



BACKGROUND PAPER

An Action Agenda for Science Technology and Innovation (STI) in driving an Agriculture-led Economic and Social Transformation of Africa

Research and Development

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Abbreviations and Acronyms

3AGT	Accelerated African Agricultural Growth and Transformation
AATF	African Agriculture Technology Foundation
AFAAS	African Forum for Agricultural Advisory Services
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
ANAFE	The African Network for Agriculture, Agroforestry and Natural Resources Education
ARAS	Agriculture and Rural Advisory Services (ARAS)
ARCN	Agriculture Research Council of Nigeria
ARI	Advanced Research Institutions
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AU	African Union
AUC	African Union Commission
BecA	Biosciences eastern and central Africa
CAADP	Comprehensive Africa Agriculture Development Programme
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CGIAR	Consultative Group for International Agricultural Research
CILSS	Comité permanent Inter-Etat / Permanent Interstate Committee for the Fight against Drought in the Sahel
CORAF/WECARD	West and Central African Council for Agricultural Research and Development
CRPs	CGIAR Research Programmes
ECOWAS	Economic Community of West African States
FAO	Food and Agricultural Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FBO	Farmer-Based Organization
FTE	Full Time Equivalent
FtF	Feed the Future
GFAR	Global Forum for Agricultural Research
GHG	Green House Gases
IAR4D	Integrated Agricultural research for Development
IARCs	International Agricultural Research Centres
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute

IITA	International Institute of Tropical Agriculture
IS&RM	Implementation Strategy and Roadmap
M&E	Monitoring and Evaluation
MoU	Memorandum of Understanding
NAFSIP	National Agricultural and Food Security Investment Plan
NARI	National Agricultural Research Institute
NARS	National Agricultural Research Systems
NCOS	National Centres of Specialization
NEPAD	New Partnership for Africa's Development
NPCA	NEPAD Planning and Coordination Agency
PAFO	Pan African Farmers Organizations
PPP	Public-Private Partnership
R&D	Research and Development
RCoEs	Regional Centres of Excellence (RCoE),
REC	Regional Economic Community
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SMEs	Small and Medium Scale Enterprises
SPS	Sanitary and Phyto-Sanitary
SROs	Sub-regional Agriculture Research Organisations
SSA	Sub Saharan Africa
STI	Science, Technology and Innovation
STISA	Science, Technology and Innovation Strategy for Africa
UEMOA	Union Economique et Monétaire Ouest Africaine / West African Economic and Monetary Union
UniBRAIN	Universities, Business and Research in Agricultural Innovation
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WAAPP	West Africa Agricultural Productivity Programme
WASP	West African Seed Program

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Executive Summary

Introduction/Background: This “Research and Development” Work Stream Paper addresses issues of R&D or STI that are central to the broader vision of ‘*AN AFRICAN AGRICULTURAL TRANSFORMATION AGENDA: Towards a Strategy for Building a Strong Agricultural Sector in Africa*’. The idea of building an effective and better “agricultural Innovation Systems’ has taken root in capacity building efforts for African R&D institutions, at national and regional level in Africa. The rationale for STI is that --only when the knowledge is converted into products and processes and used by the society in an economically and socially meaningful way, it becomes an innovation. Research is an integral part and sits at the front end of innovation. ‘Institutional innovation’ is just as important as ‘technical innovation’ in transforming African agriculture.

In line with the STI approach, the AU Summit (June 2014, Malabo) adopted the Science Agenda for Agriculture in Africa (Science Agenda) as central to implementing the CAADP national agricultural investment plans and priorities. Moreover the Malabo Declaration includes the targets to eliminate hunger and halve poverty by 2025 through agriculture- both targets of which are only achievable by leveraging STI/R&D significantly. The Science agenda is underpinned by important key drivers which include: science for agriculture in Africa is too important to rely only on external sources of knowledge; African leaders must take responsibility for the role of science in society the current economic climate offers the best opportunity for investments in science for agriculture. African synergy and solidarity for Science is the most significant strategy in achieving the vision. Africa reinforce its commitment to fulfil its role as a global player in aspects related to science for agriculture and development.

Africa’s key stakeholders at regional and continental levels on issues of STI have developed strong networks and partnership on the Science Agenda and these include: AUC, NEPAD Agency, FARA, SROs, RECs, AATF, AFAAS, RUFORUM and ANAFE, PAFO and agribusiness networks. At international level partnerships include: the GFAR, CGIAR Centres, other Advanced Agricultural Research Organizations and key multilateral organizations, notably the European Commission, the World Bank, FAO and IFAD.

Challenges: The overarching agricultural challenge for science in Africa is that of low productivity, competitiveness and value addition across all farming systems and value chains. This overarching challenge is linked to the following factors such as the following poor incentives, poor access to input and output markets; predominant rain fed agriculture; inadequate investments in agricultural R&D; heavily degraded and depleted soils; problematic land tenure systems; inadequate levels of mechanization; gender inequality postponing women and lack of inclusion of youth, considerable biophysical limitations including pests, diseases, weeds and climate change issues. Critical to the sub-regions is the absence of effective institutions for supporting R&D initiatives in a sustainable manner. 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 biofuels will further heighten the challenge. Land, water and energy sources are being rapidly depleted.

Africa is urbanising with minimal industrialisation. The rapid urbanisation of the continent is driven by services. The large numbers of people migrating from rural to urban areas are being absorbed mostly into services and not manufacturing as Africans escape the drudgery and low productivity of smallholder agriculture and the rural economy. Currently there are 1.2 billion people in Africa; the population will double to 2.4 billion by mid-century, eventually reaching 4.2 billion by the end of the century. In 2010, there were 414 million people in the Sub-Saharan Africa region who were living in poverty.

Opportunities: Opportunities in Africa start with vibrant demographic dynamic that offers increasingly high and effective demand for food. Both smallholders and other intermediary groups are the main suppliers of food to this growing urban population. Since the current process of urbanization only an incipient industrialization accompanying it, a ‘rural industrialization’ strategy offers Africa another route to eventually grow urban industry. The Science Agenda aligns with the positive school of thought and has the vision that by 2030, Africa will have to be a significant producer of food for the growing global population. Africa is more optimistic of the future, following an unprecedented decade of impressive economic growth across the continent, of improved governance, and of improvement in human development indicators. Africa has land, water and human resources good enough to be a significant contributor to the world’s food balance sheet. Moreover there is some evidence that other positive things are happening with African agriculture. Since 2003, many governments have increased their budgetary allocations to agriculture, and average agricultural growth rates across the continent have exceeded 3.6%. African post-harvest losses average 40% of the produced fresh fruits and vegetables, worth US \$ 4 billion per year – and if recovered, are enough to feed at least 48 million people. Overcoming the challenges discussed above require a vibrant dynamic R&D strategy with STI competencies and capabilities at all levels and across the diversity of value chains as indicated in the diverse and poorly integrated Agricultural Innovation Systems (AIS) are, however, a major drawback for African agriculture. In general, research, extension, educational and training services are poorly integrated, and do not effectively reach farmers and entrepreneurs. The Extension system in Africa, however, is regarded as the weakest link mainly because it has not been taken as part of the research-development continuum.

The main opportunity is in growing African entrepreneurship and the private sector related to agriculture, food systems, and agribusiness. This can be leveraged by targeting youth and women. Furthermore, Africa will also need to improve the policy and regulatory framework for agriculture to make it more supportive of both local community participation in rural areas and commercial private sector operations. Although there is an inadequacy of commensurate investment in R&D, the overall trends are improving in terms of public investment, human capacity development and STI policies.

Suggested Actions/Ways Forward: In line with the broader vision of ‘*AN AFRICAN AGRICULTURAL TRANSFORMATION AGENDA: Towards a Strategy for Building a Strong Agricultural Sector in Africa*’ - the R&D Work Stream sector has identified short to long-term measures as follows:

1. The immediate priority in implementing National Agricultural Investment Plans at country level and Regional level is building on progress already achieved and identifying 3-4 pilots in each of Africa's Regional Economic Communities (RECs) using the following procedure:
 - a. Assess STI preparedness in selected countries for accelerate investment.
 - b. Establish Innovation/Technology and Thematic Platforms in selected major farming systems and value-chains.
 - i. Enhance agribusiness trade and investment through the scaling up of established incubation models and centers: access to seed capital, skills development, mentoring and coaching along selected commodity value chains
 - c. Promote private sector investment and participation in developing market access major inputs and farm produce.
2. Engage the policy agenda on fertilizer, seed, agribusiness, value chains and food markets- engage organized private sector to address and promote R&D priority investments in seed and fertilizer industries to include breeding, legislation and regulations, and how to promote synergy between domestic and foreign investors. Other policy priorities include: driving domestic and export food industry and food safety, identify opportunities for PPP investment in selected value chains through incubation.
3. Strengthening institutional systems for innovation at national, regional and continental levels: capacity enhancement for catalyzing private sector investment into R&D; facilitate multi-stakeholder engagement, dialogue and resource support for the implementation of the science agenda and regional integration; Scientific Mobility Programs”, including mobilizing diaspora through national and regional initiatives to foster a multifaceted model for greater cooperation that will see the free movement of technologies, innovations, knowledge, services, investment, skilled labour and freer flow of capital. Regional level: Invest in an institutional reform agenda aimed at effective national systems as the building blocks for regional, continental and global partnerships; integration of NARSs, SROs and RECs in implementation of programmes and investments; facilitating Sub-Regional Cooperation agreements led by ASARECA, CORAF and CCARDESA, in support of regional priorities for the Work Stream agendas; Invest in reform agenda for Africa's global partnerships in STI: The CGIAR is key partner of the NARS, SROs and FARA. This has to be an African-led reform of CGIAR mode of operation in Africa. An Agricultural Innovation Systems Fund is needed to promote African solidarity in STI directed at priority transformation programmes at regional and continental levels. Development of a Priority Setting Framework and Operational Guidelines. Create options for agriculture mechanization; Institutional Support Facility for FARA: Need to have a continental mechanism to function as the technical arm of the AUC and NPCA.
4. Foresight capabilities for mega-trends R&D: in the long-term, Africa needs significant systemic capabilities and competencies in several areas. There are immediate priorities as follows: climate change; foresight studies and capabilities: Modern genetics, genomics and biosciences: Strengthening of university-level agricultural science curricula with recent advances in biosciences.

The 4 *Action Agenda Priorities* for the R&D Work Stream will be implemented as guided by the following principles and values of African ownership and leadership, subsidiarity and partnership and mutual accountability in planning and implementation.

Estimated Costs:

The cost of undertaking the suggested actions is estimated at USD 1.544 billion over ten years. This is to be funded from numerous sources including domestic public funds, AfDB, bilateral and other multilateral funders, foundations and the private sector.

1 BACKGROUND

This “Research and Development” Work Stream Paper is 1 of 6 for the AfDB initiative on *An African Agricultural Transformation Agenda: Towards a Strategy for Building a Strong Agricultural Sector in Africa*. The other 4 Work Streams are: 1) Agriculture Extension; 2) Traditional Export Crops (coffee, cocoa, cotton, oil palm, cashew, and horticultural crops; 3) Roots & tubers: yam, cassava and potato; and 4) Oil grains: groundnut, soybean, cowpea, and shea butter; and 5) livestock and dairy.

Issues of R&D or Science, Technology and Innovation (STI)¹ are also central to the other 5 Work Streams. This background section highlights recent developments and trends in the area of STI as well as other initiatives that are relevant to advancing this work stream.

Albeit slow pace, agriculture in Africa started growing on a more sustainable basis since 2000. According to figures from the World Bank², the average agricultural growth rates across the continent exceeded 4% from 2007-2011, which is better than that 3.6% growth reported from 2003-2006.

Africa has land, water and human resources sufficient to be a significant contributor to the world’s food balance sheet, and to significantly contribute to the growing global demand for both food staples and higher value added food, as well as to energy markets. Moreover there is some evidence that other positive things are happening with African agriculture. Since 2003, many governments have increased their budgetary allocations to agriculture, although, only a few have met the 10% budget target: as at 2010, 8 countries had reached or surpassed the 10% target, while 9 were in the 5% - 10% range. And since 2003, average agricultural growth rates across the continent have exceeded 3.6% and more recently, between 2007 and 2011, they exceeded 4% according to the World Bank. Also, a new connection between food and fuel prices is complicating the design of appropriate food policies. Food can now be converted into fuel. Corn, soybean and sugar prices have been pushed up by the US and Brazil. High energy prices also mean elevated prices for fertilizer and high transport costs. These dynamics have impacted on food prices since 2008 and currently prices are again very high by historic standards as a result of similar mix of short term and long term factors.

The idea of building effective and better “agricultural Innovation Systems” has taken root in capacity building efforts for African R&D institutions, especially at national level. For example, after the proof-of concept of IAR4D was established and the impressive potential impact of this approach was demonstrated, SROs notably CORAF/WECARD and ASARECA are promoting Innovation Platforms involving multi-stakeholder partnerships along key commodity value chains at national level. In the case of CORAF/WECARD, based on lessons learned under its first Operational Plan (2008 – 2013), the second Operational Plan (2014 – 2018) is hinged on innovation systems and the institutionalization of IAR4D to enhance experiential innovations among broad based stakeholders in agricultural research and

¹ In this paper we will use R&D and STI interchangeably and mean more-or-less the same idea of driving

² World Bank WDI and GDF 2010, figures for Sub Saharan Africa (Developing only).

development. CORAF/WECARD's experience with more than 200 IPs confirms that Innovation platforms allow key actors in an agricultural domain to be convened and facilitated to interact so as to develop a common vision and take concerted action. This common base still allows for a wide range in the ways in which innovation platforms are deployed.

The added value of innovation platforms is that they bring together producers, service providers, (micro- and macro) finance organizations, traders, policymakers, researchers and other actors, which allow for cross-fertilization of knowledge and experience and thus innovations. Innovation is the key capacity to generate, acquire and apply knowledge to advance economic and social purposes. It includes both the search for frontier technologies driven by research and development, as well as forms of learning and adaptation that might be market led or socially driven. Innovation is highly contextual and path dependent, but it is at the heart of moving the continent from its present mix of resource- and efficiency driven economic activity to one that is driven by the generation and application of knowledge. Implied here is the distinction between "invention", as the solution to a problem, and largely the outputs of research, and "innovation", the economically or socially successful invention –. In the context of agricultural research, innovation in its broadest sense covers the activities and processes associated with the generation, dissemination, adaptation and utilization of technology and knowledge. This also emphasizes the notion that the responsibility of the research organizations does not end with the production of new knowledge or technology. Success can only be claimed when inventions are being disseminated, adapted, adopted and used (Chema, Gilbert and Roseboom, 2001; Hall, Myteika and Oyeyinga, 2005; Anandajayasekeram, 2011). It is only when knowledge is converted into products and processes and used by the society in an economically meaningful way, it becomes an innovation. Research is an integral part and sits at the front end of innovation. 'Institutional innovation' is just as important as 'technical innovation' in transforming African agriculture. For instance, FARA's 'Innovation –to-impact' framework that encapsulates a number of validated and scalable models within the research-innovation continuum in African countries exemplifies this understanding.

Also, efforts to accelerate adoption and use of improved seed and fertilizer in Africa are commendable. For instance AGRA has supported countries improve policies, legislation and regulations on seed and fertilizer. AFAP, on the other hand has played a central role in private sector development efforts that grow the fertilizer industry. In the same vein ECOWAS with support from the USAID feed the future (FtP) programme is implementing the West Africa Seed Programme (WASP) in seven countries (Benin, Burkina Faso, Ghana, Mali, Niger, Nigeria and Senegal). Major challenges still remain in uptake of fertilizers and in building the seed industry.

AfDB recently published the report - *Inclusive Growth: An Imperative For African Agriculture*. This report coupled with the AfDB's 5 Presidential Priorities for implementing the Bank's Ten Year Strategy: *Light up and Power Africa; Feed Africa; Integrate Africa; Industrialize Africa; and Improve quality of life for the people of Africa*- offer building blocks to transforming agriculture in Africa. It is however pertinent to note that Feed Africa is not only crucial for the success of the other Presidential Priorities, while all the other Presidential Priorities stand or fall depending on the quantum of science they hold, so far, Feed Africa hold the least measure of science compared with the other areas.

In order to address this concern, AU Summit (June 2014, Malabo) adopted the Science Agenda for Agriculture in Africa (Science Agenda) as central to implementing the CAADP Results Framework and priorities. Moreover the Malabo Declaration includes the targets to eliminate hunger and halve poverty by 2025 through agriculture- both targets of which are only achievable by leveraging STI/R&D significantly. At the Continental level, FARA led a highly consultative process to develop the Science Agenda with the support of the SROs (ASARECA, CCARDESA and CORAF/WECARD) at the sub-regional levels. It is equally noteworthy that the S3A hold a significant role in the African context for the SDGs (and eventually the African Development Goals ADGs), and the Agenda 2063 of the African Union.

The rationale for this Science Agenda for Agriculture in Africa is the imperative of having an overarching strategic framework to guide the broad areas of science that have to be developed by the African countries, their stakeholders and partnerships. The Science Agenda is about the necessary transformation of national science and technology institutions in order to achieve the desired social and economic transformation of Africa. The Science Agenda refers to the science, technology, extension, innovations, policy and social learning that Africa needs to apply in order to meet its evolving agricultural development goals. The Science agenda is underpinned by important key drivers which include:

- Science can and should drive transformation of agriculture and society in Africa. It may be problematic to say that science drive transformation in society... science may open options, and government and communities have to make decision in participatory, democratic and rational ways...
- 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 cannot be realized without realizing 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. The current economic climate offers the best opportunity for investments in science for agriculture.
- African solidarity for Science is the most significant strategy in achieving the vision.
- No country will be left behind. Sharing knowledge, research outcomes, and research facilities amongst countries will better address common challenges, thus increasing African agricultural competitiveness. This inclusive approach has potential for exponential growth than operating independently.
- Africa commits to strengthening its role as a player in global science for agriculture.

- Africa's partnerships in science shall be based on the principles of: a) mutual benefit; b) mutual responsibility and c) mutual accountability.

A common theme that emerges from these key messages is on the imperative to ensure that essential human and technological resources are developed and maintained for a broader users group.

All key stakeholders on issues of STI have developed strong networks and partnership on the Science Agenda and these include: AUC, NEPAD Agency, AGRA, the African Agriculture Technology Foundation (AATF), the African Forum for Agricultural Advisory Services (AFAAS), the main education networks (RUFORUM and ANAFE), the Pan African Farmers' Organisation (PAFO) and agribusiness networks. At the sub-regional level the stakeholders include the Regional Economic Communities, and the sub-regional agricultural research organisations (SROs). At national level, actors consulted on the Science Agenda include Ministries of Agriculture and the national agricultural research systems (NARS) comprising actors engaged in research, extension, education, production, and agribusiness. At international level partnerships include: the Global Forum for Agricultural Research (GFAR), CGIAR Centres, other advanced agricultural research organizations and key multilateral organizations, notably the European Commission, the World Bank, FAO and IFAD. The Science Agenda now serves as the framework for the implementation of the first priority of the Science Technology and Innovation Strategy for Africa (STISA-2042) on Food security and eradication of hunger.

2 CHALLENGES

The R&D sector is expected to provide the most significant leverage and energy in transforming smallholder agriculture in terms of productivity, competitiveness and contribution to economic growth as farming as business becomes the major way to develop agriculture. There is need to separate the challenges in agriculture that the R&D sector especially that of R&D and the challenges in the capacity of the R&D sector. These will be discussed in that order.

Although African economies have grown steadily and sustainably since 2000, Africa remains the most food insecure continent, with the largest proportion of poor and hungry citizens. This challenge is discussed more in depth below.

The overarching agricultural challenge for science in Africa is that of low productivity, competitiveness and value addition across all farming systems and value chains. Among the main challenges are: conspicuous absence of commensurate degree of science for agriculture that is commensurate with the growing demand from the continent, a lack of coherent and conducive policies; poor incentives; poor access to input and output markets; predominant rain fed agriculture; inadequate investments in agricultural R&D; heavily degraded and depleted soils; problematic land tenure systems; inadequate levels of mechanization; considerable biophysical limitations including pests, diseases and weeds; climate.

2.1 Agricultural Research Support

Critical to the sub-regions is the absence of effective institutions for supporting in a sustainable manner agricultural research and development initiatives. During the 1970s and 1980s, several national governments created various research institutes and other structures in an effort to combat food insecurity and low productivity and competitiveness of the sector. However, most of the national systems have remained unsustainable, mainly due to very limited budgets in particular for operational expenditures. Furthermore, the existing fragmented support provided to the agricultural research needs to be adequately coordinated, harmonized and channeled to ensure greater productivity, competitiveness and accountability.

The global context for African agriculture is changing rapidly and will continue to present both challenges and opportunities. The increasingly unpredictable weather events, changing patterns of disease in crops and livestock, depletion of fossil hydrocarbons and consequent increase in demand for biofuels 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 biofuel and food production. Africa needs investments in agriculture but the main challenge associated with the large-scale land acquisitions is the lack of institutional frameworks to promote equitable distribution of benefits arising from the investments.

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. Urbanization 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.

Africa is urbanising with minimal industrialisation. Manufacturing share of employment still stand at a mere 8% average, and the share of GDP a mere 10% average, down from 15% in 1975. Africa is the only developing region where accelerating urbanisation is NOT driven by manufacturing. Rather Africa's rapid urbanisation is driven by anticipated services. The large numbers of rural to urban migrants are being absorbed mostly into services (and not manufacturing) as Africans escape the drudgery and low productivity of smallholder agriculture and the rural economy.

Currently there are 1.2 billion people in Africa, more than five times the population in 1950. By 2050, Africa's population will double, to 2.4 billion, eventually reaching 4.2 billion by the end of the century- just about the entire world population in 1977 (UNICEF, 2015). In 2010, there were 414 million people in the Sub-Saharan Africa region who were living in extreme poverty; surviving on less than US\$1 per day; a surge from the 1990 figure of 290 million (Munang, 2013). Africa is also the most youthful continent, with 43% being youth under the age of 15 (PRB, 2013).

Africa's circumstances, however, are paradoxical and progress since 2000 may have reached a certain threshold requiring a change in script. In other words, statistics as the ones presented above could have more than a singular trajectory or interpretation. In 2015, following an unprecedented decade of impressive economic growth across the continent, of improved governance, and of improvement in human development indicators, Africa still faces major challenges. Africa is the world's most food insecure continent, with commensurately low levels of agricultural productivity, low rural incomes, high rates of malnutrition and stunting, and a significantly worsening food trade balance. Much of Africa's recent growth has come from metals, minerals and energy and this means that there has been little impact on employment: only agriculture and the food industry offer the prospect of increasing employment and incomes rapidly for the majority of the population.

The demand for bio-fuels and food has the potential to raise the price of basic agricultural commodities. Two scenarios are possible in Africa:

- The demand spells impoverishment for much of the population because of the resulting high food prices, or
- The demand spells dynamism for rural economies and the eventual end to rural poverty

A further dimension to the evolving opportunities for Africa is a global recognition that land is a scarce resource. Water is also becoming increasingly scarce around the world because of heightened competition from urban consumers and industry. The fact that Africa has significant land and water resources has meant that it has become a target for foreign investors who see significant long term potential (16% of Africa's land is arable, the largest share in the world, and 79% of Africa's arable land

reportedly remains uncultivated). At least 60 million hectares of land was purchased or leased in Africa since 2009 yet productivity from these large scale land based investments has not gone up.

What has remained unchanged is the playing field for trade, which is still not level. It is estimated that industrialized countries spend \$300bn on agricultural subsidies, making it difficult for farming in developing countries to compete.

Food wastage is a grave concern for food security and FAO (2011) reports that most African nations lose about 40% of the produced fresh fruits and vegetables; with these losses occurring early in the food supply chain - between the field and the market. In Sub-Saharan Africa, post-harvest food losses are estimated to be worth US \$ 4 billion per year - or enough to feed at least 48 million people. Unlike industrialized countries, much less food is wasted at the consumer level. The causes of this food loss are predominantly poor practices in harvesting, careless handling of produce, lack of storage or poor storage conditions and transportation.

The African continent is the most vulnerable region to climate variability and change. Therefore, climate variability and change is one of the biggest challenges facing agricultural transformation in Africa. Climate change also disproportionately affects the livelihoods of the most vulnerable population by increasing the occurrence of natural disasters, affecting the continuity of ecosystem functioning and the provision of quality ecosystem services. Climate change also damages the critical natural resources that vulnerable communities depend on for both sustenance as well as as a source of income. Climate change does not respect boundaries hence it is necessary for African countries to work together to build resilience in order to master the adversity of climate change. Fader et al. (2013) points out that climate change causes lower crop productivity and therefore reduced agricultural efficiency and also has the effect of a reduction in the land suitable for production. Extraordinary agricultural efficiency improvements will therefore be necessary in Africa to offset the negative effects of climate change while still increasing agricultural productivity.

Overcoming the challenges discussed above require a vibrant dynamic R&D strategy with STI competencies and capabilities at all levels and across the diversity of value chains as indicated in the various Work Streams discussed in introducing this paper. Poorly integrated Agricultural Innovation Systems (AIS) are, however, a major drawback for African agriculture. In general, research, extension, educational and training services are poorly integrated, and do not effectively reach farmers and entrepreneurs. The Extension system in Africa, however, is regarded as the weakest link mainly because it has not been taken as part of the research-development continuum. The core proposition in the Science Agenda recognizes the importance of the five 'i's: strengthening of *institutions*, availability and affordability of improved *inputs*; expansion of rural *infrastructure*; *incentives* for producers; and adequate and timely supply of *information* to support production and marketing decisions. A key prerequisite to successfully address the challenges outlined above is an imperative for an agricultural R&D agenda developed and implemented with concrete plans for positioning NARIs and universities, a competitive private sector, empowered farmers, supportive institutions and policies and responsive international partners/donors. In addition to the above constraints, we may include:

- Limited access to technology and low human capabilities to adopt new skills. The improved or high yielding varieties or climate smart technologies and innovations are most of the time absent on local markets. Even when they are available, knowledge of their application is limited and effective usage for optimal results is constrained.
- Weakness of entrepreneurship and the private sector: many African countries have a small local private sector in the agricultural and agro-industry sectors. The African smallholder is private and lacks education; it has severely limited access to communications or physical infrastructure; suffers poor health and nutrition; lacks remunerative markets and access to yield-enhancing inputs. This farmer constitute a "private sector" which cannot stand alongside and compete with multinational farming and agroindustry giants that trade with Africa.
- Other concerns: (a) inadequate targeting of attention on the particular needs of women who are the dominant agricultural producers, traders and nutrition providers in many parts of Africa; (b) limited specialization in production and inadequate capacity of any one country or of the region to influence global markets; (c) unclear definition of roles among the public, private and civil society institutions in development; (d) poor harmonization of agricultural development promoting initiatives at national, sub-regional and continental levels; (e) inability to systematically mobilize savings for reinvestment; (f) disengagement from or poor performance of cash crops that were formerly important for rural incomes.

Furthermore, Africa will also need to improve the policy and regulatory framework for agriculture to make it more supportive of both local community participation in rural areas and commercial private sector operations. It will need to improve governance, in terms of giving a voice to both small and large-scale players in the farming community.

2.2 Trends in agricultural R&D investments and capacities

There is an absence of commensurate investment in R&D that will foster long term implementation of programs with long lasting implications on the African production systems. (Beintema and Stads, 2014 <http://www.asti.cgiar.org/publications/ssa-rd-capacity-2014>)

- *Overall trends:* After a decade of stagnation in the 1990s, public agricultural R&D spending in SSA increased by more than one-third in real terms during 2000 to 2011 (from \$1.2 billion in 2000 to \$1.7 billion in 2011, measured in constant 2005 PPP dollars). During the same period, SSA agricultural research capacity increased by 50 percent and totaled about 14,500 full-time equivalent (FTE) researchers in 2011. Agricultural research, in terms of investments and capacity, is concentrated in a few African countries: Nigeria, South Africa, and Kenya.
- *Institutional distribution:* Agricultural R&D is predominantly performed by government agencies (accounting for about three quarters of SSA capacity), but the higher education sector has expanded over time. Nonprofit and private

organizations still only play a minor role, but offer future growth potential.

- *Human capacity*: Overall, the distribution of researchers by qualification level has shifted over time toward younger, mostly BSc-qualified scientists due to the departure and retirement of senior researchers and their predominant replacement, after years of recruitment restrictions, with junior researchers. Despite an absolute increase in the number PhD-qualified researchers during 2008–2011, the regional share of agricultural researchers with PhD degrees fell from 25 to 22 percent during this timeframe. As of 2011, in 19 countries for which data were available more than half the PhD-qualified researchers were more than 50 years old (Figure 5.2). The situation is most severe in West Africa, Madagascar, and a few other countries. Female involvement in agricultural R&D has increased in recent years, both in absolute and relative terms (on average, 22 percent in 2011).
- *Investment*: Spending increase between 2000 and 2011 was mostly driven by a handful of larger countries that recognized the urgent need to increase researcher salary levels and to rehabilitate derelict infrastructure and equipment. Hence these spending increases consolidated and strengthened the NARIs involved, without necessarily increasing the amount of research being conducted. Agricultural R&D spending as a share of AgGDP averaged 0.51 percent in 2011. Only In fact, 29 of the 39 SSA countries for which data were available still fall short of the minimum investment target of 1 percent of AgGDP set by the African Union and United Nations. Compared with other developing regions, SSA is highly dependent on donor and development bank funding for agricultural R&D (30 percent, on average).
- *Policies*: Despite limited funding and capacity, many countries in SSA have adopted policies to strengthen higher education and research investments and capacities.

3 OPPORTUNITIES

Opportunities in Africa start with vibrant population dynamics that offer increasingly high and effective demand for food. As alluded to already, this is because of Africa's rapid urbanization, accompanied by growing middle-class. A youthful population also solidifies these demographics. Africa's abundant natural resources – in terms of land, forests, water, and soils—all position Africa favorably as a future global player in global food markets and agribusiness. Africa has now therefore entered a development stage where some analysts are taking a more positive outlook and script as opposed to the traditional 'Afro-pessimism' of the last 5 decades where the dominant strategy has been food aid, humanitarian assistance and poverty reduction strategies (livelihood enhancement) with no major development assistance to capacity building and commercializing agriculture. Private sector support focuses mainly on FDI.

Africa is now in a better position to aid itself become food secure moving forward. Africa's economies are growing sustainably and governance and human development indices improving. Agriculture has started growing, albeit slowly but sustainably over the last decade.

This positive view is emerging and growing as more data and evidence accumulates. The dominant growth detected here is by small intermediary groups (smallholder farmers, truckers, warehousemen, artisanal food processors) etc. who are responding to rapid urbanization and growing 'middle-class'. This class of business people is 'invisible to Governments and donors in terms of serious strategy and support to this budding 'indigenous commerce', yet they constitute a significant segment of Africa's private sector given they supply 80-90% of all food marketed.

The challenge with classical economic theory and experience is the agreed fact that Africa is urbanizing rapidly, yet there is little industrialization or manufacturing. This is a puzzle because no other region in the world has urbanized without accompanying industrialization (Europe, US and now Asia). The average in Africa is 8% employment from industrial sectors. Urbanization in Africa is driven by services: housing, education, health, banking, telecoms etc. Yet smallholders and intermediary groups are the main suppliers of food to this growing urban population. Africa, however, has a more de-congested urbanization as compared to Asia- so there is a growth in smaller rural towns as opposed to mega-cities. Africa's middle class start at lower income levels and research shows that those with an average income of \$4 and more will change dietary patterns and consume more meat products, vegetables and manufactured foods.

Therefore, governments and donors could re-think structural transformation and focus on the following:

- Rural infrastructure (energy, transport, water, telecoms) that improves efficiency and reduces transactions costs for this 'rural industrialization';
- Investment in the resuscitation of the weathered agricultural research and Support Systems;

- Study patterns of the indigenous commerce so as to identify opportunities for growth, economies of scale, and improvement in regulatory environment for the groups and value chains with potential;
- Find synergy with traditional domestic private sector and FDI;
- Re-build capacity of public sector to support domestic private sector and intermediary groups
- Promote the process of rural industrialization (including appropriate science and technology innovations) as the main pull for African agriculture market and non-market interventions given that producing and processing for the growing urban market open many opportunities.
- The strengths of African agriculture are,: 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; rapidly growing mobile and internet connectivity; and expanding provision of infrastructure.
- The strength of agriculture in Africa also lies in the multitude of successful agricultural initiatives that the continent has experienced in the immediate past include the following :
 - Intensifying staple food production: e.g. banana, maize, rice, cassava, sorghum
 - Diversifying the value-chains: e.g. dairy, horticulture, livestock
 - Developing growing export sectors: e.g. beef, coffee, cotton, tea
 - Community-led soil fertility management: e.g. ‘re-greening of Sahel’ in Burkina Faso, Niger (Great Green Wall of the Sahara initiative)
 - Africa-global partnership to unlock production constraints: e.g. eradication of Rinderpest
 - Building regional centres for excellence: e.g. CORAF’s, ASARECA’s commodity centres: (The Second Operational Plan of CORAF/WECARD is ensuring continued provision of guidance and support to existing National Centres of Specialization (NCoS) and their evolution to Regional Centres of Excellence (RCoE), to strengthen relevant partnerships for more efficient and effective delivery of technologies and innovations. The Regional Centers of Excellence would collaborate with IARCs and ARIs, and be devolved with the task of carrying-out world class research activities to develop cutting edge technologies that are needed by the region, to spur and sustain rapid agricultural growth: (i) reviewing the most effective options for establishing a network of RCoE and (ii) developing a comprehensive strategy for the establishment of the network of RCoE.
 - ICT-based marketing systems: e. g. Commodity Exchange initiatives in Kenya and Ethiopia

- Africa's 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 Science Agenda aligns with the positive school of thought and has the vision that by 2030, Africa will have to be a significant producer of food for the growing global population. This challenge is further exacerbated by the high demand 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 increasing production has to be achieved on less land, water, chemicals, waste, and GHGs. Public policies, however, have been slow in responding to these trends. Scientific solutions will be required to mitigate Climate Change impacts

Fortunately, Africa is endowed with abundant natural resources, including about 60% of the world's arable land, some of it still virgin land and abundant water resources. These resources, if effectively and efficiently harnessed, could reduce the threat of food insecurity. Increased agricultural productivity, combined with viable agribusiness that adds value to farmers' production and improved access to markets, can drive broader economic growth across the continent and vastly improve food security.

Africa's growing imports of cereals, soybeans, milk powder and poultry reflect the increasing competitiveness of agricultural imports into Africa. In order to compete successfully with imports in their own growing domestic and regional agribusiness markets, African farmers and agribusinesses will need to improve value chain efficiency at all levels. It is important to note that the local domestic food economy and the intra-regional market are at present the main opportunities. About 95% of the African food market (in value terms) is domestic (local and regional); exports and imports constitute the rest. But over time the global export market will also grow as an opportunity. It will be important to help a broader set of farmers to access inputs and rural services and extension information to take advantage of this growing market. At first this will be an issue of volume and cost, and increasingly over time, of quality differentiation and food safety. There will be need for a number of kinds of coordination – cooperatives of farmers to achieve scale, clusters of small/medium food supply chain firms with training and market-linking assistance to maximize efficiency and innovation, and coordination over agriculture ministries, energy ministry, commerce ministry, infrastructure ministries, to bring about integrated solutions to bottlenecks holding up this emerging dynamic transformation.

4 SUGGESTED ACTIONS/WAYS FORWARD

In line with the Science Agenda for Agriculture in Africa, the STI sector has short to long-term trajectory as follows:

- In the short term to accelerate the implementation of national agriculture investment plans by establishing technology and thematic platforms
- In the medium term to invest in reforms that lead to integration and strengthening of Africa's agricultural innovation systems (that take into consideration the whole value chain from laboratory to spoon); and
- In the long term establish STI programmes that address emerging trends especially climate change as well as foresight analytical capabilities to anticipate and address long term challenges and opportunities.

The 4 priority R&D investments that are envisaged for the AfDB initiative are:

- I. The immediate priority in implementing National Agricultural Investment Plans at country level, and Regional Agricultural Investment Plans
- II. Engage the policy agenda on fertilizer, seed, agribusiness, value chains and food markets
- III. Strengthening institutional systems for innovation at national, regional and continental levels
- IV. Foresight capabilities for mega-trends for R&D

These are addressed more in depth below.

4.1 The immediate priority in implementing National Agricultural Investment Plans at country level and Regional level: This is building on progress already achieved and identifying 3-4 pilots in each of Africa's Regional Economic Communities (RECs) using the following procedure:

- a. Assess STI preparedness in select countries in readiness for accelerate investment:** FARA has developed a self-assessment instrument for STI preparedness at country level that is administered by a cohort of STI partners.
- b. Establish Innovation / Technology and Thematic Platforms in selected major Farming Systems in each region to promote farming as a business and promote domestic private sector investment in agriculture:** In many countries, agricultural production is moving from subsistence systems to more market-led systems. Productivity is the result of several factors, including higher yielding crop varieties; better breeds, feed and health of livestock; the interactions of genetics with the environment; better management of natural resources, including water for rain-fed and irrigated agriculture; crop and animal husbandry; external agricultural inputs such as seeds, fertilizer, agricultural machinery and implements; access to credit to purchase inputs; availability of labour; and market access, through value chains, linking farmers to markets. The relative importance of these factors varies by country and community and by farming system. The priority themes are:

Sustainable productivity in major farming systems: Transforming production systems in the major Work-Stream value chains: 1) Traditional Export Crops (coffee, Cocoa, cotton, oil palm, cashew, and horticultural crops; 2) Roots & Tubers: Yam, Cassava and Potato; and 3) Oil grains: Groundnut, Soybean, cowpea, and Shea butter. Crop improvement and crop protection; Livestock breeds, health and feed; Aquatic and inland fisheries; Agro-forestry and forestry;

Agricultural mechanization. Increase labour productivity through mechanization³.

Develop the food systems and value chains through innovation platforms: food systems and value chains (including food and nutritional security); post-harvest handling, food processing, safety and storage; Post-harvest handling and loss prevention.

Transforming production systems in general is key across all farming systems in the African context. This includes crop and livestock improvement and crop protection as well as customer-focused plant breeding and horticultural and tree crops.

Improving livestock production and productivity is increasingly a priority and the agenda includes: livestock production, better feeds, better breeds, better health, better nutrition management to control GHG; Aquatic systems and inland fisheries.

- i. Enhance agribusiness trade and investment through establishment of incubation centers and support to SMEs, Incubates and graduates to access seed capital, skills development, mentoring and coaching along selected commodity value chains.
 - ii. Other priorities in the agenda include: agroforestry and forestry systems; agricultural mechanization; agricultural biodiversity and natural resource management; conservation and enhancement of agricultural biodiversity; land and water resources; irrigation and integrated natural resource management.
- c. Promote private sector investment and participation in developing market access major inputs and farm produce.

4.2 Engage the policy agenda on fertilizer, seed, agribusiness, value chains and food markets

- d. **The STI partners will engage organized private sector coordinators to address and promote:**

³ According to FAO, in 2000, primary land cultivation for 80% of the cultivated in SSA relied on human muscle power with draught animals and tractors being used on only 15% and 5%, respectively (compare with Asia where 60% of cultivated land is tilled by tractors).

- i. R&D priority investments into seed and fertilizer industries to include breeding, legislation and regulations, and how to promote synergy between domestic and foreign investors. Existing and on-going initiatives here include the West Africa Seed Programme. This programme was very instrumental during and after the Ebola pandemic in West Africa.
 - ii. STI priority investments in driving the domestic and export food industry and food safety, including technical and economic soundness of technologies, policies, legislation and regulations.
- e. **Identify opportunities for PPPs** that accelerate pace of investment in selected value chains through incubation.
- f. **Market access and development through enhanced agricultural value chains:** Enabling smallholder farmer compliance with sanitary and phytosanitary (SPS) measures. Building the capacity of African smallholder farmers to meet SPS requirements reduces their risks, improves food safety, creates confidence in trading partners and increases agri-food trade and biosecurity. These are important pre-requisites for transforming Africa's agriculture.

4.3 Strengthening institutional systems for innovation at national, regional and continental levels

- g. **Capacity enhancement at national level crafted around priority investments and catalyzing private sector investment.** Weaknesses to be addressed in strengthening the national systems include poor linkages between research, education, and advisory services. This will initially be achieved through establishment of multi-partnerships for technology and thematic innovation platforms. The aim is to build and strengthen innovation systems and partnerships among national and regional stakeholders as well as development partners to facilitate multi-stakeholder engagement, dialogue and resource support for the implementation of the science agenda and regional integration. In this domain the sub -regional agricultural research organisations have on-going initiatives in Agricultural and Rural Advisory Services (ARAS) around four axes: knowledge management, capacity strengthening, advocacy and policy dialogue and, networking and partnerships.
- h. **Establishment and strengthening of capacity for Managing and promotion of agribusiness incubation/innovation** initiatives with specific focus on youth and gender; Promotion of Collaborative Service Agreements. This will include platforms that foster and harness innovation capabilities amongst the African youths and women to create a crop of African innovators today for African development tomorrow: African Youth Innovation Incubation; Women Innovation Incubation; Innovation Platforms (IAR4D)/ UniBRAIN; Agribusiness Incubation models, etc.

- i. Scientific Mobility Programs**, including mobilizing diaspora through national and regional initiatives to foster a multifaceted model for greater cooperation that will see the free movement of technologies, innovations, knowledge, services, investment, skilled labour and freer flow of capital. Intra-African mobility of people and exchanges of scientists, faculty and students in order to encourage networking and increase diversity of experience in teaching and research. This area would be effectively addressed through leveraging emerging models of regional collaborations and triangular agreements between African NARS/Regional programs/International Advanced Research Institutes to contextualize collaborative research and capacity building to ensure reasonable funding allocation, sustainability, relevance and impact. (Several of such partnerships have been set and are in operation at the BecA-ILRI Hub).
- j. Regional level: Invest in an institutional reform agenda at regional level aimed at;**
- Effective national systems as the building blocks for regional, continental and global partnerships
 - Integration of NARSs, SROs and RECs in implementation of programmes and investments;
 - Crafting Sub-Regional Cooperation agreements led by ASARECA, CORAF/WECARD and CCARDESA, in support of regional priorities for the Work Stream agendas all aimed at effective support to country implementation of investments. In 2013 ASARECA convened such a gathering between, ASARECA and CRPs leaders to map out plans for the delivery of the joint mission
 - An effective continental mechanism for: (i) coordinating the translation of continental frameworks into arrangements for implementation of the agriculture STI dimensions of these frameworks; (ii) decision support supported by readily accessible and reliable data (iii) convening agriculture R&D stakeholders around visioning, planning, information and technology sharing, capacity development, tracking progress and quality assurance; (iv) integrating and inter-mediating among the various actors of the continental agricultural innovation system; and (iv) policy advocacy.
 - Strengthen capacity of private sector actors and other players through information exchange, capacity building and networking for collaborative advantage
- k. Invest in reform agenda for Africa’s global partnerships in STI:** This has to be an African-led reform to integrate home-grown solutions that will assure the massive transformation envisage in the next ten years. The NARS-SRO-FARA-CGIAR partnership should be strengthened to support the realization of this transformation.

- I. An Agricultural Innovation Systems Fund** is needed to promote African solidarity in STI directed at priority transformation programmes:
 - A special fund is needed as major vehicle to ensure that short-term opportunities can be piloted, while design is intended for long-term systemic STI capabilities in Africa.
 - While no country should be left behind, sequencing and priority setting is key. Ultimately each country needs a minimum capacity to address its needs. The fund activities could include: fast-tracking best-bet technologies; catalyzing domestic private sector investment into STI; increasing scientist mobility in Africa; and in engaging the African Diaspora.
 - **Development of a Priority Setting Framework and Operational Guidelines:** FARA and partners will undertake the development of frameworks and guidelines for; Priority setting and development of country action plans in the implementation of the Science Agenda. Establishing and managing innovation platforms and systems for implementation of the Science Agenda.
 - **Create options for agriculture mechanization support and incentives** to double production, reduce post-harvest losses and facilitate access to market for agricultural products and services along selected value chains.

4.4. Foresight capabilities for mega-trends R&D: In the long-term, Africa needs significant systemic capabilities and competencies in several areas. There are immediate priorities as follows:

- a. Climate Change:** Disseminating available technologies on climate change, variability adaptation and mitigation and mapping out the long term R&D agenda and investments to address climate change.
- b. Foresight Studies and Capabilities:** These foresight studies are needed to start positioning Africa and African countries as serious players on global agricultural and food markets. These studies and capacities are needed to enable countries, the sub regions and the continent to envision scenarios of what various aspects of their agriculture and food system will look like several years in future. The main objective is to identify the interventions required to result in the most likely scenarios. This includes strategic planning, modeling, and analysis of ‘critical technologies’, as a means of systematic analysis and interpretation of data and perspectives to better understand trends and future challenges.
- c. Modern genetics, genomics and biosciences:** to give better understanding of gene function, leading to more specific targeting of genetic improvement in agriculturally important species of crops, livestock, fish and trees; etc. Africa has to start accessing these modern tools for local relevance and application, as African players begin to establish STI competitive advantage for the long term. The potential of harnessing the power of genetics, genomics, bioinformatics, and other key areas of the bioscience is

enormous and must be leveraged through state of the art regional bioscience centers for excellence such as the BecA-ILRI Hub.

d. A diversity of short-term and long-term actions/proposals is envisaged:

- Strengthening of university-level agricultural science curricula with recent advances in biosciences. This will include short-term internships for students who are the next generation of professionals to drive STI in Africa.
- Providing retooling /upgrading opportunities for teaching, research and technical staff through fellowships, exchanges and internships.
- Mobilizing Africa's bioscience capacities and catalyzing joint actions in research, capacity building, training, resource mobilization.
- Creating a vibrant African-led bioscience platform for knowledge exchange, peer review, creating links and partnerships.
- Effective mechanisms for strengthening institutional research and training infrastructure.
- Commitment to invest in the Bioscience Challenge Fund to support consolidation and growth of African-led NARS bioscience research.
- Effective national and regional mechanisms to facilitate and catalyse interaction between bioscience and policy at national regional, continental level.

The 4 *Action Agenda Priorities* for the R&D Work Stream will be implemented as guided by the following principles and values:

- Adherence to the subsidiarity principle recognizing that agriculture development is first-and-foremost a national responsibility to be pursued at the country level.
- Measures to ensure joint planning, implementation and reporting system
- Sharing of good practices
- African and/or local ownership, which is inclusive and accountable.
- Mandates, roles and responsibilities must be clear and shared among partners at all levels
- Communication mechanisms are needed for regular sharing of ideas and plans among stakeholders at national, regional and continental levels
- A priority setting system is needed so that investments reflect highest priority actions of countries and regions.
- Regular reviews are done which inform reprioritization as may be necessary.
- Crafting M&E instrument for tracking the implementation for the next decade.
- Participation in major regional and continental platforms

5 ESTIMATED COSTS

5.1 Indicative Budget (amounts in millions of United States Dollars (USDs))

Action Agenda Priorities	Short Term	Medium Term	Long Term	Total
1. Immediate priorities in implementing National Agricultural Investment Plans at country level				
1.1 Assessments of STI preparedness in 3-4 countries in each sub-region in readiness for accelerated investment in STI	4.0	2.0	-	6.0
1.2 Establish Innovation / Technology and Thematic Platforms to promote “farming as a business” and domestic private sector investment into agriculture.	20.0	40.0	60.0	120.0
1.3 Promote private sector investment in developing market access major inputs and farm produce.	8.0	16.0	30.0	54.0
2. Engage the policy agenda on fertilizer, seed, agribusiness, value chains and food markets				
2.1 Engage organized private sector coordinators to address and promote R&D priority investments in: Seed enterprises, Fertilizer industries, food industry; PPPs for investment in these sectors; and Market access through enhanced agricultural value chains (incl SPS)	25.0	50.0	75.0	150.0
3. Strengthen institutional systems for innovation at national, regional and continental levels				
3.1 Enhance national-level capacities for priority investments and catalyzing private sector investment.	15.0	60.0	125.0	200.0
3.2 Establish and strengthen the capacity for managing and promotion of agribusiness incubation	20.0	50.0	80.0	150.0
3.3 Establish and manage Programmes for Mobility of STI capacities	10.0	25.0	55.0	90.0
3.4 Strengthen the effectiveness of Agriculture STI institutions at national, sub-regional and continental levels	35.0	65.0	100.0	200.0
3.5 Reform Africa’s global partnerships in STI (CGIAR, ARIs & African AR4D institutions)	5.0	20.0	50.0	75.0
3.6 Establish and manage an Agricultural Innovation Systems Fund (AISF) to promote African solidarity in STI for priority transformation programmes	5.0	95.0	200.0	300.0
4. Foresight capabilities for mega-trends for R&D				
4.1 Climate Change:	3.0	4.0	10.0	17.0
4.2 Foresight Studies and Capabilities	4.0	8.0	15.0	27.0
4.3 Modern genetics, genomics and biosciences	4.0	20.0	50.0	74.0
5. Works Stream Coordination (within R&D Work Stream and with other Work Streams)				
5.1 Coordination including joint planning, implementation and reporting; collation and sharing of lessons; M&E and Mutual Accountability, Communication etc.	9.0	22.0	50.0	81.0
TOTAL	167.0	477.0	900.0	1,544.0

5.2 Cost Sharing Measures

Many of the activities listed above will build on on-going work especially work carried out by the implementing partners. Some activities contribute to future work that is to be financed by committed investments. Thus financing of the budget will draw on already secured and committed investments. It is roughly estimated 25-30% of the budget is covered by these kinds of investments.

5.3 Potential Financial Sources

The funding for the budget presented is expected to come from several sources, namely:

- Domestic public funding at national level
- The African Development Bank
- Funding from other multilateral sources (World Bank, IFAD,)
- Bilateral donor funding earmarked to countries, RECs, African Union Commission, sub-regional and continental AR&D organisations.
- Cost sharing with research institutions for example CGIAR Centres and Programmes, AGRA, AATF, NARIs, advanced research institutions, African university networks (RUFORUM and ANAFE), United Nations Agencies (FAO, UNECA, WFP, UNICEF) etc.
- Foundations (e.g. Bill and Melinda Gates Foundation, Rockefeller Foundation, Kellogg Foundation, etc.)
- Partnerships with emerging economies (Brazil, India, China)
- Private sector in Africa and beyond

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