options for financing the implementation of the Science Agenda for agriculture in Africa, by Tshikala Tshibaka

• Lessons from the CAADP country and regional processes on ARD and entry points for the application of science in the implementation of country and regional agriculture and food security investment plans, by Simbarashe Sibanda.

This paper synthesises the findings from these studies (refer to Annex 1 for details of studies) and provides strategic options for operationalising the S3A, focusing on how it should support CAADP implementation in the short term and on how strategic capacities at national and regional levels need to be built, coordinated and integrated in implementing the Agenda in the long term.

1.1 Context and relevance of studies to S3A

The key milestones achieved so far in the development of the S3A include:

i) Development of institutional arrangements for effective African consultation, buy-in and ownership.

ii) Writing of a Discussion Paper (DP).

iii) Undertaking of e-consultation and face-to-face consultations that elicited inputs from wide stakeholder groups largely from Africa.

iv) Identification and commissioning of relevant studies.

v) Development of the final S3A document and adoption of the Science Agenda by the CAADP PP, African Ministers of Agriculture and Rural Development, and by the AU Summit in Malabo in July 2014.

vi) A set of studies were commissioned (see methodology section for the titles of the studies) in line with these achievements towards the S3A.

vii) Development of a web site to host the S3A.

Given this background, the studies provide valuable information on and analysis of the status of the institutional and policy aspects of the critical sectors and agricultural services that are key to the successful implementation of the Science Agenda. The studies also fill gaps in literature on some of the issues that need to be fully understood before implementing the Science Agenda and ensure that the agricultural science system is better informed and will provide information for strategic planning and for the current situation.
1.2 The value and importance of the S3A companion studies for CAADP implementation

In the short- to medium term, the Science Agenda is aligned with the implementation and advancement of CAADP’s targets under the ‘Sustaining the CAADP Momentum’ strategy, with emphasis on Level 2 of the CAADP results framework whose priorities are: increasing production, productivity, and competitiveness; improved food and nutrition security; regional integration; and enhanced management of natural resources. In the next 5–10 years, the most practical and effective way is to roll out the Science Agenda as part of the CAADP Country Processes that include the implementation of the National Investment Plans for Agriculture and Food Security. CAADP therefore provides the larger frame in which the Science Agenda is operationalised. This framework is in the form of the CAADP processes at country and regional economic community (REC) levels and at the continental level. CAADP will not achieve its aims, and S3A will not be fully meaningful unless a strong pipeline of contextually relevant new knowledge is made available and applied. These studies, therefore, generate the much-needed situation analysis and baseline of key research themes outlined in the S3A as critical to transform agriculture in Africa.

At the AU Joint Conference of Ministers of Agriculture, Rural Development, Fisheries and Aquaculture held 28 April–2 May 2014, Addis Ababa, Ethiopia, the Ministers identified a set of composite indicators or a “Frontline Dashboard” of key change and desired impacts; by 2024, to allow for higher level tracking of progress and performance at both political and technical levels. Chief among these indicators identified was the need to endorse the Science Agenda for Agriculture in Africa (S3A) to increase the level of ATFP annual growth through technology generation, dissemination and adoption, and skilled human resources. Further, through the CAADP Results Framework process, FARA, in collaboration with key stakeholders (AUC/NEPAD, SROs, PAFO, and CGIAR) is scoping out the main strategic outcomes expected out of the implementation of S3A within the next decade. This shows how important the S3A is to the CAADP process, and demonstrates why a deeper understanding of the issues on the ground, through the studies, is important.

1.3 Long-term implications for S3A in building systemic capacities

The long term strategic thrust for the S3A is to build systemic capacities for science at various levels from national to regional. Integrating, connecting and strengthening science across the board is the main strategy of the Science Agenda. This will enable the S3A to achieve its long-term goal of doubling current level of Agricultural Total Factor Productivity (ATFP) by 2025 through application of science for agriculture. The S3A is further expected to provide a basis for the alignment of national, regional and international research providers in coordinating their actions to meet the demands of African agricultural stakeholders. There is need for better connection between universities and agricultural research institutes as well as communicating science more effectively with decision-makers and among professionals. An important aspect is collective action and solidarity across stakeholder groups in implementing S&T on CAADP programmes. Activities, which increase and improve solidarity and scientist mobility, facilitating exchange programmes on information, facilities, staff and other resources will be necessary in creating technology-sharing platforms. This would ensure that no country is left behind. Sharing knowledge and research facilities among countries will better address common challenges, thus increasing African agricultural competitiveness.
Moreover, science has to be better connected at the national, regional and continental levels with open portals to global science. For this to happen there is need for strengthening institutional systems of science for agriculture in Africa. There is also need to maintain basic science capacities at various levels as follows:

1. Sustaining basic science capacity at the national level: Integrating science institutions at national level and building their capacities. The Science Agenda will translate to practical reality as the continental vision is adopted and adapted into the working modalities of national, regional and continental institutions that implement agricultural development programmes.

2. Sustaining integrated capacity at regional and continental level as well as global partnerships. Effective national systems are the building blocks for regional, continental and global partnerships:
   a. An example of enhancing sub-regional cooperation is where ASARECA, CORAF and CCARDESA support Regional Commodity Centres that share results with neighbouring countries, e.g. Kenya on smallholder dairying, Tanzania on rice, Ghana on roots and tubers and Burkina Faso on cotton.
   b. FARA and SROs have represented NARS in the CGIAR and the Global Forum.
   c. RECs are supporting country implementation of CAADP.
   d. Global partnerships in science: The CGIAR is key partner of the NARS and SROs. Recent reform of the CGIAR including CRPs targeting collaboration on specific themes is expected to improve alignment with CAADP.

The medium- to long-term goals of the S3A are also in unison with the target CAADP level 3 results framework that emphasises systemic capacity of institutions, policy practice and leadership, including more effective partnership, learning and knowledge development and utilisation, and sustained investments by public and private sectors.

1.4 Methodology of Papers

In a bid to align the FARA strategic priorities to the Science Agenda, the studies were guided by the three Strategic Priorities (SPs) of FARA. Under each of the SPs, collaborating institutions worked with individual consultants contracted to undertake the studies. This synthesis report is an aggregate and further synthesis of the findings of the individual studies towards operationalisation of the S3A. The five studies completed and forming the main evidence base for this synthesis report are:

1. A critical review and analysis of agricultural extension and advisory services in Africa within a science and innovation system context (guided under FARA SP 1; collaborating institution: AFAAS; authors: Dan Kisauzi and Franie Terbancle).
2. A critical review of partnerships and collaborative efforts in the context of operationalizing the Science Agenda for agriculture in Africa (guided under FARA SP 1; collaborating institution: SROs; author: Ajuruchukwu Obi).
3. Analysis of Agriculture Education and Training (AET) for transformative change in Africa’s Science and Innovation System (guided under FARA SP 2; collaborating institution – RUFORUM; author: Frans Swanepoel). A follow up study on Analysis of National Science Capacities is being planned under the guidance of SP2 in collaboration with ASTI-IFPRI.
4. **Strategic options for financing the implementation of the Science Agenda for agriculture in Africa** (guided under FARA SP 3; collaborating institution: IFPRI; author: Tshikala Tshibaka).

5. **Lessons from the CAADP country and regional processes on ARD and entry points for the application of science in the implementation of country and regional agriculture and food security investment plans** (guided under FARA SP 3; collaborating institution: SROs; author Simbarashe Sibanda).

For all the studies, the methodology included an inception meeting of the consultant(s) with the FARA Science Agenda Task Team under the leadership of the Divisional Manager and Strategic Priority Leader, Integrated Capacity Development, and Focal Persons of all the collaborating institutions for the studies. Its purpose was to enable researchers to have a common understanding of the objectives, tasks to be performed and expected outputs. The studies largely depended on review of secondary literature and data. Authors were free to come up with their own analytical frameworks that suited their study theme. The authors were invited to an author’s workshop that also served as a verification workshop given the broad representation at the workshop of key science stakeholder organizations. At this workshop, authors presented their initial findings and received expert review and comments on both quality and relevance to the operationalisation of the Science Agenda. The authors finalised their papers following the workshop.

This synthesis paper consolidates the findings from the five studies, to extract – for each strategic study area – the situation, status and recommendations for implementing the S3A in support of CAADP. The synthesis paper is organised into four broad sections as follows:

- **Section 1:** Introduction, highlighting the importance of studies in operationalising the S3A in support of implementing CAADP;
- **Section 2:** Presents an emerging framework for operationalising the Science Agenda;
- **Section 3:** Presents summaries of the major findings of the situation and status in each strategic study area; and
- **Section 4:** Presents the strategic priorities, recommendations and implications for and emerging strategy for operationalising S3A and implementing CAADP.
SECTION 2. A FRAMEWORK FOR OPERATIONALISING THE SCIENCE AGENDA

The overall framework is divided into; a) short- to medium-term focus on CAADP Level 2 result areas of increasing production, productivity, competitiveness, regional integration and sustainable natural resources management; and b) medium to long term CAADP Level 2 results priorities of building systemic science capacity that is well socialised in lives of Africans, every country developing minimum capacity to benefit from science, and Africa becoming a major global player in science and technology (see Figure 1 in Annex for the CAADP Results Framework).

The short- to long-term priorities, however, both rely on the same over-arching strategies for the S3A: a) integrating; b) connecting; and strengthening science.

Integrating sciences at national level is a key strategy that is addressed by all the companion papers to draw implications from the various perspectives; partnerships, extension and advisory service, agricultural education and training, financing science, and how all this contributes to the acceleration in implementing CAADP as well as in building long term capacity for strategic and foresight issues such as climate smart agriculture and evolving global food systems.

Connecting science and technology to farmers, producers, entrepreneurs, policy makers and consumers is arguably the most urgent strategy especially in the implementation of CAADP and its goal of attaining the ambitious 6% average annual growth in agriculture. Strengthening capacity of science in the short term will largely depend on solidarity among nations and regions as well as more effective partnerships. Strengthening capacity in the long term requires a greater integration of agricultural science into the basic sciences and in anticipating skills, facilities and policy environments capable of addressing new and evolving challenges for agriculture, food systems, nutrition and the environment. Well-integrated systems of education research and advisory services are ultimately the universal way forward.
2.1 The CAADP implementation process and implications for S3A, FARA and partners

It is important to recognise that institutions that drive science and technology in Africa (within the National Systems of Innovation, NARS, SROs, FARA, CGIAR, as well as education and extension institutions) tend to be indirectly involved in the implementation of CAADP, which is now undoubtedly the main accepted framework and vehicle for operationalising S3A. CAADP is implemented at country level through the CAADP Country Teams, the Agriculture Sector Wide Groups (ASWGs) with various oversight structures including the CAADP PPs, Joint Sector Reviews, and APRM activities. Moreover, RECs are at the forefront of CAADP implementation; yet they hardly invest in science and technology for agriculture. Herein lies the implications for FARA as the strategist and coordinator of S3A and its operationalisation.

2.2 Developing long-term strategic and foresight science capabilities

S3A commits Africa to strengthening its role as a player in global science for agriculture to drive the transformation of agriculture and society. S3A foresees Science contributing towards making agriculture in Africa more productive, competitive, sustainable, and inclusive. Scientific solutions for agricultural transformation need to be pursued further without losing sight of the fragility of African environments, the continent’s rich biodiversity and the range and complexity of its agricultural production systems. Transforming Africa’s agriculture requires a science system that produces both ‘technical’ and ‘institutional’ innovations. It is therefore essential that Science is mainstreamed as an essential part of agriculture-led social and economic transformation in Africa.

To this end, Africa’s leaders must undertake to: (i) ensure a basic science capacity in all countries of Africa, including a capacity to deliver science-based solutions on the ground; (ii) support regional centers of excellence to share knowledge and facilities; (iii) encourage and maintain the open flow of people, knowledge and resources among African countries through policies that facilitate exchanges within and beyond Africa; (iv) contribute to a new African Science for Agricultural Transformation Initiative that will provide incentives for all countries to invest in science; and (v) put the moral and financial support of the African Union and its agencies behind such national, regional and continental initiatives to transform the role of science for agriculture in Africa. Overall, the Science Agenda document articulates the framework and guidelines for:-

- Identifying the broad areas of science to be developed in partnership with the main stakeholders.
- Facilitating the necessary transformation of national science and technology institutions.
- Focusing on the need for human capacity building at all levels.
- Facilitating increased funding from diversified sources to support science.
- Facilitating alignment of actions and resources to ensure value-for-money and desirable impact.
- Facilitating effective partnerships among mandated African institutions at sub-regional and regional levels, and between these actors and their external partners.
- Committing to solidarity in science by sharing information, technologies, information, facilities and staff in pursuit of common challenges and opportunities.

One of the defining features of the Science Agenda is the premium it places on African ownership and leadership. The Forum for Agricultural Research in Africa (FARA) led the development of the S3A through a
consultative process involving the broader agricultural science community and the CAADP constituency, both within Africa and globally, as well as high-level decision-makers. The Science Agenda refers to the science, technology, extension, education, training, innovations, policy and social learning that Africa needs to apply in order to meet its evolving agricultural development goals. The Agenda identifies the key strategic issues that will impact on science and agriculture and presents a suite of high-level actions/options for increasing and deepening the contributions of science to the development of agriculture in Africa at the local, national, regional and Pan-African levels.

2.3 The challenge and the opportunity

The overarching agricultural challenge for science in Africa is that of low productivity across all farming systems. Among the main challenges are: a lack of coherent and conducive policies; none or ineffective incentives; poor access to input and output markets; predominant rain-fed agriculture; inadequate agricultural R&D spending; heavily degraded and depleted soils; problematic land tenure systems; inadequate levels of mechanisation; many pests, diseases and weeds; and climate change. African agriculture, however, has a number of major strengths: the diversity of agro ecosystems and their natural resources providing for mixed and resilient livelihoods; active rural-urban linkages and expanding domestic urban demand for agricultural products; high efficiency of smallholder agriculture given appropriate inputs and management; large and youthful population; increased investment in education; acceleration in GDP growth; effectively coordinated agricultural development policy frameworks; prevalence of pro-poor and gender sensitive policies; rapidly growing mobile and internet connectivity; and expanding provision of infrastructure.

Africa also has large agro-ecological diversity and farming systems. Of the 14 major farming systems, five host over 70% of Africa’s rural poor, and the majority of cultivated area and livestock. These are: a) Maize-mixed; b) Agro-pastoral; c) Highland perennial; d) Root and tuber Crop and e) Cereal-root crop. The Science Agenda offers options across all the major farming systems.

The global context for African agriculture is changing rapidly and will continue to present both challenges and opportunities. The increasingly unpredictable weather events, changing pattern of disease in crops and livestock, depletion of fossil hydrocarbons and consequent increase in demand for bio-fuels will further heighten the challenge. Land, water and energy sources are being rapidly depleted. These developments globally have resulted in an acute demand for land, resulting in on-going controversial large-scale land acquisitions on the African continent by foreign investors seeking alternative investment options, as well as bio-fuel and food production. These new challenges and opportunities require Africa to have greater foresight and a science strategy for managing these anticipated global changes in agriculture and food systems. Similarly, urbanisation comes with changing consumption patterns: 1) more rice and wheat (bread) at the expense of roots and tubers, 2) more high value fruits and vegetables, and 3) increasing meat, dairy and poultry consumption. The propagation of fast-food chains throughout Africa is a trend towards more processed (and in some cases less healthy) foods, thereby requiring more rigorous food safety measures and traceability systems.

By 2030, Africa will have to be a significant producer of food for the growing global population. This challenge is compounded by the fact that people worldwide are looking for healthier, safer and more nutritious foods and these are generally more costly to produce. In addition, the need to protect the environment also means
that increased production has to be achieved using less land, water and reduced use of chemicals, waste, and GHGs. Public policies, however, have been slow in responding to these trends.

In summary, the Science agenda is underpinned by important key messages:-

- Science can and should drive transformation of agriculture and society in Africa.
- Science for agriculture in Africa is too important to be outsourced. African leaders must take responsibility for the role of science in society.
- Science is essential to preserve and use Africa’s rich biological heritage, as well as indigenous and local knowledge.
- Agricultural transformation in Africa will not happen without realising the potential of women and young people.
- Now is the time to increase investments in science for agriculture in Africa, when countries have the means and opportunities to invest, and gain returns.
- African Solidarity in Science is an important dimension of the strategy for harnessing the power of science

### 2.4 CAADP priorities

The 23rd Ordinary Session of AU Assembly Summit, held in June 2014 in Malabo Equatorial Guinea, the African Heads of State and Government (HoS&G), made a series of commitments for advancing agricultural transformation on the continent targeting the next decade. Specifically, the Africa HoS&G under the Decision [Assembly/AU/Decl.1(XXIII)] adopted a Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods [Doc.Assembly/Au/2(Xxiii)].

Under this declaration, seven key commitments were made notably:-

1. Recommitment to the Principles and values of the CAADP Process.
2. Commitment to enhancing investment finance in agriculture.
3. Commitment to ending hunger in Africa by 2025.
4. Commitment to halving poverty by the year 2025, through Inclusive Agricultural Growth and Transformation.
5. Commitment to boosting intra-African trade in agricultural commodities and services.
6. Commitment to enhancing resilience of livelihoods and production systems to climate variability and other related risks.
7. Commitment to mutual accountability to actions and results.

Furthermore, the AU Joint Conference of Ministers of Agriculture, Rural Development, Fisheries and Aquaculture endorsed the Sustaining the CAADP Momentum Results Framework and the Malabo July 2014 AU Assembly endorsed the commitments on Africa Accelerated Agricultural Growth and Transformation Goals to be achieved by 2025 (3AGTGs 2025).

Under this specific Declaration, and within the commitment to a Mutual Accountability to Actions and Results, the HoS&G committed themselves to a systematic regular review process, using the CAADP Results
Framework, as an instrument in measuring, tracking and reporting on the progress made in implementing the provisions of this Declaration. Under this the HoS&G further resolved to undertake three key actions to effect this part of the declaration notably:-

1. To conduct a Biennial Agricultural Review Process that involves tracking, monitoring and reporting on progress;
2. To foster alignment, harmonisation and coordination among multi-sectorial efforts and multi-institutional platforms for peer review, mutual learning and mutual accountability;
3. To strengthen national and regional institutional capacities for knowledge and data generation and management that support evidence based planning, implementation, monitoring and evaluation.

In addition to Level 1, 2 and 3 Results as indicated in the CAADP Results Framework, African Ministers of Agriculture and Rural Development also compiled a smaller set constituting ‘priorities of priorities’ headline results. These targets now form the Dashboard Headline Indicators as follows:-

1. **Commitment to the principles and values of the CAADP process**
   i. Participatory and evidence-based policy practice and planning;
   ii. Effective partnerships between state and non-state actors;
   iii. Commitment to assess country CAADP M&E and Mutual Accountability Processes every two years;
   iv. Commitment to the CAADP Results Framework and to an Agricultural Joint Sector Review Process to be conducted every two years;

2. **Commitment to the allocation of at least 10% of public spending on agriculture**
   i. Improve agricultural budget target execution to at least 75% achievement;
   ii. At least double spending on catalytic agriculture investment (focusing on rural infrastructure, market access, technology, R &D);

3. **Commitment to zero hunger**
   i. At least double productivity (focusing on inputs, irrigation, mechanisation);
   ii. Reduce Post Harvest Losses (PHL) at least by half of current levels;
   iii. Improve Nutrition: reduce stunting by half

4. **Commit to reduce poverty through agriculture by half**
   i. Sustain annual sector growth in agricultural GDP by at least 6%;
   ii. At least double the current level of annual growth in Agricultural Total Factor Productivity;
   iii. Establish and/or strengthen inclusive public-private partnerships for at least five priority agricultural commodity value chains with strong linkage to smallholder agriculture;
   iv. Create job opportunities for at least 30% of the youth in agricultural value chains;

5. **Commitment to triple Intra-African trade in agricultural commodities and services**
   i. At least double the agriculture-based contribution to global trade;
   ii. Eliminate food-aid dependency;
6. **Commitment to ensuring at least 30% of farm and pastoral households become resilient to shocks**

   i. Ensure that at least 30% of population affected by extreme events do not suffer extreme hunger and can internally “bounce-back”.

In related Decisions and as part of emphasising their earlier commitments, and during the consideration of the Report of Heads of State and Government Orientation Committee (HSGOC) on NEPAD [Doc. Assembly/AU/9(XXIII)] the HoS&G recommitted to the 2003 Maputo Decision on CAADP and called on continued support to Member States to effectively monitor the 10% target in agriculture budget allocation. In this similar decision, the HoS&G, endorsed the CAADP Results Framework as a tool to enhance evidence-based planning, monitoring and learning by Member States in the pursuit of agricultural-led economic growth and inclusive development.

In their call for action, the HoS&G committed to an expedient process of translation of these commitments into results and called on AU Commission and NEPAD Planning and Coordinating Agency (NPCA) to develop an implementation strategy and roadmap that facilitates translation of the 2025 Vision And Goals Of Africa Accelerated Agricultural Growth and Transformation (3AGT) into concrete results and impacts, and report to the January 2015 Ordinary Session of the Executive Council for its consideration. The HoS&G finally, and among other areas, called the Development Partners to rally and align their technical and financial support in a harmonised and coordinated manner to support the implementation of the provisions of this Declaration.

While it follows that the implementation of S3A is within the CAADP Framework, there are two distinct areas that concretely come out of the above decisions that call immediate attention by, mainly AUC and NPCA.

   - The first one is the commitment to CAADP Results Framework as an instrument to measure, track and report progress on the commitments.
   - The second one is the call for the design of an implementation of a strategy and roadmap which will facilitate the translation of the 2015 vision and goals of 3AGT.

Section 4 of this report makes recommendations that include responses to the Malabo Declaration.
SECTION 3: SITUATION ANALYSIS IN STRATEGIC THEMES

3.1 Overall status of Science and its application to agriculture in Africa

Although Africa is transforming – with extensive evidence of widespread economic growth and development – there is still much that needs to be accomplished in order to move the continent out of poverty and towards prosperity and sustainable development. Undoubtedly, agriculture will remain a fundamental instrument for poverty reduction, economic growth, and environmental sustainability for the foreseeable future. Yet, despite its critical role on the continent, the agriculture sector continues to underperform. The reasons for this are myriad, complex and interrelated with no simple fix-all solutions that can be proposed. Mobilising domestic political support for agriculture, and especially for agricultural research/development, has been difficult in Africa. The overriding reason is that evidence of high payoffs to agricultural research/development on the ground in SSA is limited, despite the evidence of empirical studies suggesting high rates of return to science. The analysis of the FAO data over 45 years indicates that agricultural production in SSA has grown mainly through area expansion, while yields per hectare have essentially remained stagnant in contrast to substantial yield increases in other regions of the world between 1961/1963 and 2003/2005. Cereal yields increased only 29% compared to 177% in developing Asia and 144% in Latin America during the same period. These data point to the fact that the fundamental problem that cannot be ignored by both governments and donors, and other stakeholders alike is that, despite all the efforts and assistance, the utilisation of science results, improved technologies and best agricultural practices has been grossly limited, thus constraining significantly the growth of agricultural productivity and competitiveness in Sub-Saharan region for more than four decades.

This situation seems to justify the lukewarm attitude portrayed by several policy makers who are not totally wrong to suggest that the priority should be on resolving the bottlenecks to increasing the up-take of the available agricultural research results that are currently in the shelves of research stations across the
continent. However, what needs to be noted here is that to increase the intensity of up-take of productivity-increasing technologies and best agricultural practices, governments and other stakeholders are also to invest consistently and significantly in order to develop an enabling environment for farmers and other participants in agricultural value chains to effectively access marketing, financial, technical and information services so as to make farming profitable for businesses to provide these services.

Given important challenges, such as rapid population growth, adaptation to climate change, and the volatility of prices in global markets, investing in S3A development remains crucial in increasing agricultural productivity, enhancing food security and reducing poverty in Sub-Saharan Africa (SSA). Available empirical evidence demonstrates the potential invaluable contribution of agricultural research/development to agricultural development and poverty reduction in SSA over the past five decades. Investing in S3A will result in new technologies and best practices that will enhance the quantity and quality of agricultural outputs, leading to higher incomes, greater food security, and better nutrition.

Though the historical evidence that the reckonings to science are extensive, many countries in the region continue to grossly under-invest in agricultural scientific research. It is noted that the time-lag between investing in science and reaping its rewards is typically decades, not just years and therefore S3A will need a long-term commitment of sufficient levels of sustained funding. Science and human capital and institutional development for agriculture in many SSA countries is highly dependent on donor and development bank funding, which by nature is mostly short-term, ad-hoc and unpredictable. And this reveals that policy makers are to be persuaded of the critical importance of these three intertwined building blocks of their countries for their development to be left to the goodwill of external partners.

A review of a sample of NAIP developed under CAADP implementation framework suggests that overall most countries clearly recognise the need to increase the productivity and competitiveness of agriculture. But they do not articulate how this objective would be achieved without giving a definitive attention to science, technology and knowledge development and dissemination. Most of the plans reviewed say little about the level and source of financial resources earmarked to agriculture and to its science/technology/knowledge component. These plans provide neither details about the share of agriculture in public expenditure, nor the share of foreign assistance in the total agricultural budget. This makes it hard to carry out a meaningful evaluation of government expenditure policy. It is obvious that these investment plans were designed primarily with foreign public sector in mind as the major source of resources. The Science Agenda for agricultural transformation is too strategic to be left to the goodwill of development partners. Common sense suggests that, even without the political economic analysis of costs and benefits associated with science, investing in this sub-sector, in a way that is efficient, holistic, productive and inclusive, is not a zero-sum game, but rather a win-win operation for all the social groups in the economy.

The implementation of the Science Agenda for Agriculture in Africa demands exploiting strategic financial options for executing its programmes and projects. The 2003 Maputo Declaration committed African nations to allocating at least 10% of their national budgetary resources to agriculture. Also in 2006, a 1% national GDP contribution for S3A and development was declared. These and other declarations are however yet to be actualised as both national and continental African S3A and development is still largely dependent on donor funding. It is also important to reiterate that several similar visions of this nature have failed in Africa.

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1. The national agricultural investment plans were reviewed for the following countries: Democratic Republic of Congo, Malawi, Tanzania, Sierra Leone, Rwanda, Togo, Senegal, Uganda, Kenya, and Nigeria.
because of the lack of appropriate strategic funding strategies and options to provide the required funding to implement them. Therefore, the need is, to assure with certainty that the Science Agenda will thrive with appropriate funding support for its programmes especially from African states, the private sector and consumers of agricultural products. The study on Strategic options for financing the implementation of the Science Agenda therefore aims to provide empirical support of the appropriate financial choices to exploit in order to spearhead and sustain the Science Agenda during its implementation.

**Existing and projected basic science capacity at national levels in Africa**: The situation of science and innovation in Africa today is considered to be in a palpable crisis. In explaining the reasons for the failure of the Green Revolution to succeed in Africa as it did elsewhere in the world, one reason commentators have given is the absence of a critical mass of scientists in Africa as was the case for Asia and Latin America at the time they began to embrace the change process. In fact, it is claimed that the countries of South Asia and South-East Asia as well as China, had as many as 1000 times more scientists than many Africa countries have today. These scientists were engineers, doctors, as well as basic scientists and teachers who were able to understand the contexts in which the Green Revolution practices were effective and provided the necessary guidance to overcome obstacles as they arose. Where such indigenous capacities are lacking, even simple problems would remain and build up until the entire production base is weakened to a point that recovery is difficult, if not impossible.

It is against that background that Shem Arungu-Olende, secretary-general of the African Academy of Sciences, remarked in 2007 that “Africa’s development has been lagging behind the rest of the world because of, among other things, inadequate science and technological activities, including research and development”. According to the UN Secretary General on the occasion of the 2007 Africa Industrialisation Day, Sub-Saharan Africa’s share of world industrial output remains stagnant at less than 1 % (Ki-Moon, 2007). This is the reason African countries export their resources as basic produce to the world at low prices only to buy them back at much higher prices when industry in the developed world has added some value to the raw produce.

The question then is, what has been happening and how can this situation be reversed to raise the stature of science and also ensure its use and enhance its contribution. As has been noted earlier, many governments on the continent now have explicit science and technology policies and are working actively to reverse the trends. One indication that science education is increasing is that several African countries are actually producing more science graduates relative to their populations than many western countries. The political leadership often quote these numbers as evidence that they are investing in science and increasing the stock of scientists. But it has been shown that while the number of researchers with technical knowledge is obviously important, it is how they work that makes the difference. Agricultural development is also limited because of the sharp compartmentalisation of science and research, and the tendency of scientists and researchers to turn down opportunities to cross disciplinary boundaries (Stepman, 2012). This narrow focus of scientific research may actually discourage “fruitful collaboration necessary for solving development problems”.

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2. This section draws mainly from the paper ‘A critical review of partnerships and collaborative efforts in the context of operationalizing the Science Agenda for Agriculture in Africa’ by Ajuruchukwu Obi
3.2 Status of CAADP country process on ARD in the implementation of country agriculture and food security investment plans

3.2.1 Status of application of science in implementation in CAADP process

Areas of focus in National Agricultural Investment Plans

In qualitative terms, there is good agreement between the areas of focus of the NAIPs and the strategic thrusts of the Science Agenda when viewed at continental level. However, at individual country level, there are some gaps. For example, communication of science to ordinary citizens as well as sustainable financing of science, especially from in-country resources is far from satisfactory.

The formulation of NAIPs and their implementation need to be supported by quality data and increased knowledge sharing through the use of knowledge and innovation platforms, among other initiatives. This is an area that seems to be getting little attention in terms of investment.

The poor linkages between research, extension, agricultural education and the end-users of innovations need to be addressed by all countries where there is a tendency to consider these as separate stand-alone entities. The integration of agricultural research and extension is discussed in more detail in the paper on extension. The identified gaps would need to be addressed when the countries undertake technical reviews of their NAIPs, taking into account the potential contribution of science and technology to these areas.

Areas of focus in regional agricultural investment plans and programmes of sub-regional research organizations

Among the RECs, only ECOWAS and IGAD have developed regional compacts and agricultural investment plans. ECOWAS is largely focusing on management of natural resources, especially soil, water, forestry and fisheries management. The other areas of focus are development of supply chains for different agricultural commodities, promotion of national, regional and international trade, food security and disaster risk management and institutional capacity strengthening in gender sensitivity, policy, funding, communication, coordination and monitoring and evaluation. The ECOWAS regional agricultural investment plan has been used to guide the formulation of member country NAIPs. IGAD is focusing on sustainable use and management of natural resources, rural infrastructure and market access, improved agricultural production and food security, institutional capacity development and harmonisation of policies in the region.

COMESA and SADC have not yet developed regional agricultural investment plans. However, COMESA has a Regional Agricultural Policy (RAP) based on CAADP principles and has a focus on two strategic thrusts: removal of barriers to trade in agricultural commodities and harmonisation of policies, systems, regulations and procedures to facilitate trade with backward and forward linkages from the farmer to the market. SADC has recently formulated a RAP whose focus areas are in line with the CAADP Results Framework: production and productivity, regional and international trade and access to markets, public and private engagement and investment in agricultural value chains and reduced vulnerability food and nutrition insecurity.

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3 Mainly from paper ‘Lessons from the CAADP Country and Regional Processes on ARD and Entry Points for the Application of Science in the Implementation of Country and Regional Agriculture and Food Security Investment Plans’, by Simbarashe Sibanda,
The SROs are promoting regional initiatives that support the CAADP processes and are in line with the Science Agenda. The Conseil pour la Recherche Agricoles en Afrique/West and Central African Council for Agricultural Research and Development (CORAF/WECARD), is implementing a number of regional projects located in various countries in the region, for example rice research in Ghana, Nigeria and Liberia; yam research in Ghana, Nigeria, Togo and Benin; maize in the savannah zone of Cameroon and Nigeria; and cow peas in Mali and Sierra Leone. This facilitates information and cost sharing among countries with similar conditions. The Association for Strengthening Agricultural Research in East and Central Africa (ASARECA), is taking a similar approach in East and Central Africa.

3.2.2 Lessons learnt

Public and private funding of agriculture and Research and Development.

A few countries such as Malawi, Tanzania, Liberia and Zimbabwe presented budgets for application of science and technology, but most did not have a separate budget for agricultural research and extension. Most agricultural research is funded by external partners, while African Governments are not making enough use of fiscal policy instruments at their disposal to get the private sector to fund science. Such instruments include a combination of tax incentives, inclusive financial models and use of corporate social responsibility. A good example of how to involve the private sector is that of Rwanda which has placed private sector involvement as the top priority to drive agricultural investment and development by creating an enabling environment through reforms in policy and regulations.

Integrating, connecting and strengthening science

Every African nation seems to have in place institutions that are responsible for agricultural research and transfer of innovations. These institutions include the NARIs, universities conducting research and offering agricultural training, private sector entities with an interest in some agricultural commodities, producer/farmer organizations and non-governmental organizations (NGOs). The levels of production of innovative products of ARD from public institutions have been low, mainly due to institutional weaknesses aggravated by inadequate funding. The SROs are also better placed to coordinate activities for solidarity in science activities. Such activities would be very cumbersome and costly if undertaken by individual nations. There is need for sub regional or continental publishing platforms in Africa where scientists can publish and share cutting edge research done in Africa. They can organise and host scientific meetings at regional and pan African levels. These activities would be to increase the visibility of African agricultural research. When national systems (public or otherwise) are well linked and coordinated, it becomes easier to work with the SROs and continental and CGIAR Centers in a way that maximises returns on research investments. Alliances could then be built across countries and beyond the continent.

Technology uptake

A review of the national investment plans indicated the low uptake of agricultural technology by end users and other stakeholders, including the limited use of biotechnology. The inconsistencies in technology uptake were ascribed to out-dated agriculture research and technology dissemination frameworks as well as weak institutions for coordination and management of the sector. Moving forward, there is need to considerably increase investment in research, technology development, efficient extension and farmer
capacity development to adopt and adapt these technologies. This should include incorporation of climate smart technologies.

**Targeting and measuring the impacts of R&D**

One of the major problems limiting agricultural growth in Africa is low total factor (land, labour and capital) productivity; there is huge potential for science and innovation to address this. In Kenya, Tanzania, Uganda and Malawi, it was noted that increasing growth of the different subsectors has differential effects on poverty and spin offs to other non-agricultural sectors, although they have the same effect on agricultural GDP. Large farmers and estates, for example, dominate certain major cash crops, and increasing their output may have positive effects on exports and GDP but not necessarily on poverty and food security. On the other hand, growth in the production of commodities such as maize, resulting from improved technologies and methods, has been found to impact a wider cross-section of the population because most smallholder farmers produce maize. This dual system is largely applicable in East and Southern Africa and not so much in West and Central Africa, where cash crops such as cocoa and oil palm and food crops are both produced by smallholders. Therefore, the solution may not necessarily lie in supporting food crops rather than cash crops, but in adopting inclusive models that promote domestic market development, fair trade and build the capacity of smallholders to partner with the private sector to improve market access. This is the approach advocated by the Science Agenda.

**Knowledge and Innovation Platforms**

The importance of science in the agricultural transformation process lies in the fact that it produces new knowledge, innovations and technologies that can make farm operations easier, cheaper and cost-effective, and increases production levels. However, the products from science need to get to the farmers and other value chain actors, who, through their use, would transform economies. There is acknowledgement in the NAIPs of nearly every nation that the systems for knowledge and technology dissemination are weak. Much work has been done by the NARS which has not reached the farmers. Some of that work may not have been relevant owing to the lack of farmer and extension involvement in the setting up of the research agenda. The response by countries to this weakness has been to make policy and other interventions. Communication of science products has been weak between science institutions, individual nations and also within extension systems. There is need to improve these so as to avoid costly duplications and inefficiencies. With respect to the application of science and technology in food and agriculture development, NAIPs for countries such as Rwanda, Ghana, Mali, Uganda, Kenya, Liberia, Malawi and Gambia clearly outline the importance of increasing private sector participation in agricultural transformation through development of a platform for private sector-civil society engagement, improved coordination with development partners as well as strengthening of both intra and inter-ministerial coordination. Therefore, it is possible that private sector-derived innovations may not easily be accessible to all actors in the short-term.

**Collective action and solidarity in implementing science and technology in CAADP programmes:** The CAADP envisions a continent-wide growth in which no nation is left behind others. While challenges requiring scientific solutions may be identified at national or regional levels, action on solutions may require collaborative efforts by more than one nation. Less resourced countries would benefit if actions are carried out in solidarity. Thus the vision is of national and multinational research teams sharing facilities, human resources and ideas to conduct research on common problems. Within the NAIPs, coordination arrangements are weak in some countries. This would result in unnecessary duplication and inefficient use of resources. Regional and international cooperation in research is not explicitly stated in the agricultural strategies of the majority of the countries. However, there is evidence that some cooperation is taking place, for example, the East African Agricultural Productivity Program (EAAPP) being run in Ethiopia, Kenya, Tanzania and Uganda under the auspices of ASARECA (Government of
Kenya, 2010) and the competitive grant schemes for regional collaborative research run by both ASARECA and CCARDESA. The solidarity envisioned here could also promote mobility of African scientists from one institution to another. Nations such as Rwanda and Malawi point to shortages in skilled human capital as a constraint to addressing some researchable problems. These could benefit from mobility programmes for scientists by engaging the required expertise from another country for a specified duration. For this to happen at the scale envisaged, it could be coordinated by SROs who would keep up-to-date databases of experts on particular disciplines. The result of cross national collaboration in science is that eventually all national systems become more strengthened in comparison to what they would have been if they tried to do it alone.

3.2.3 Entry points for operationalising S3A in implementing CAADP

Most of the reviewed NAIPs identified the potential contribution of science and technology to most, if not all, priority investment areas. The FAAP largely focuses on applying agricultural research and development to improve productivity and production. However, the Science Agenda provides an overarching strategic framework to guide and rationalise investments in science by African countries, RECs and their partners as a tool for catalysing agricultural development, well beyond the issues articulated by FAAP. The S3A provides a framework for integrating areas that were traditionally not considered as “scientific” but that can benefit from the application of the scientific approaches. Possible entry points for operationalising the Science Agenda in implementing are shown in Annex Table 1.

3.3 Agricultural extension and advisory services in Africa within a science and innovation system context

3.3.1 Evolution of AEAS and their integration into science and agricultural innovation systems

The AEAS have evolved along a path that has widened their scope in all the aspects analysed in this study. The AEAS goals have retained enhancement of production and productivity at the core but the underlying rationale has been expanded from production for export during the colonial period to embracing food security and poverty reduction. The immediate objectives (AEAS impacts) through which the goals have been pursued have expanded from bringing about adoption of production and productivity enhancing technologies to addressing this in a way that also addresses systemic social, economic and natural resource utilisation issues. Hence one of the early steps in reforming the AEAS was the introduction of Farming Systems Extension and Research approaches (FSE/R). This broadened the science base of the AEAS to include the farmers’ own knowledge and other natural sciences – particularly those associated with sustainable natural resource use.

By themselves these FSE/R approaches did not bring about the needed enhancement in the adoption of technologies for attaining the goal. Analysis of the reasons – why this was the case led to the realisation that farmers needed to be active partners in the extension and research processes. Therefore approaches and methods had to change from regimented coercive ways of engaging with farmers, or patronising ways that assumed that the knowledge flow had to be one way from AEAS providers to farmers, to ways that put the farmers in the driving seat. The roles and services that AEAS providers rendered therefore changed from training farmers to facilitating farmers to make their own choices – from a comprehensive menu of technologies – according to their social and economic circumstances. The Participatory Extension Approaches (PEA) that evolved introduced the social sciences in the AEAS. The sciences that underpin building institutions through

4. This section is drawn mainly from paper ‘A Critical review and analysis of agricultural extension and advisory services in Africa within a science and innovation system context’ by Dan Kisauzi
which farmers acquire and exchange knowledge were significant elements in the sciences introduced. The integration of AEAS into agricultural innovation system was strengthened mainly from the perspective of enhanced farmer-extension-research linkages.

While the PEA approaches went some way in achieving the goal in which production and productivity were pursued for poverty reduction and food security, they were not sufficient. It was realised that benefits from enhanced production and productivity were determined by many off-farm factors, which the PEA approaches did not address. The next stage (which is the current one) in the evolution of AEAS approaches addressed this in several ways. First, value/commodity chain approaches were introduced to address off-farm bottlenecks to profitability of agricultural production. Second, innovation system approaches started to emerge that went beyond addressing on-farm and value chain issues, to looking at AEAS as integral elements in a complex system of innovation, in which the AEAS had to play an intermediating role: not only between farmers and research but also between the demanders of agricultural products (such as markets and policy makers), and institutions that support agriculture (such as financial institutions, professional networks, other development sectors). Third, and mainly as a result of a big surge in the use of modern ICT in Africa, approaches that utilise a wide range of ICTs—radio, mobile telephones and internet—are emerging. These approaches open the door for AEAS to be integrated into general science and to enhance the integration of the AEAS into agricultural innovation systems.

As the AEAS have evolved, the clients have become more diverse. Starting from the colonial and immediate post-colonial governments being the major clients, the AEAS have most significantly become increasingly more accountable to farmers and value chain actors. Furthermore, the farmers are no longer dealt with as a homogeneous category but as socially and economically differentiated in categories—most notably by gender and poverty status—so that AEAS have to be rendered differently for the different categories. One of the challenges that has been faced in all the phases of AEAS evolution is ensuring equity in the delivery of AEAS. All the approaches that were reviewed in this study appear to have fallen short in this regard.

The AEAS have evolved to deliver a diverse range of services by an equally expanding range of providers in addition to the public AEAS providers. They include, among others, non-government/community/faith-based organizations and private sector service providers. Starting from a narrow focus on technology transfer, the services now include facilitation of interactions and networking/collaboration/partnership brokerage between value chain and innovation system actors. This has precipitated the related challenges of equipping the AEAS providers with the necessary knowledge and skills, keeping them updated and ensuring quality of service provision.

The increasing complexity in all dimensions of AEAS can no longer be supported by policies that are embedded into general agricultural development policies, as was the case in the early periods of AEAS evolution. Robust policies that address AEAS in a comprehensive manner have to be developed and a number of countries have already done this.

While the funding for the AEAS still remains largely from the public sector and international donors, ways are being conceptualised for diversifying funding sources. Countries that have developed AEAS policies and strategies are explicit on the desire to gradually migrate to funding systems that bring on board private
sector and commercial funding. The funding route through social investors and crowd-funding mechanisms is entering the discussions on funding albeit not at the level of intensity that one would expect, considering the potential that these mechanisms have, for funding small projects such as those undertaken by small scale farmers and value chain actors.

### 3.3.2 Status of the effectiveness of AEAS in Africa

Empirical evidence suggests that agricultural production and productivity in Africa – the core goal of AEAS – lags considerably behind that of other continents and is below the region’s potential. However, the results of impact evaluations of most agricultural extension programmes reviewed in this study indicate that AEAS have had positive impacts on agricultural production and productivity. Adoption of improved technologies and practices is a prerequisite for improving productivity. However data on adoption of improved agricultural technologies reveal low levels of adoption in Africa. The reasons for this contradiction lie in the failure to meet the preconditions for effectiveness. Most notable are that AEAS coverage in most countries is very poor, and the coverage is not inclusive of the segments of the population that would generate high impact i.e. the women and the youth. Literature suggests that the number of AEAS providers in Africa is inadequate. The governance and management of the AEAS is poor and the incentives for AEAS providers are low. The budgets allocated for public extension services are inadequate and disbursed erratically. The knowledge and skills base of AEAS providers is weak and the majority of them do not have opportunities for continuous professional development in the light of a very dynamic and diverse demand on the AEAS.

The assessment of the evolution of AEAS points to the following as the defining characteristics of the status of the AEAS in Africa and therefore the launching pads for the S3A to engage with AEAS:

1. Expanded goals of AEAS that still maintain the core of increasing production and productivity but through impacts that do not only target technology adoption but do this in ways that address systemic social, economic and in natural resource utilisation issues, engender farmer participation and ownership, and embed them in value chains and agricultural innovation systems;
2. The technical approaches and methods that are currently in use and/or emerging through which the S3A can engage with the AEAS, are the value chain, innovation systems and reinforcing ICT-based approaches;
3. These expanded roles and services that AES providers have to offer open the door for AEAS to be integrated into science – not just agricultural science – and to enhance the integration of the AEAS into agricultural innovation systems.
4. The roles and services that AEAS providers play have changed from training farmers to facilitating farmers to make their own choices and to link them to actors within value chains and innovation systems. The providers of AEAS have also become very diverse and now include non-public actors;
5. One of the challenges that have been faced in all the phases of AEAS evolution is ensuring equity in the delivery of AEAS to all client categories. All AEAS interventions have to be explicit in ways in which this challenge is to be addressed;
6. Future evolution of AEAS has to include ways of equipping the AEAS providers with the necessary knowledge and skills, keeping them updated and ensuring quality of service provision.
The increasing complexity in all dimensions of AEAS requires that robust policies that address AEAS in a comprehensive manner are formulated and implemented.

The ambition of countries is to evolve funding mechanisms that include private sector and commercial funding. The funding route through social investors and crowd-funding mechanisms although not mentioned in the literature should also be considered.

### 3.3.3 AEAS challenges and opportunities for operationalising S3A and implementing CAADP

Challenges and opportunities were identified in the context of the S3A. The immediate priority of the S3A is implementation of CAADP. FARA has developed the Framework for African Agricultural Productivity (FAAP) as the tool to help stakeholders in implementing the CAADP Pillar IV. The FAAP lays out a number of guiding principles that articulate the best practices that should be employed to improve the performance of agricultural institutions – including AEAS. The principles are aligned with the thrusts of the S3A. Therefore the FAAP principles were used as the background for identification of the challenges and opportunities. Reviews were undertaken to assess the alignment with FAAP principles of (i) The national AEAS policies of eight African countries, (ii) The national investment plans of 10 countries, and (iii) The CAADP technical reviews of 11 countries.

Within the limitations of the small number of countries studied, the trends that the analysis of the policies reveals, is that the level of explicitness of the policies in addressing the FAAP Principles is generally good for countries – like Kenya – that have stand-alone extension policies or their equivalent. This is an opportunity that can be exploited. From the FAAP perspective, the challenging areas appear to be systematic utilisation of improved management information systems and introduction of cost sharing with end users. Generally there will be a challenge in policy implementation in ways that build on past experiences. This challenge is currently most vividly evident in Uganda. The opportunity for addressing this is that AFAAS is facilitating national AEAS actors to come together to share experiences and lessons and to have a collective voice for policy advocacy.

The AEAS feature in all the country investment plans. The variation is in the emphasis and contextualisation of the AEAS within the plans. Contextualising the plans from the S3A perspective is likely to be a challenge. However, Ghana has a plan in which the AEAS are explicitly tied to science. This can be used as an example for other countries. Generally there appears to be a challenge at the planning stage in dealing with the pre-conditions (especially poor capacity and low investment) and assumptions for effectiveness. The Ethiopia plan is an example of a plan in which capacity development for AEAS is highly emphasised. The opportunity that can be exploited generally is to utilise the capacity that AFAAS has built to support countries in CAADP investment planning processes.

The technical reviews reflect the extent to which the AEAS policies (where they exist) and FAAP principles are translated into actions in the investment plans. Unfortunately the technical reviews were silent or not clear on many aspects of the FAAP in many of the plans – which suggests that the reviews are not systematically done with respect to the AEAS. This is a challenge that has to be addressed. The review of the Uganda plan noted that the research and extension programmes are: “… exemplary in Africa for the extent to which, in most respects, they are aligned with the principles advocated by the Pillar Framework for Pillar 4”. At a conceptual level the Uganda Plan can be taken as an example of good practice in aligning AEAS plans with FAAP Principles.
From the perspective of effectiveness of AEAS, the conclusion is that the AEAS can be effective in meeting their set objectives but their effectiveness is limited by low quantitative and qualitative capacity of AEAS providers as well as by institutional and organisational constraints.

The future of the AEAS is going to be shaped by the S3A through CAADP and the FAAP. The conclusions from the assessment of national AEAS policies, CAADP investment plans and technical reviews of CAADP investment plans are:-

- Many countries do not have comprehensive AEAS policies that are aligned with the FAAP principles;
- Even countries that have AEAS polices are facing challenges in implementing them;
- AEAS stakeholders will have to come together under fora that can enable them to share experiences and to have a common voice for policy advocacy;
- The preconditions for AEAS effectiveness are not adequately addressed in CAADP investment plans;
- The technical reviews of CAADP implementation do not cover the AEAS comprehensively.

3.4 Financing the implementation of the Science Agenda for Agriculture in Africa

3.4.1 Situation of agricultural research financing in Africa

Investments in public agricultural R&D in SSA increased by 20 % between 2001 and 2008 albeit from a rather narrow base, following two decades of almost stagnant growth. This growth, however, was observed in a few large countries where funds earmarked to research were mainly used to readjust salary levels of research staff and rehabilitate infrastructure and equipment. These investment efforts in many African countries appear to be inadequate, particularly in francophone West and Central Africa, where the levels have even fallen in real terms. Agricultural R&D in SSA is primarily funded by national governments in a handful of countries, while in the majority of countries, governments are highly dependent on donors. Donor funding, together with large World Bank loans, generally supports operating costs and capital investment, but has been highly erratic.

In recent years, both traditional and new donors—notably the Bill and Melinda Gates Foundation and large emerging economies such as Brazil and China—have shown renewed interest in funding agricultural research in Africa. Although a number of countries have increased their support to agricultural R&D, overall investment levels in most SSA countries remain below the levels required to sustain viable agricultural R&D programmes that address current and future priorities.

3.4.2 Funding S3A: Commitment and ability of African countries

Notwithstanding the declared political commitments to targets for investments in agriculture, the available data reveals that most African governments and their partners pay lip service to agricultural development as portrayed by the share of the public investments extended to agriculture as well as to its research

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5 Material in this section drawn mainly from paper ‘Strategic options for financing the implementation of the Science Agenda for Agriculture in Africa’, by Tshikala Tshibaka
sub-sector. Agriculture has been under-funded across Africa over the years by national governments, donor community and private sector. It should be noted that the limited budgets most governments allocate to agriculture in sub-Saharan Africa do not necessarily imply the lack of adequate level of domestic resources that could be used to finance the development of the sector, and thus the region has no option than to rely on foreign assistance. Therefore it can be assumed that African countries have domestic resources that could be mobilised to this effect including the financing of the agricultural research and development. What is required is the design and consistent application of appropriate fiscal instruments that will mobilise and efficiently utilise some of these domestic resources.

### 3.4.3 Implementing S3A (solidarity fund): Mechanisms for raising and management of funds

Funds for S3A can also be mobilised from the private sector players engaged in business within the country where the Solidarity Fund (SF) is to be set up. Private Sector players hardly get engaged in agriculture except where this has been chosen as their line of business. Capitalisation for this FUND hinges on the contribution of the Private Sector through SCR. Be this as it may, other sources could also be tapped to capitalise for this FUND. These include a number of conventional and nonconventional sources stemming out of the fact that agriculture in Africa needs a special effort for it to be transformed. Some of these include the following:

1. Government Sources in form of grants;
2. Contributions in form of grants and loans from Private Sector and philanthropists on benevolent investment which is not expected to be tagged for market rate interest;
3. Contributions from Diplomatic Missions in the country;
4. Contributions from the Development Partners;
5. Special levies tied to extractive commodities like minerals and petroleum products in countries where these exist.

Additional options for raising revenues in-country could include:

**Income through sales and services.** This could be more of the products than services. Research agencies can increase their funding by commercialising their outputs. Agricultural R&D agencies could derive significant share of their total funding from the services they render to third parties, such as laboratory analyses or tests done in support of phytosanitary measures or traceability compliance, the sale of crop and animal products, renting out farming equipment, and so on.

**Commodity levies.** Research can also be funded through levies on agricultural production or exports. The benefits of these funding mechanisms are that farmers gain increased involvement in setting the research agenda, and the more they pay in levies, the greater the benefits they gain from the research.

**Competitive funding mechanisms.** Competitive funds have gained ground in Africa in recent years, but they remain limited compared with other developing regions around the world. These funds typically finance R&D carried out by government, higher education, nonprofit, and private-for-profit agencies through grants allocated to projects on the basis of their scientific merit and congruence with broadly defined agricultural R&D priorities. Competitive funds complement yearly appropriations from national budgets, while increasing the accountability of research and researchers.
3.4.4 Management and administration of the funds

Once the money has been mobilised, it is proposed that the fund should be administered solely as a reconstruction fund in which case, the interest rate could be subsidised or repayments deferred as a means of keeping the effective cost of capital as low as possible. In general terms, interest rates are determined against the baseline of interbank lending with a top up to take care of transaction costs and inflationary trend. These three factors are high in Africa and as such, interest rates are consequently high. However, this fund is supposed to be capitalised using a low or no interest fund, which makes the high interbank lending rate irrelevant. Thus, when enough grants have been mobilised, there is a reasonable level of flexibility. However, where enough grants and soft loans have not been attracted, the fund could end up as a mixture of grants and market value loans. In this case, the interest rate could still be much lower as a result of the interest free grant portion of the Solidarity Fund.

It is recommended that this Solidarity Fund be located in an Investment Bank. It could however be managed by a separate specialised agency which may be set up by the Innovation Platform. The Fund needs a Board or the Steering Committee but with the responsibility of managing the fund. The Board or Steering Committee considers proposals or business plans that come from Innovation Platforms for consideration for funding. The Platforms develop their business plan indicating how much money is expected to support farmers to produce the volume demanded and agribusiness players to supply the inputs required. This is brought to the Board or Steering Committee for consideration. Accepted business plans or proposals will be supported through the Fund.

3.4.5 Sustaining implementation of the S3A: funding criteria

Agricultural research and development have always been regarded as the responsibility of the State. The payment for the production and dissemination of these public goods (science, technology and knowledge) is handled by national public sector that sometimes receives the support from foreign public sector. Increased and consistent levels of funding that cover salaries, operating costs, and capital investments over the long term are needed to make national agricultural R&D more productive. Better evidence of the value of and returns to agricultural R&D investments are needed to spur stronger domestic political support. A body of empirical evidence reveals high rates of return from agricultural research/development investment (mostly in research stations). This makes agricultural research a cost-effective way to accelerate agricultural growth and development.

A number of tools can be identified to make investment in agricultural and food value chains more attractive and to reduce the high level of risks associated to agricultural investments. These tools are widely used in developed countries and have proven their efficiency for financing agriculture and can be considered as innovations to be adapted and developed to meet the financing needs, in most developing countries. Based on a review of available experiences and existing literature, the most promising mechanisms are the following: Risk Management tools and innovative credit mechanisms, Guarantee Funds for bank credit, Development Impact Bonds (DIB), Lotteries, Migrant remittances, Tobacco tax and Tax on Fertilisers. Compared to traditional approaches, this innovative financing mechanism offers several benefits which have been identified and explored by the Center for Global Development (CGD) and Social Finance. Some of the benefits include:

- Creating incentives to focus on achieving and measuring outcomes;
- Enabling donors to fund outcomes while leaving flexibility for service providers to experiment with solutions that work in different contexts;
• Leveraging support of the private sector to increase innovation and efficiency in service delivery;
• Creating mechanisms for coordinating government, private sector investors and non-government service providers;
• Transferring risk from public sector to enable earlier intervention and innovation; and
• Providing upfront funding to service providers enabling them to more easily participate in results-based contracts.

3.4.6. African Science for Agricultural Transformation Initiative (ASATI): Justification for establishment as a driver for operationalising the S3A

The overarching goal for establishing ASATI is to promote the competitiveness of agricultural research institutions in Africa by identifying and adding permanent flow of new resources for regional agricultural research. ASATI aims at greater integration of research among countries in the region. Because regional research has not been sufficiently developed, the ASATI may engage in limited capacity building where this is needed in order to achieve greater regional collaboration. ASATI will assist the agricultural institutions in each African country to:-

• Meet research challenges through cooperation, especially where the necessary scale of operations and skills are not easily available in just one country.
• Increase the level and ensure sustainability of resources for research, particularly aimed at producing public-good type technologies of regional interest.
• Encourage collaboration among research organizations within the region, between the region, and with others outside the region.
• Promote quality and innovation in research through competitive funding of research projects of cross-country interests.
• Strengthen the participation of the region in decision making in fora where international agricultural research is planned and financed.

The key benefit of ASATI would be the provision of subsidised finance to promote the reconstruction of African agricultural sector as a continental public good. Giving low interest is important to jump-starting the competitiveness of the sector.

Membership is open to all research organizations in Africa that subscribe to the basic principles of:

• Transparency. The decisions of the ASATI are guided by transparent criteria relating to its mission and objectives.
• Universal Access. The ASATI supports research leading to the production of public goods that are freely available to all, including potential beneficiaries outside membership in the ASATI. The ASATI may protect the intellectual property arising from its research and provide guidelines and systems in order to ensure free and fair use by others.

ASATI is owned and directed by its member countries and development organizations contributing to its capital endowment. All subscribing countries have a basic voice in its decisions, with additional weight in voting conferred by the size of contributions. Once the money has been mobilised, it is proposed that the
ASATI should be administered solely as a reconstruction fund in which case, the interest rate could be kept as low as possible. It is recommended that the funds collected should be lodged in a Commercial Bank and be managed by a separate specialised agency which may be set up by the Board of ASATI.

3.5 Tertiary agricultural education institutions as part of Africa’s agricultural science and innovation system

3.5.1 Current initiatives and activities driving AET in Africa

Appropriate and adequate education and training, at all levels and in many spheres, are essential for a revitalised agricultural sector. Education and training underpin all other development efforts. In realising the potential role of AET, African countries have been working to organise themselves in order to react to major emerging challenges, such as food security, population growth, urbanisation, climate change, and to address poverty reduction in the agricultural sector. A number of very important initiatives and institutions currently work to achieve these objectives. The S3A and other efforts of FARA should work in synergy with current initiatives and activities which serve as drivers for AET on the continent to drive the S3A operationalisation and CAADP implementation. These drivers include (but are not limited to): CAAPD and the recent developments in ‘Sustaining CAADP Momentum’; the NEPAD Planning and Coordinating Agency (AU/NPCA) and their efforts along with Tertiary Education for Agriculture Mechanism in Africa (TEAM-Africa) and the Agriculture Technical and Vocational Education and Training (ATVET) initiative to develop the Agricultural Education and Skills Improvement Framework (AESIF); networks such as The African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE) and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) and others. These initiatives include the key FARA capacity development programmes on Needs Assessments, Approaches and frameworks (e.g. research management: SCARDA) and on strategic human capital formation through the AHC-STAFF initiative. These high level drivers demonstrate both the scale and scope of activities on the continent to address the needs in the agricultural sector – all of them with a focus in one or other way on AET.

3.5.2 Current status of AET capacity building on African continent

Appropriate and adequate education and training at all levels is essential to bringing about change and underpins all other development efforts. Yet the current approaches to Agricultural Education and Training (AET) in Africa are largely outdated and out of touch with reality. A radical refocusing centred on building appropriate indigenous capacities of people and institutions able to work from within African contexts and with African experiences—is needed to create a uniquely African Green Revolution and to address the challenges faced by African agriculture today. Such a strategy would give large and small-scale African agricultural enterprises the capacity to exploit opportunities for access to the global agri-food business system, to effectively address food security and vulnerability through environmentally and commercially sustainable agricultural practices, and to improve agricultural governance and leadership (including enabling farm producers and women) through an interactive and responsive AET system.

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6 Material drawn mainly from paper ‘Analysis of Agriculture Education and Training (AET) for transformative change in Africa’s Science and Innovation System’ by Frans Swanepoel,
Africa has around 200 public universities today, compared to twenty in 1960. Of the current universities, around 100 offer courses in agriculture and natural resource management. Africa also has an unknown number of agricultural training colleges and farm institutes that can produce the middle-level human resources and skills critically needed for the development of the agriculture sector.

Despite the “brain drain” and cutbacks in aid for overseas training, African universities must continue to rapidly expand postgraduate programmes and research output, and curriculum reform must be underpinned by increase in research outputs and publications as well as use of locally grown knowledge and textbooks for undergraduate education. Success in this regard requires transforming Africa’s approach to AET—a process that should be informed by the valuable lessons learned from the experiences of international counterparts. Since academics in African universities typically spend about 25% of their time on research (a challenge which is also clearly highlighted in the S3A), it is important that their research address high priority national development problems rather than turning out what one university’s vice-chancellor called a “thick sludge of consultancy reports” for donors.

Therefore the critical issues include focused financing and support, the need for relevant local curricula and training, the challenges of training students abroad, as well as the value of small country linkages and regional networks. The strategic matters that need attention include the fundamental importance of a focus on gender in AET and the need to increase the use of ICT as a platform for learning within AET; implying the resolution of access to broadband and the costs of connectivity. The critical elements of a transformed AET system include focused support and financing; ensured relevance of training abroad; the returnee challenge, the critical role of incentives; and linkages between key stakeholders.

3.5.3 Challenges and constraints in the AET system

The sub-Saharan AET system has been largely neglected for at least three decades and, with some exceptions, is now inadequately prepared to address the enormous task resulting from the recognition of AET’s critical role in development on the continent. Strong alignment between the challenges highlighted in the S3A and the challenges highlighted below are noted, particularly as it relates to the lack of staff with PhD’s, the aging academic workforce, and the limited number of researchers. The most significant challenges facing the system are:

- Misalignment between demographics of graduates and SHF population
- Misalignment between type of training provided and skills needed in the workforce
- Misalignment between level of training provided and sector needs
- AET isolated from research and extension
- Poor feedback mechanisms
- Limited leadership
- Inefficient allocation of scarce resources
- Distorted enrolment pattern
- Isolated and fragmented AET institutions
- Curricula that are obsolete and disassociated from the economy
- Crisis in staffing
• Inadequate teaching facilities and outdated teaching methods
• Other challenges and constraints that now arise with the expanded focus on the agri-food value chain

AET on the continent needs to undergo transformative change in order to fulfil its mandate and reach its potential. It is necessary to consider on the one hand the balance between drivers and enablers (catalysts of change) and existing strengths in the AET system, and on the other hand drivers of vulnerabilities and constraints that act as impediments to change. This balance will differ by context—that is, by sub-region, country, institution, or set of institutions. However, there are enough commonalities to start constructing an “ideal” roadmap that can serve as a broad indication of which routes might lead to change. From this ideal road map, four critical areas for investigation and investment emerge, namely: pre-conditions and a supportive environment; relevant institutions and adequate resources; appropriately trained graduates; and, strong effective partnerships and networks for impact.

3.5.4. International evidence to inform African AET

International evidence confirms the critical role of AET in agricultural development. AET has been an integral part of national strategies in countries such as India, Brazil, Malaysia, Chile, and the Philippines that have developed their agricultural sectors successfully (Staatz and Démbele, 2008). These countries have achieved notable successes in establishing productive and financially sustainable AET systems through consistently high levels of investment in AET, both by the countries themselves and by their development partners. The analysis of these international examples of AET contributions to agricultural development identifies the following strategic pointers:-

• Direct investment at country level. Patterns across Asia and Latin America confirm that AET (and broader agricultural development) require strong country-level institutions.
• Pro-Smallholder Farmer (SHF) agricultural development as a national priority. Without sustained commitment of national governments to continuously improve and invest in the agriculture sector, donor projects are likely to fail.
• Expansion of existing, and creation of new programmes. It is important to prioritise postgraduate training to invigorate research and support national agricultural development.
• Improve quality and ensure alignment with SHF’s needs. Curricular reform efforts have successfully improved linkages with agribusiness, SHFs, natural resource management, and practical skills, exemplified by, inter alia, EARTH University in Costa Rica.
• Ensure pro-SHF decision systems. Agricultural development literature shows that the AET systems most beneficial to SHFs have actively incorporated their needs and aspirations throughout.
• Improve Agricultural Innovation Systems (AIS). Development literature indicates that the most effective pro-SHF systems closely link education and training, research and extension at national and provincial levels.
• Strengthening the funding base. In Asia, the success achieved through significant investment in agricultural R&D and AET confirms the necessity of sustained public funding for AET to achieve impact.
• AIS and decentralisation of decision-making. Land grant-style institutional structures have been critical and highly successful for AET transformation and agricultural development impact in the U.S., Japan, and India. The main reason for these successes is that the models in these countries have been demand-driven—and thus have developed “from scratch” within an enabling institutional environment.

3.6 Partnerships and collaborative efforts in the context of operationalising the Science Agenda for Agriculture in Africa

3.6.1 The FARA experience with partnerships for science

At the time FARA started its operations in the area of partnership engagement in 2008, it confronted multiple challenges across the continent. These challenges were particularly more daunting because of the fact that they differed from one sub-region to the other, requiring that approaches be tailored to each sub-region’s unique circumstances. For instance, the West and Central African Sub-region seemed probably more constrained by the non-integration of the relevant stakeholders in agricultural sector which is not much different from the preliminary finding that the East and Central Africa is possibly disadvantaged by the lack of a critical mass of expertise to engage agricultural stakeholders to achieve their development goals. For the Southern African sub-region the problem seemed to be more of low entrepreneurial spirit to absorb and translate available infrastructure and policy support into welfare-enhancing activities.

A systematic assessment by a panel of development experts revealed that the Southern African sub-region faced more severe constraints in the areas of civil society engagement and agricultural finance while the sub-region seemed to be better than the others in terms of existence of organised markets. The Western African sub-region was the best performing from a gross human and social capital standpoint when such factors as entrepreneurial spirit, human resources, and civil society engagement are considered. The sub-region was also better endowed with good natural capital than the other two sub-regions. The Eastern African sub-region seemed to be the least performing in all respects.

Going back to the broad macroeconomic and policy level impacts of the partnerships, important sources of information on the performance of international partnerships for FARA and the SROs include the copious documentation produced by FARA and the SROs themselves as well as reports of the international partners on their own activities. The World Bank and other multi-lateral agencies working on Africa’s development issues also report frequently on the continent’s progress and challenges. It is clear that the partnerships have been highly productive and have led to substantive and impressive changes in the sector and in the programming of assistance and support to individual member countries. Without a doubt, in recent years Africa has amassed sufficient human capacity to drive change. The national research capacity has grown markedly for many countries and indigenous skilled manpower have largely replaced expatriate personnel in virtually all stages of the research and programming value chain.

At the individual household level, there was scope to assess the performance of FARA’s partnerships initiatives. These initiatives have been part of diverse collaborative efforts and engagements with national and international entities. A summary of these partnership arrangements and the organizations involved

7. This section draws mainly from paper ‘A critical review of partnerships and collaborative efforts in the context of operationalizing the Science Agenda for Agriculture in Africa’ by Ajuruachukwu Obi.
in them will therefore be helpful at this stage. Table 2 presents a summary of the partnership programmes undertaken by FARA between 2008 and 2012.

**Table 2: Identification of FARA partnership arrangements**

<table>
<thead>
<tr>
<th>Micro-level Interventions</th>
<th>Meso and Macro-level Interventions</th>
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<tbody>
<tr>
<td>Dissemination of New Agricultural Technologies in Africa (DONATA)</td>
<td>Strengthening Capacity for Safe Biotechnology Management in sub-Saharan Africa (SABIMA)</td>
</tr>
<tr>
<td>Sub-Saharan Africa Challenge Programme (SSA CP)</td>
<td>Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA)</td>
</tr>
<tr>
<td>Regional Agricultural Information and Learning Systems (RAILS)</td>
<td>Universities, Business and Research in Agricultural Innovation (UniBRAIN)</td>
</tr>
<tr>
<td>Africa-Brazil Programme</td>
<td>Platform for African-European Partnership on Agricultural Research for Development (PAEPARD)</td>
</tr>
<tr>
<td>Africa Human Capital in Science, Technology and Agripreneurship for Food security Framework (AHC-STAFF)</td>
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Source: FARA Document Analysis, 2012

As Table 2 shows, FARA was undertaking eight major partnership programmes during 2008-2012. While some of these partnerships addressed policy and coordination issues at the meso and macro-levels, a good number of them targeted the grassroots with micro-level interventions designed to bring about sustained improvements in the welfare of households, especially the acutely resource-poor. The other important element of the partnership programmes was their multi-sectoral approach and multi-institutional contexts. The crucial element of forging stronger regional and continental integration and collaborations was also emphasised as in the example of the Africa-Brazil programme which aimed to put African farming systems in a position to benefit from the phenomenal know-how and experience of Brazil.

The other significant element of the FARA programmes is the way it builds and strengthens synergy between and among diverse development organizations and extends their reaches so that they are better able to serve their burgeoning clientele as deteriorating socio-economic conditions mean that more and more people join the ranks of the poor and unemployed. In this regard, the work that FARA has been doing with the CGIAR group stands out for special mention. The main initiative under the CGIAR-FARA partnership is the implementation of the CGIAR Challenge Programme.

The Sub-Saharan Africa Challenge Programme is an initiative of the CGIAR, which FARA is helping to implement by the application of the Integrated Agricultural Research for Development (IAR4D) approach. The expectation of the Consultative Group on International Agricultural Research (CGIAR) in developing the CGIAR Challenge Programmes back in the 1990s, was that they would form a platform for building “complementarities, synergies, and collective action among Research Centres”, and will foster synergies among disciplines and institutions along with a renewed commitment to change at all levels, from farmers to agro-dealers and processors and markets as well as national and international development administrators and policy makers.

FARA through the SSACP proposed and adopted the IARD approach to address the weakness of ARD resulting from the fact that it relies on the linear research-extension-adoption approach. The IAR4D approach is
expected to lead to the generation of technologies that are relevant to local conditions and are acceptable to local communities. It brings together different actors of a value chain to develop solutions that benefit all the players. Realising the expected impacts of IAR4D approach for Africa, SSA CP initiated proof of concept research in three pilot learning sites (PLS) that represent three African contexts – East and Central Africa, West Africa and Southern Africa (FARA, 2008). In each PLS there are three teams (named taskforces) working together to test the concepts of IAR4D, that is, (i) assess the usefulness of IAR4D concept in generating deliverable public goods for the end users, (ii) assess its superiority over conventional approaches and, (iii) assess its applicability as a research approach to generate more end user acceptable technologies.

Between 2008 and 2012, the SSA CP focused on generating impact in smallholder agriculture through IAR4D and was implemented through a hierarchical structure called Innovation Platforms (IP). This structure constitutes a major component of the IAR4D concept which differentiates it from conventional or other participatory approaches. It is a tool for bringing together multi-stakeholders for visioning, planning and implementing or application of new ideas, practices, services which arise through interaction, creativity, insight, empowerment, with the aim of improving the existing conditions around a common interest and or challenge and thereby bringing about desired change.

The SSA CP was established to address the past major constraints or failures of agricultural markets, inappropriate policies and natural resource degradation in Africa. The Programme aims to entrench agricultural research into a broader innovation system where knowledge from various sources can be integrated and put into use.

The specific objectives of SSA CP are to:-

- Develop technologies for sustainably intensifying subsistence oriented farming systems
- Develop smallholder production systems that are compatible with sound natural resource management
- Improve the accessibility and efficiency of markets for smallholder and pastoral products
- Catalyse the formulation and adoption of policies that will encourage innovation to improve the livelihoods of smallholders and pastoralists

FARA promoted a new approach to conduct agricultural research called “Integrated Agricultural Research for Development” (IAR4D). This approach is based on an innovation systems framework that brings together multiple actors along a commodity value chain to address challenges and identify opportunities to generate innovation. This is a network of stakeholders or partners who are able to consider the technical, economic, social, institutional, and policy constraints in an environment. The process is done through an approach called Innovation Platforms (IPs). This network facilitates research and learning that in addition to generating new knowledge, products or technologies also ensures the use of research products. This interaction among the stakeholders gives the opportunity for joint problem identification, prioritisation and innovation of viable solutions.

The SSA CP’s Meta-Analysis project focuses on the proof of concept and Pilot Learning Site (PLS) projects in the three different sub-regions of sub-Saharan Africa. This mainly involved planned and opportunity driven innovations. The SSA CP is a response to the finding by FARA that the existing linear relationship among the research, extension and farmers was an obstacle to the improvement of smallholder livelihoods. The insights gained from international experience showed that an interactive approach was best suited to the resource-poor setting of the smallholders and that such an approach would fit the Integrated Agricultural Research for
Development (IAR4D) methodologies that FARA was developing and which draws upon innovation and uses a systems perspective as its organising principle. The SSA-CP was then established as a framework by which the IAR4D could be articulated, tested, and validated. The overarching aim was to ascertain the conditions under which it works and to what extent it could be relied upon to deliver greater impact than traditional approaches.

The structure comprises three Pilot Learning Sites (PLS) covering 8 countries in the ASARECA, CORAF/WECARD and SADC-FANR sub-regions and focuses on:-

1. Delivering international public goods concerned with best practices in relation to multi-stakeholder engagement in the generation and wide-scale adoption of agricultural innovations and
2. Evaluating whether IAR4D works and is more cost-effective than conventional approaches.

Ultimately, FARA’s intention is to turn the SSA CP into a “clearing house” for promoting the adoption of IAR4D, by serving as a platform that will share information and knowledge concerning agricultural innovation and multi-stakeholder (partnership) engagement in ARD (FARA, 2012).

To assess its performance in respect to the foregoing goals, a study was conducted in 2013 to synthesise and document lessons learnt on diverse partnerships and strategic alliance programmes of the organization between 2008 and 2012. The main findings in respect to the SSA-CP in the three sub-Regions (East and Central Africa, Southern Africa and West and Central Africa) revealed that the programme has been highly successful in revolutionising the pattern of engagement of smallholder farmers by the public extension services. The evaluation exercise took note of the instrumentality of the Innovation Platforms (IPs) as the main vehicle for interpersonal, intergroup and inter-organizational collaborations and linkages that ultimately worked out to the advantage of the smallholders (Adekunle, et al., 2013). Since the SSA-CP was designed as a micro-level intervention, its performance was also assessed in terms of the changes it brought about in the lives of ordinary farmers.

Regarding how the SRO’s have fared, the limited time available allowed for only Internet search to be conducted to access information about what has been going on within their regions of influence. An assessment of the work of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) revealed that it has equally made significant impact on several fronts, including breeding work to develop improved varieties that farmers apply in their farming operations and enhancing market access for the farmers. The major interventions of the ASARECA have been through its Operational Plans (OP-1 and OP-2). These are expected to run over the period 2008 and 2017 [Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), 2014].

3.6.2 National and regional experience with partnerships

The Science Agenda foresees a major role of partnerships in integrating higher agricultural education with research and extension. Building the research, policy, service delivery and private sector capacities that will underlie the transformation – especially of small-holder-farmers in Africa – will depend critically on developing such partnerships and integrative capabilities. At national level, therefore, partnerships are a major S3A strategy for integrating and strengthening science and in connecting science to farmers, producers, entrepreneurs and consumers.

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8. This section draws from the main report of the Science Agenda.
Regional collaboration exploits natural comparative advantages through networks; allows specialisation (whether acquired or natural); and facilitates attainment of economies of scale – particularly in the use of expensive laboratory equipment and databases that are beyond the reach of individual countries. Regional collaboration is most effective when it addresses common problems that a country could not address on its own and when benefits are perceived to be shared fairly. It is important to build on the experience and expertise of Africa-based regional and sub-regional research coordination mechanisms, which have been established over the past three decades.

The Science Agenda, however, foresees a major change in the way SROs do business if Africa has to realise the S3A vision. The principal challenge of the SROs in the future is to institutionalise national funding as a basis for contribution for both their core capacity and work, and recognise the importance of increasing their support to the NARS, to reduce possibility of the research agenda being driven by the ebbs and flows of outside support. With collective support by their governments, SROs will be able to concentrate on scientific collaboration and strengthening of the NARS than on project. The S3A needs to build on the strength of sub-regional collaboration efforts to advance collective action in technology generation and use.

It is for the same reasons that S3A also foresees a major role of RECs which to date have insignificant direct interest in science and technology for agriculture. The RECs have a particularly important role to play in creating the regional environment for the Science Agenda and putting in place support to planning at the national level, sub-regional mobility and opening of trade and collaboration. All the RECs have been quite active in supporting member countries in developing the country CAADP compacts and are therefore going to play a key role in the coordination of the implementation of the science agenda in their respective sub regions. As with economic exchange, scientific mobility and economies of scale in capacity building may begin first at the sub-regional level before taking off at the continental level.

In terms of global partnerships, the S3A foresees the strengthening of current relationships with the CGIAR in particular. S3A perceives science as a global enterprise and that Africa should emulate the most productive countries scientifically since these are most strongly networked globally. From the point of view of Science in Africa, it is expected that the S3A will strengthen the framework for collaboration with global partners while, at the national level, an established programme of cross-ministerial scientific priorities will facilitate access by external partners to the differing capacities found in universities and research institutes. This may help strengthen links between university staff, national institute researchers and other actors in the national innovation system.

The CGIAR has been one of the key partners of the NARS and their SROs over the last four decades. The recent reform of the CGIAR with its new CRPs targeting collaboration on specific themes is expected to improve alignment with CAADP. The CRPs are expected to increase collaboration and reduce transaction costs for NARS in collaborating with the CGIAR, as the CRPs will enable access to packages of global knowledge and expertise targeted at specific regions and/or farming systems. The CRPs are uniquely placed to facilitate multi-level and multi-stakeholder collaboration – including capacity strengthening at national level - and align themselves with NARS partners. Africa has also had long-standing collaboration with Advanced Research Institutes (ARIs) in developed countries especially those from Europe and North America. Africa is also beginning to collaborate with a new array of bilateral partners, with advanced research institutes of their own.
through agreements with – among others – Brazil, China, India and Argentina bringing specialised scientific and eco-system specific expertise. These ARIs have been providing technical support to national institutions in Africa especially for capacity building – with some having been working in Africa for over five decades.

Multilateral programmes are also not immune to selection bias. Experience has shown that donor support to enhancement of Africa’s agricultural research and scientific capacity has tended to focus on a relatively small number of countries – often in a repetitive manner. In the absence of conscious regional measures to spread benefits, such approaches do not enhance the capacity of several neglected national systems and are thus inimical to the advancement of the Science Agenda. The need for better coordination and alignment of these ARI efforts with the support provided by the CGIAR system to Africa needs to be factored in the emerging institutional framework for the implementation of the science agenda.
4.1 Thematic options for operationalising S3A in support of CAADP

4.1.1 Recommendations for improving current CAADP processes towards implementing S3A

1. African countries should use the CAADP Results Framework and the Science Agenda to identify issues that can be addressed by science and technology, incorporate these into the NAIPs and ensure adequate budgetary provision for technology development and dissemination.

2. There seemed to be no targets in the investment plans for R&D outputs. Where resources are invested, there must be mechanisms for setting targets, metrics and KPI’s as well as systems and mechanisms measuring and recording and reporting on the outputs, outcomes and impact from the research efforts. These instruments need to be spelt out clearly in the strategic plans.

3. It was clear from the NAIPs that some priority areas are common to a number of countries, some of which may be neighbours sharing the same agro-ecological environments. In such circumstances, it is recommended that countries adopt an eco-regional approach, pool resources, conduct joint R&D activities and share the results, with assistance of the SROs.

4. There is need to strengthen sub-regional research cooperation through sub-regional groupings such as CORAF, ASARECA and CCARDESA. These bodies should be responsible for mobilising resources, forging partnerships with CGIAR Centers and conducting research on common regional
problems, becoming hubs for regional solidarity in science for agricultural development. They can host regional knowledge and information hubs, publishing forums and scientific meetings that may be too expensive and less effective when done by a single country.

5. To increase adoption of improved technologies, it is necessary for potential users of innovations to be involved in the setting up of the research agenda. This may include involvement of farmer groups and other value chain actors in the design, implementation, evaluation of agricultural research projects and participation in innovation platforms at local level.

6. Agricultural training institutions (universities and colleges) are an integral part of national innovation systems, conducting research and training research scientists and extension personnel. They have an advantage in mobilising funds for research over government institutions. It is, therefore, imperative that their research priorities are largely in-line with the national aspirations and that they too are part of the national agricultural research systems.

7. African Governments should be encouraged to invest at least 1% of GDP specifically to agricultural research and technology transfer.

8. FARA should develop guidelines for mainstreaming science into CAADP processes, specifically NAIPs.

### 4.1.2 Recommendations for AEAS for implementation of CAADP

1. AFAAS should be supported to build the capacity it needs to develop, sustain and deploy an AEAS facilitation team for CAADP technical planning and review.

2. Within the framework of CAADP and the S3A, AFAAS should be supported to facilitate the emergence and institutional development of country fora that bring AEAS actors together with one of their objectives being to advocate for AEAS policy implementation.

3. In its capacity as the continental body that is mandated to spearhead the integration of AEAS within CAADP and S3A, AFAAS should develop a strong communication, information and knowledge management capacity to enable country-level AEAS actors to share lessons, exchange experiences, and have an audible voice in dialogue on policy processes.

4. The technical reviews of CAADP should disaggregate research from AEAS and review them separately.

5. AFAAS should engage with CAADP to ensure that capacity building of AEAS providers is strongly addressed in CAADP’s current strategic theme on knowledge and knowledge management.

6. In the implementation of AEAS interventions in the S3A, AFAAS is going to be the lynchpin at regional level but its actions are going to be largely expressed at national level. It is therefore recommended that:
   
   a) A critical review of current AEAS approaches and methods – especially value chain, innovation systems and ICT-base approaches – should be undertaken to deepen the assessment of how well they have enabled AEAS to integrate science and to be integrated into agricultural innovation systems.

   b) AFAAS should develop communities of practice around all the approaches and methods being used and facilitate them to share experiences and learn practically from each other’s experiences.
c) AFAAS should endeavour to assist countries to develop AEAS policies in the way that Kenya, Liberia and South Africa have done.

d) A pool of African experts who have been engaged for AEAS policy formulation processes should be put in place (under AFAAS) to facilitate processes in other countries.

e) The FAAP principles should be re-framed so that they are explicit about integration of science into AEAS and of AEAS into agricultural innovation systems.

f) AFAAS should spearhead the development of a strategy and framework for promoting use of ICT in extension with the objective of enhancing the reach of AEAS and of increasing the efficiency of utilisation of the limited AEAS capacities in most countries.

g) AFAAS should commission a study on lesson learning from the Ethiopian experiences on accelerated human capacity development for AEAS.

h) AFAAS should take stock of how the AEAS in different countries in Africa and elsewhere are professionalising their AEAS. It should also begin to increase the awareness of the country AEAS fora on the need to initiate processes that would lead to recognition of AEAS as a science-driven profession requiring registration of AEAS providers.

4.1.3. Recommendations on AET for implementation of CAADP

1. In operationalising S3A, FARA’s AHC-STAFF initiative should feed into current initiatives and activities that serve as drivers for AET on the continent to drive the S3A operationalisation and CAADP implementation. These drivers include: AU/NPCA efforts with Tertiary Education for Agriculture Mechanism in Africa (TEAM-Africa), Agriculture Technical and Vocational Education and Training (ATVET) initiative to develop the Agricultural Education and Skills Improvement Framework (AESIF); networks such as The African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE) and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) and others.

2. Promote AET alignment with needs of smallholder farmers through curricular reform and improved linkages with agribusiness, and other needs such as natural resource management, and practical skills.

3. Invest in reforms that promote AET as part of the agricultural innovation systems (AIS), closely linking education and training, research and extension at national and provincial levels, with special emphasis on smallholder agriculture.

4. Strengthening the funding base of AET as it aligns with the above.

5. Experiment with land grant-style institutional structures that decentralise decision-making, and are demand-driven—and this may mean developing some of these “from scratch”.

4.1.4 Recommendations on financing of S3A

1. More funding for S3A should be mobilised from the private sector players engaged in business within the country.

2. Countries should explore a number of nonconventional sources of funding for science to include the following: special government grants; local philanthropy; and special levies tied to extractive commodities like minerals and petroleum products.
3. Income through sale of products and services where effective market exists for such;
4. Competitive funding mechanisms especially targeting AET institutions.
5. Levies on commodities that have gone sufficiently commercial. Based on a review of available experiences and existing literature, the most promising mechanisms are the following: Risk Management tools and innovative credit mechanisms, Guarantee Funds for bank credit, Development Impact Bonds (DIB), Lotteries, Migrant remittances, Tobacco tax and Tax on Fertilisers. Compared to traditional approaches, this innovative financing mechanism offers several benefits which have been identified and explored by the Center for Global Development (CGD) and Social Finance, including creating incentives to focus on achieving and measuring outcomes.
6. Enabling donors to fund outcomes while leaving flexibility for service providers to experiment solutions that work.
7. Leveraging support of the private sector to increase innovation and efficiency in service delivery.
8. Creating mechanisms for coordinating government, private sector investors and non-government service providers.
9. Transferring risk from public sector to enable earlier intervention and innovation.
10. Providing upfront funding to service providers enabling them to more easily participate in results-based contracts.

4.1.5 Recommendations on partnerships for operationalising S3A

1. Given that in recent years Africa has amassed sufficient human capacity to drive change, and that the national research capacity has grown markedly for many countries and indigenous skilled manpower has largely replaced expatriate personnel in virtually all stages of the research and programming value chain, Africans need to better organise and mobilise more local partnerships to drive technology and innovation for agriculture;
2. FARA should build on its existing partnership agreements in the operationalisation of S3A. These current partnership programmes are strong in their multi-sectoral and multi-institutional approaches.
3. The CRPs should place more emphasis on strengthening capacity of NARS and SROs than before, while placing priority on targeting collaboration on specific themes as expected to improve alignment with CAADP. The CRPs must facilitate multi-level and multi-stakeholder partnerships.
4. The SSA CP, an initiative of the CGIAR, that FARA and its application of the IAR4D approach, should be upgraded to form the basis for science and technology support to CAADP implementation.
5. Partnerships at national and regional level should be driven by the IAR4D approach with the expectation to generate technologies that are relevant to local conditions and are acceptable to local communities, and achieving impact by bringing together different actors of a value chain to develop solutions that benefit all the players.
6. FARA and its partnerships at national and regional levels should promote the establishment of IPs derived from the application of IAR4D, especially for technology and knowledge support for smallholder farmers. IPs have been proven effective for interpersonal, intergroup and inter-organisational collaborations and linkages that ultimately worked out to the advantage of the smallholders.
7. The SROs may have to undergo major changes in the way they do business with the idea of realising the S3A vision. There is need to institutionalise national funding for both their core capacity and work, and recognise the importance of increasing their support to the NARS, to reduce possibility of the research agenda being driven by the ebbs and flows of outside support. With collective support by their governments, SROs will be able to concentrate on scientific collaboration and strengthening of the NARS than on projects. The S3A needs to build on the strength of sub-regional experiences in collaboration efforts to advance collective action in technology generation and use.

8. RECs have to play a more direct and catalytic role in science and technology than hitherto. Moreover RECs are on the forefront of CAADP implementation support and have therefore to play the coordination role for the implementation of the science agenda in their respective sub regions. As with economic exchange, scientific mobility and economies of scale in capacity building may begin first at the sub-regional level before taking off at the continental level.

4.2 Summary of S3A Specific Strategic Tasks

Further translation of the strategic areas identified in the previous section into specific tasks that should be followed in implementing the S3A yields the following tasks:

1. Plan for Deploying S3A Vision;
2. Companion Study on Basic Science Capacities;
3. Craft Blue-Print for Developing Long Term Science Capacities for Africa;
4. Develop Country Guidelines for Mainstreaming S3A in CAADP RF Implementation, Level 1, Level 2;
5. Strategy for S3A to Connect National and Regional Structures and Processes Between S&T and CAADP;
6. Develop and deploy AEAS Facilitation Process for CAADP investment plans and implementation;
7. Programme for alignment of AET initiatives: TEAM-Africa, ATVET, AESIF, AHC-TAFF, ANAFE and RUFORUM initiatives;
8. Craft AET Reform Agenda that promote AET as AIS;
9. Guideline for Leveraging NSAs to Increase Innovation, Service Delivery and Funding Including Non-conventional Sources of Finding and Levying Extractive Industries;
10. Executive Leadership Programmes for:
   a) Building Basic Science Capacity;
   b) Operationalising Regional Centres of Excellence;
   c) Opening Flow of People, Knowledge and Resources;
   d) Mobilising Investment;
11. Transformation Model for Science Institutions;
12. Develop Plan and Proposal for SROs Direct Participation With RECs in Building Knowledge and Innovation Platforms for CAADP Implementation;
13. Strategy, Blueprint, Plan and Budget for Strengthening National Science Capabilities;
14. Formulating Blueprint for Workforce Development for a Modern African Food System up to 2040; and,
15. Fuse all above into the 3 SPs of FARA MTOP.
4.3 Draft operationalisation strategy for the S3A

In operationalising S3A, FARA has to complete a number of strategic plans and execute these including the following: deploying S3A Vision; blue-print for developing long term science capacities for Africa; country guidelines for mainstreaming S3A as part of CAADP Results Framework implementation at Level 3 and 2; plan and support for SRO’s direct participation with RECs in building knowledge and Innovation Platforms for CAADP implementation. Overall, FARA needs a concise and well thought through strategy for: integrating, strengthening, and connecting science to farmers, producers and entrepreneurs. FARA has to work closely with AUC, NEPAD and RECs in fleshing out the S3A operationalisation strategy in line with the Malabo Declarations, and especially through implementation of the Sustaining CAADP Results Framework. The specific actions for FARA are as follows:

1. **Establish S3A Steering Group:** There is need for FARA – in collaboration with key stakeholders (eg. AUC/NEPAD, SROs, PAFO, CGIAR) – to establish a Steering Group for the Operationalisation of the S3A. The Steering Group’s main task is to finalise and oversee the implementation of this strategy.

2. **The Malabo Declaration 2015 vision and goals of Africa Accelerated Agricultural Growth and Transformation (3AGT)** have two distinct implications for FARA and the operationalisation of S3A:
   a) A commitment to CAADP Results Framework as an instrument to measure, track and report progress on the S3A commitments; and
   b) The need to participate effectively in the design and implementation of a strategy and roadmap, with emphasis on the role and process of S3A in the translation of the 3AGT. The overall framework for operationalising S3A is divided into:
      i. Short to medium term focus on CAADP Level 2 results of increasing production, productivity, competitiveness, regional integration and sustainable natural resources management; and
      ii. Medium to long term CAADP Level 3 results priorities of building systemic science capacity that is well socialised in lives of Africans, every country developing minimum capacity to benefit from science, and Africa becoming a major global player in science and technology.

3. **Develop a concise overarching strategy and theory of change for:**
   a) integrating;
   b) connecting; and
   c) strengthening science.

The poor linkages between research, extension, agricultural education and the end-users of innovations need to be addressed by all countries where there is a tendency to consider these as separate stand-alone entities. Connecting science and technology to farmers, producers, entrepreneurs and consumers is arguably the most urgent strategy especially in the implementation of CAADP and its goal of attaining an ambitious 6% average annual growth in agriculture. Strengthening capacity of science in the short-term will largely depend on solidarity among nations and regions as well as more effective partnerships. Strengthening capacity in the long term requires a greater integration of agricultural science into the basic sciences and in anticipating skills, facilities and policy environments capable of addressing new and evolving challenges for agriculture,
4. Support and strengthen science and technology interventions for CAADP NAIPs implementation:
   a) Develop a S3A Country Implementation Guidelines aligned to and driven by the country CAADP NAIP working across stakeholder groups. A review of a sample of NAIPs suggests that overall most countries recognise the need to increase the productivity and competitiveness of agriculture. But they do not articulate how this objective would be achieved without paying a definitive attention to science, technology and knowledge development and dissemination. The formulation of NAIPs and their implementation need to be supported by quality data and increased knowledge sharing through the use of knowledge and innovation platforms, among other initiatives. This is an area that seems to be getting little attention in terms of investment.
   b) Support SROs to align better with RECs agenda on CAADP. SROs are promoting regional initiatives that are in line with the Science Agenda but not well aligned with RECs implementation agenda on CAADP. FARA has to provide leadership to better connect SROs with REC CAADP agenda.

5. Verify the identified entry points for operationalising S3A in implementing CAADP and share through technology exchange platforms.
   a) Improved inputs (germplasm, pest and diseases control, reducing post-harvest losses, mechanisation etc). Applying existing and new technologies for maintaining and improving the management of the production base (land/soil, water, forestry, fisheries and wildlife).
   b) Applying results of past experiences and market research and development, including market information, food safety and standards, mechanisms to reduce transaction costs, post-harvest handling, processing, and infrastructure such as feeder roads, storage, processing facilities, public-private partnerships and inclusive market access models.
   c) Value chain studies, product development and support for local small-scale agro-processing; Entrepreneurship and business development for smallholder farmers and promotion of investment by private sector following needs assessments and analysis of potential returns on investment.
   d) Promotion of private sector investment through catalytic public investments to reduce risk and initial cost of entry and use of fiscal instruments such as tax incentives on rural investments and corporate social responsibility projects.

6. Craft a S3A results framework derived from the above.

7. Strengthen partnerships for operationalising S3A: FARA should build on its existing partnership agreements in the operationalisation of S3A. Dissemination of New Agricultural Technologies in Africa (DONATA); SABIMA; SSA CP; Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA); Regional Agricultural Information and Learning Systems (RAILS); Universities, Business and Research in Agricultural Innovation (UniBRAIN). The CRPs should place more emphasis on strengthening capacity of NARS and SROs than before, while placing priority on targeting collaboration on specific themes as expected to improve alignment with CAADP. The SSA CP should be upgraded to form the basis for science and technology support to CAADP implementation.
8. **Adopt and promote reforms in the agricultural extension and advisory services (AEAS) in Africa within a science and innovation system context.** Work with AFAAS and other players to develop and share models of Participatory Extension Approaches (PEA) that evolved introducing the social sciences in the AEAS. This should strengthen the agricultural innovation system in support of technical change in smallholder agriculture.

   a) ASATI is a vehicle to ensure that no country is left behind, and that each country has a minimum capacity to address the needs of the agriculture based on deeper needs and problem analysis.
   b) Strengthening systemic capabilities at all levels, more especially in rebuilding the sharing, collaborative and learning capabilities, including how to be innovative in doing science
   c) Promoting technology platforms especially for smallholder farmers.

10. **Mainstreaming and promoting the Science Agenda**
   • Strengthening African ownership and leadership of the Science Agenda.
   • Social marketing S3A so that farmers, producers, and rural entrepreneurs and consumers come closer to science, as the processes of science become more appealing to rural societies.
   • Identifying appropriate channels for communication (mass media, electronic media, workshop and conferences).
   • Use of African and non-African Champions and Ambassadors to sell the S3A.

11. **Mobilise investments in public agricultural R&D in SSA:**
    Investments in agriculture research have increased by 20% between 2001 and 2008 albeit from a rather narrow base, following two decades of almost stagnant growth. This growth, however, was observed in a few large countries and investment efforts in many African countries appear to be inadequate and highly dependent on donors. It can be assumed that African countries have domestic resources that could be mobilised and more funding for S3A should be mobilised from the private sector. Countries should explore a number of nonconventional sources of finding for science to include the following:-
    • Special government grants; local philanthropy; special levies tied to extractive commodities like minerals and petroleum products.
    • Income through sale of products and services where effective market exists for such; competitive funding mechanisms especially targeting AET institutions; levies on commodities that have gone sufficiently commercial.

12. **Finalise a reform agenda for the Tertiary Agricultural Education and Training (AET) institutions in Africa with the broader participation of the main stakeholder groups:**
    AET has been an integral part of national strategies in countries such as India, Brazil, Malaysia, Chile, and the Philippines that have developed their agricultural sectors successfully. The AET system in Africa therefore needs reforms and strengthening, particularly as it relates to the lack of staff with PhD’s, the aging academic
workforce, and the limited number of researchers, and curricula that are obsolete and disassociated from the economy.

**CONCLUSION**

FARA has to complete a number of strategic plans and execute these with priority on supporting implementation of CAADP Results Framework. The overarching strategy is about integrating, strengthening, and connecting science to farmers, producers, entrepreneurs and policy makers. FARA has to establish a S3A Steering Group that guides and supports FARA in working with AUC, NEPAD and RECs in fleshing out the S3A operationalisation strategy in line with the Malabo Declarations, and especially through implementation of the Sustaining CAADP Results Framework.

**REFERENCES**


ANNEXES

Annex 1: Summary of CAADP results framework

**Level 1 - Agriculture's Contribution to Economic Growth and Inclusive Development**

- Increased contribution to wealth creation
- Economic opportunities and prosperity - jobs and poverty alleviation
- Improved food security and nutrition for all
- Increased access to productive safety nets
- Environmental and ecosystems resilience and sustainability

Assumption: Countries follow an agriculture-led, inclusive growth strategy for social and economic transformation

**Level 2 - Agriculture Transformation and Sustained Inclusive Agricultural Growth**

**Main assumptions:** Systemic capacity for transforming agriculture as envisaged in Level 3 results is attained

- 2.1 Increased agricultural production and productivity
- 2.2 Better functioning national & regional agriculture and food markets & increased intra/inter-regional trade
- 2.3 Expanded local agro-industry and value addition in agricultural products
- 2.4 Improved management, governance and sustainable use of natural resources for sustainable agricultural production

**Level 3 - Strengthening Systemic Capacity for Effective Execution and Delivery of Results**

Conducive policy environment; systemic capacity building; improved technologies and access to knowledge and information

- 3.1 Effective and Inclusive policy design and implementation (policy practice) capacity
- 3.2 More effective and accountable institutions including human capital development
- 3.3 Strengthened capacity for evidence-based planning, implementation & review process
- 3.4 Improved coordination partnerships and multi-sectorialism in agriculture and agriculture related sectors
- 3.5 Increased (volume and quality) of public and private investments in agriculture value chains
- 3.6 Increased statistical capacity to generate data (monitor), analyse as well as strengthen capacity for research and innovations in agriculture

- 3.7 COMMITMENT TO PRINCIPLES AND VALUES OF CAADP PROCESS: IMPLEMENTATION GUIDELINES; KNOWLEDGE POOLS, CAPACITY BUILDING, PEER REVIEW MECHANISMS
### Annex Table 1: Possible entry points for the Science Agenda in National Agriculture Investment Plans

<table>
<thead>
<tr>
<th>Priority areas</th>
<th>Possible entry points for the Science Agenda</th>
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| Increased production and productivity                      | • Application of existing and novel technologies to increase efficiency and competitiveness in commodities of comparative advantage.  
• Technologies include those related to use of improved inputs (germplasm, pest and diseases control, reducing post-harvest losses, mechanisation etc).                                                                                                                                                    |
| Improved management of natural resources for sustainable agriculture production | • Applying existing and new technologies for maintaining and improving the management of the production base (land/soil, water, forestry, fisheries and wildlife).                                                                                                                                                                                                 |
| Better functioning national agriculture and food markets and increased intra/inter-regional trade | • Applying results of past experiences and market research and development, including market information, SPS issues, food safety and standards, mechanisms to reduce transaction costs, post-harvest handling, processing, and infrastructure such as feeder roads, storage, processing facilities, public-private partnerships and inclusive market access models. |
| Empowered and expanded local agro-industry and value addition | • Value chain studies, product development and support for local small scale agro-processing.                                                                                                                                                                                                                                                                       |
| Increased investments in agriculture (commercialisation)   | • Entrepreneurship and business development for smallholder farmers, and promotion of investment by private sector, following needs assessments and analysis of potential returns on investment.  
• Promotion of private sector investment through catalytic public investments to reduce risk and initial cost of entry and use of fiscal instruments such as tax incentives on rural investments and corporate social responsibility projects. |
| Food and nutrition security and safety nets                | • Application of lessons and research on DRRM, early warning systems, integration of nutrition into food security and disaster risk reduction and management strategies, use of agriculture-based social safety nets and food for assets programmes.                                                                                                      |
| Creating an enabling environment for agricultural growth and increased contribution to development | • Evidence-based policy formulation to support developments in other priority areas:  
• Promotion of private sector participation in agricultural value chains.  
• Coordination of agricultural sector actors, institutional capacity building for rural public and local level institutions.  
• Provision of timely agricultural statistics and related information.  
• Capacity building and coordination of agricultural research and extension systems, training of farmers and agricultural personnel (researchers and extension agents).  
• Development of national and regional knowledge and innovation platforms to communicate and share scientific information and lessons.  
• Empowerment of women and youth through improved access to rural business and employment opportunities. |
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADC</td>
<td>Agricultural Development Centres</td>
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<tr>
<td>ADS</td>
<td>Agriculture Development Strategy</td>
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<td>AEAS</td>
<td>Agricultural Extension and Advisory Services</td>
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<td>AFAAS</td>
<td>African Forum for Agricultural Advisory Services</td>
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<td>AGRA</td>
<td>Alliance for a Green Revolution in Africa</td>
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<td>AIS</td>
<td>Agricultural Innovation Systems</td>
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<tr>
<td>ARD</td>
<td>Agriculture Research and Development</td>
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<tr>
<td>ASARECA</td>
<td>Association for Strengthening Agricultural Research in East and Central Africa</td>
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<tr>
<td>ATVET</td>
<td>Agricultural Technical and Vocational Education and Training</td>
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<tr>
<td>AU</td>
<td>African Union</td>
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<tr>
<td>AUC</td>
<td>African Union Commission</td>
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<tr>
<td>CAADP</td>
<td>Comprehensive Africa Agriculture Development Programme</td>
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<tr>
<td>CBO</td>
<td>Community Based Organisation</td>
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<tr>
<td>CCARDESA</td>
<td>Centre for Coordination of Agricultural Research for Development in Southern Africa</td>
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<tr>
<td>CGIAR</td>
<td>Consultative Group for International Agricultural Research</td>
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<td>CORAF</td>
<td>Conseil pour la Recherche Agricoles en Afrique</td>
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<tr>
<td>CPD</td>
<td>Continuous Professional Development</td>
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<tr>
<td>CRP</td>
<td>CGIAR Research Programme</td>
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<td>CYMMYT</td>
<td>International Maize and Wheat Improvement Centre</td>
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<tr>
<td>DFID</td>
<td>Department for International Development</td>
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<td>DRC</td>
<td>Democratic Republic of Congo</td>
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<td>ECOWAS</td>
<td>Economic Community of West African States</td>
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<td>EU</td>
<td>European Union</td>
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<td>FAAP</td>
<td>Framework for African Agricultural Productivity</td>
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<td>FAO</td>
<td>Food and Agriculture Organisation</td>
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<td>FARA</td>
<td>Forum for Agricultural Research in Africa</td>
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<td>FBO</td>
<td>Faith Based Organisation</td>
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<td>FFS</td>
<td>Farmer Field School</td>
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<td>FSR/E</td>
<td>Farming Systems Research/Extension</td>
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<td>FTC</td>
<td>Farmer Training Centre</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GFRAS</td>
<td>Global Forum for Rural Advisory Services</td>
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<td>HOS</td>
<td>Heads of State</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technology/ies</td>
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<td>IDA</td>
<td>International Development Agency</td>
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<td>IEG</td>
<td>Independent Evaluation Group</td>
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<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<td>IMF</td>
<td>International Monetary Fund</td>
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<tr>
<td>IP</td>
<td>Investment Plan</td>
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<td>MTOP</td>
<td>Medium-Term Operational Plan</td>
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<td>NAADS</td>
<td>National Agricultural Advisory Services</td>
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<td>NAIP</td>
<td>National Agriculture Investment Plan</td>
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<td>NARS</td>
<td>National Agricultural Research System</td>
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<td>NEPAD</td>
<td>New Partnership for African Development</td>
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<td>NGOs</td>
<td>Non Governmental Organisations</td>
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<td>NPCA</td>
<td>NEPAD Planning and Coordinating Agency</td>
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<td>NSF</td>
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<td>Poverty Reduction Strategy Paper</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>RDS</td>
<td>Rural Development Strategy</td>
</tr>
<tr>
<td>REC</td>
<td>Regional Economic Community</td>
</tr>
<tr>
<td>S&amp;T</td>
<td>Science and Technology</td>
</tr>
<tr>
<td>S3A</td>
<td>Science Agenda for Agriculture in Africa</td>
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<tr>
<td>SAP</td>
<td>Structural Adjustment Programme</td>
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<tr>
<td>SIDA</td>
<td>Swedish Agency for International Development</td>
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<tr>
<td>SP</td>
<td>Strategic Priority</td>
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<tr>
<td>SRO</td>
<td>Sub-regional Research Organisation</td>
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<tr>
<td>ToT</td>
<td>Transfer of Technology</td>
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<tr>
<td>UFAAS</td>
<td>Uganda Forum for Agricultural Advisory Services</td>
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<tr>
<td>UKAID</td>
<td>United Kingdom Agency/Department for International Development</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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About FARA

The Forum for Agricultural Research in Africa (FARA) is the apex continental organization responsible for coordinating and advocating for agricultural research-for-development (AR4D). It serves as the entry point for agricultural research initiatives designed to have a continental reach or a sub-continental reach spanning more than one sub-region.

FARA serves as the technical arm of the African Union Commission (AUC) on matters concerning agricultural science, technology and innovation. FARA has provided a continental forum for stakeholders in AR4D to shape the vision and agenda for the sub-sector and to mobilise themselves to respond to key continent-wide development frameworks, notably the Comprehensive Africa Agriculture Development Programme (CAADP).

**FARA’s vision:** Reduced poverty in Africa as a result of sustainable broad-based agricultural growth and improved livelihoods, particularly of smallholder and pastoral enterprises.

**FARA’s mission:** Creation of broad-based improvements in agricultural productivity, competitiveness and markets by continental-level strengthening of capacity for agricultural innovation.

**FARA’s value proposition:** Strengthening Africa’s capacity for innovation and transformation by visioning its strategic direction, integrating its capacities for change and creating an enabling policy environment for implementation.

FARA’s strategic direction is derived from and aligned to the Science Agenda for Agriculture in Africa (S3A), which is, in turn, designed to support the realisation of the CAADP vision. FARA’s programme is organised around three strategic priorities, namely:

- **Visioning Africa’s agricultural transformation** with foresight, strategic analysis and partnerships to enable Africa to determine the future of its agriculture, with proactive approaches to exploit opportunities in agribusiness, trade and markets, taking the best advantage of emerging sciences, technologies and risk mitigation and using the combined strengths of public and private stakeholders.

- **Integrating capacities for change** by making the different actors aware of each other’s capacities and contributions, connecting institutions and matching capacity supply to demand to create consolidated, high-capacity and effective African agricultural innovation systems that can use relative institutional collaborative advantages to mutual benefit while also strengthening their own human and institutional capacities.

- **Enabling environment for implementation**, initially through evidence-based advocacy, communication and widespread stakeholder awareness and engagement and to generate enabling policies, and then ensure that they get the stakeholder support required for the sustainable implementation of programmes for African agricultural innovation.

Key to this is the delivery of three important results, which respond to the strategic priorities expressed by FARA’s clients. These are:

**Key Result 1:** Stakeholders empowered to determine how the sector should be transformed and undertake collective actions in a gender-sensitive manner

**Key Result 2:** Strengthened and integrated continental capacity that responds to stakeholder demands within the agricultural innovation system in a gender-sensitive manner

**Key Result 3:** Enabling environment for increased AR4D investment and implementation of agricultural innovation systems in a gender-sensitive manner

FARA’s development partners are the African Development Bank (AfDB), Bill and Melinda Gates.