Final Report

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Unleashing Science, Technology and Innovation for Food and Nutrition Security
With special focus on Africa, Caribbean and the Pacific
Developing a road map

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TABLE OF CONTENTS

LIST OF TABLES

Page

ACRONYMS AND ABBREVIATIONS

ACP	African, Caribbean and Pacific
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
Bt	*Bacillus thuringiensis*
CAADP	Comprehensive Africa Agriculture Development Programme
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CoE	Centre of Excellence
CEPHYR	Centre for Phytotherapy Research
COS-SIS	Convergence of Science – Strengthening Agricultural Innovation Systems
CTA	Technical Centre for Agricultural and Rural Cooperation ACP-EU
EU	European Union
FARA	Forum for Agricultural Research in Africa
FNS	Food and Nutrition Security
GM	Genetically modified
IPR	Intellectual Property Rights
M&E	Monitoring and Evaluation
NEPAD	New Partnership for Africa's Development
NGO	Non-governmental Organisation
OECD	Organisation for Economic Cooperation and Development
PPP	Public and Private Partnership
PRI	Public Research Institution
R&D	Research and Development
RCoE	Regional Centre of Excellence
REC	Regional Economic Community
STEM	Science Technology Engineering and Mathematics
STI	Science Technology and Innovation
UNECA	United Nations Economic Commission for Africa

Executive summary

The 2014 CTA international forum on "Unleashing Science, Technology and Innovation for Food and Nutrition Security: Developing a Road Map" with a special focus on Africa, the Caribbean and the Pacific (ACP) was the first event of its kind. It brought together leading ACP and EU scholars, senior scientists/researchers/academicians, policy-makers, development practitioners, innovators, farmers and private sector representatives to deliberate on these interlinked issues which have national and global significance.

The Forum covered four strategic issues: novel pathways for agricultural innovation; optimising resources (human and physical); the enabling policy and institutional environment; and the way forward. Several associated issues namely; research and development (R&D), higher education (HE), extension and innovation within the wider national innovation systems were also considered.

Participants acknowledged that while there is a growing body of scholarship on science, technology and innovation (STI) for food and nutrition security (FNS), there is little attempt to identify good practice and customise these developments to improve implementation and increase investments; public and private, in the local and national context. The discussions were dynamic and valuable contributions were made for advancing the FNS agenda along three thematic intervention areas which were clustered in a transformation-response-support framework.

Three thematic Intervention areas

Participants recognised the transformative power of institutions for shaping the enabling environment around farmers, entrepreneurs and innovators. Several interventions (Prof Röling, Prof Gurib-Fakim, Dr Ayele) suggested that institutional frameworks should be at the core when developing the capabilities needed to unlock the bottlenecks that hinder innovation. Some of the CTA Top 20 innovations such as the successful farmer-led finance and management innovations (e.g. The farmer ownership model: Uganda's coffee revolution, Uganda; Producer business group model for value addition, Kenya), supported this argument. However, tensions exist in efforts at commercialisation and in conforming to intellectual property rights regimes when taking innovations to scale. These could possibly be dispelled via effective partnerships, better role definition and equitable and inclusive governance mechanisms.

Agility in STI policy processes is another dimension which was addressed from different perspectives, to respond to the changing and emerging social, ecological and global challenges. The call was made for STI policies which institutionalise innovative strategies such as; the farmer (user/entrepreneur) centric model (profiled by Prof. Umaharan) which encourages user engagement very early in the research and innovation process, the creation of commodity exchange markets so that small-holder farmers are more aware of the trading value of their commodities and, the adoption of early warning systems and other data systems structures for improving evidence based decision-making in managing risks and ensuring eco-system and agricultural sustainability.

The final intervention area was linked to mechanisms that empower and build capacity for implementation, to address the ineffectiveness of national STI policies. Moving from a needs-based approach to a rights-based approach backed by legitimate and participatory governance was mooted. Conceptual clarity and systematically surveying innovations and innovation processes were determined to be important priorities for STI policy-makers. For example, functional differentiation in education, to counteract the phenomenon of jobless growth, was seen as an important priority-setting criterion if national governments are to address the long term objectives of harnessing the human capital required for creating and sustaining knowledge-based economies and knowledge-intensive agricultural led economic growth.

The Road Map

The integrated Road Map addresses critical gaps which were prioritized for the three strategic areas considered relevant when going forward:

(i) STI Governance and Public Policy: R&D, higher education, and engaging the private sector;
(ii) Taking innovation to scale and private sector engagement; and
(iii) Financing/Investment modalities, partnerships, incentives and reward systems.

Participation, accountability and transparency are key. Moreover, in view of the investment backlog resulting from decades of under-investments and inequitable targeting of the agricultural sector as a pillar of economic development, attracting new investment is imperative. In this regard, the Road Map focuses on the means to upscale institutional change and to harness STI knowledge for business /social enterprises and entrepreneurs to exploit opportunities, enhance effectiveness and impact, and strengthen governance systems.

The Road Map has been designed for a three-year duration and the actions promulgated are time-bound; short-term (0 – 11 months), medium term (0 – 23 months) and long-term (0 – 24 months). For each of the critical gaps, an over-arching empirical action item has been put forward which is then detailed via specific action items with corresponding proposed solutions and responsibilities assigned to stakeholders. Case examples derived from the CTA Top 20 Innovations and from other sources were included as examples of good practice to inform future decisions on the proposed actions.

The consensus was that unleashing STI to achieve FNS is a function of creating efficient linkages among actors and across economic sectors. While the conceptual underpinnings and empirical strength of these linkages can be debated, and may vary across the ACP countries and over time, the question arises as to whether the relevant policy question is the impact of STI itself on FNS or the effectiveness of STI implementation in setting the targets and deploying the monitoring and evaluation framework including the specific indicators for tracking success in achieving FNS. Unleashing STI therefore represents a new development opportunity in which economic development and achieving food and nutrition security reinforce each other and effective strategies must be deployed.

The Road Map is detailed in the Table below.

The Road Map

STI governance and public policy

Issue / Gap Area	Action Item, Time Frames: Short-term	Medium- Term	Long-term	Responsibilities: Active-stakeholder	Accountability
STI Governance and Public Policy: R&D, Higher Education, and Engaging the Private Sector					
Overall action item: Empowering the civil society in promoting accountability					
Issue 1 – Limited capacity Issue 2 - Weak institutional accountability Issue 3 - Weak public awareness					
1. Capacity building	Identify a pool of experts at the local, national, regional and international level including expertise outside conventional agriculture disciplines to support capacity building.			National government via specific Working Group committees	Public
	Review educational policies/ programmes/ plans for STI and agriculture to identify gaps and synergies/complementarities; Identify relevant and applicable multi-disciplinary training needs.			Government ministries, schools, training / vocational colleges, universities	Public
		Develop training material /reference literature for specific target audiences		International/ regional/national academia, PRIs, CoEs	Public, trainers, entrepreneur, social workers
		Draw on non-formal science and local and traditional knowledge when devising integrated food, agricultural, and natural resource policies		Policy-makers, academia, researchers	Public
			Provide targeted training and exposure to improve the scale, efficiency, and responsiveness of public service delivery at the national, regional and local level; Empower citizens to participate more effectively in shaping their own development and to promote good governance and accountability.	Service providers with diverse skills and strength: universities, NGOs, PPP which support agriculture productivity programmes	Policy-makers, research staff, extensionists, legal officers, standards & controls officers, trainers, communication specialists, NGOs, public
			Bring multiple ministries together into new institutional formations	National government via specific Working Group committees	Public, farmers, entrepreneurs
Case example / Good practice The Africa Leadership Training and Capacity Building Program (Africa Lead) which is done within the framework of the NEPAD's CAADP					

2. Strengthen institutional accountability	Set-up think-tank / expert groups to identify new institutional pathways and governance structures to reorient food systems to meet STI and equitable development goals	National government, inter-institutional /industry task force	Public, PRIs, educational institutions, national/ regional/internatio nal, policy-makers
	Democratise participatory processes to dispel monopoly of participation by elite forces; Increase knowledge of frameworks/processes to link the public with state institutions by adopting a top-down & bottom-up approach; Promote policies to stakeholders at different levels and create strategies to reach local actors and M&E systems which engage farmers/entrepreneur organisations	National government, development agencies, equal opportunities commissions, farmers' group	Public, farmers, entrepreneurs
	Institutionalise mechanisms for accountability via new legislation to ensure that access to food is a right which is justifiable—actionable in court, with redress and liability enforcement mechanisms in place	National government, state law office	Public
	Conduct systematic statistical data collection and testing to create and validate open access database with the aim of updating and realigning institutional arrangements, frameworks, policies	National statistical offices, national development agencies	Public, farmers, entrepreneurs
Case example/ Good practice The CAADP Mutual Accountability Framework			
3. Create public awareness	Facilitate involvement of citizens in public policy making as a constitutional obligation by setting-up regional and continental forums to coordinate local actors	Multilateral consortium of stakeholders: national governments NGOs/interest groups	Public
	Intensify public political education to deepen and strengthen knowledgeable public participation in policy formulation; Conduct systematic media campaigns against the negative stigma of agriculture among the public, private sector, politicians; Report success stories from agriculture; engage the youth in competitions	National & regional development institutions, NGO's, universities, farmer organisations, media	Public
Case examples CTA Top 20 Innovation: The rural resource centre project: community based approach to extension Application of the comparative action research approach as applied in the COS-SIS project			

Taking innovation to scale

RoadMap	Action Item, Time Frames			Responsibilities	
Issue/Gap Area	Short-term	Medium- Term	Long-term	Active-stakeholder	Accountability
Taking Innovation to Scale and Private Sector Engagement including IPR issues					
Overall action item: Convergence of Public and Private Partnerships					
Issue 1 - Lack of a private sector engagement to facilitate upscaling and commercialisation Issue 2 - A fragmented IPR regime, lack of awareness regarding adherence to global standards to distil hindrance related to trans-boundary commerce Issue 3 - Lack of a supportive environment for outscaling					
1.Establishment of an enabling national platform for private sector engagement	Commission investment fora, workshops and match-making events to foster novel linkages among different economic sectors with a view to shaping innovation pathways for the food and agricultural sectors			PPP, national research organisations, ministries	Professional farmer organisations, small-holder farmers/ innovators
	Attract new entrants and service providers via business incubator schemes in the agri-food sphere. Small-holder farmers should have the opportunities to extend their role in the value chain through post-harvest value addition and marketing services			National development organisations, Industry Board	Farmers, entrepreneur, public
		Provide life-long learning to develop and dispense short courses on entrepreneurship by business schools-large agri-food organisations consortia		Private sector led & supported by business schools	Farmers, entrepreneur, public
			Inculcate the notion of IPR to current, potential and aspiring innovators through the provision of counsel e.g. in signing legal agreements with respect to the development of patentable innovations	Private foundations, philanthropists	Farmers, entrepreneur, public

Case examples

1. The Africa platform for startup funding. **Venture Capital for Africa (VC4Africa)** is the largest online community of entrepreneurs and investors dedicated to building game changing companies on the continent. Entrepreneurs have access to free online tools, mentorship opportunities and private deal rooms. The community has members in 159 countries and meetups have been hosted in more than 50 cities around the world. VC4Africa operate as a peer-to-peer network and champion an open source approach.
2. The **Forum national de la Recherche Scientifique et des Innovations Technologiques** (FRSIT) is convened every two years in Burkina Faso. It brings together various national, regional and international organisations for scientific exchange and displays the results of research and innovation to the public. The forum is an institutionalised event decreed by the government of Burkina Faso No. 95-374/PRES/MESSRS.

2. Harmonisation of IPR regime and standards through a participatory process and awareness building (Regional, International)	Align existing different national laws and policies on intellectual property rights protection with updated regional framework	Private sector, Chambers of Agriculture & Commerce	RECs such as namely AU, CARICOM, Pacific Union
	Apply policy pluralism in engaging the civil society and state actors' participation in the negotiations and processes that shape harmonisation of IPR issues	National governments, PPP	NGOs, professional farmer organisations, innovators
	Popularise information about IPRs and the larger context within which they are emerging and organise public, rural communities and scientists around requirements for agri-products standardisation	Community centres, professional farmer organisations, NGOs, media	Public, farmers, entrepreneurs
	Build capacity in IPR offices and standard setting offices	National governments, PPP, certifying bodies	Public, farmers, entrepreneurs
Case examples/Good Practice : CTA Top 20 Innovations with potential for rights protection. 1. Bio-herbicide: eco-management of water hyacinth 2. Improved beans outperform traditional varieties 3. Cassava steam dryer			
3.Developmental Grant Scheme to support private sector cross-border outscaling	Form alliances with the various service providers linking technologies and the civil society to exploit entrepreneurial opportunities and drive the innovation process.	Private sector, NGOs	National rural development institution and professional farmer organisations
	Establish PPP by way of co-funding schemes from large private entities coupled with governmental support via the repayment of loans at low interest rates	private sector, NGOs	Public, farmers, entrepreneurs
	Develop an inclusive financial mechanism to ensure: (i) that small-holder farmers and innovators can protect their innovations (ii) that the poorer end-users can afford products and services derived from protected technological innovations	National government, industry development board	Public, farmers, entrepreneurs
	The contextual nature of innovation should be evaluated when assessing out-scaling opportunities given the ecological dimension associated with agricultural activities and services.	HE institutions, Research institutions, professional farmer organisations	Public, farmers, entrepreneurs
The Bio-Innovate Program Network is a multi-disciplinary competitive funding mechanism for biosciences research in eastern Africa (Ethiopia, Kenya, Tanzania, Burundi, Uganda, Rwanda). It uses an innovation systems approach, engaging new and existing actors in and outside the eastern african region in bioresource innovations, laying foundation as well as up- and out-scaling approaches for development.			

Financing/Investment modalities

RoadMap	Action Item, Time Frames			Responsibilities	
Issue/Gap Area	Short-term	Medium- Term	Long-term	Active-stakeholder	Accountability
Financing Investment Modalities					
Overall action item: Establishment of responsible partnerships/linkages; Incentives and reward systems					
Issue 1 - Lack of the national and regional mechanisms to identify, analyse and value innovation Issue 2 - Lack of financing mechanisms for investing in innovation Issue 3 - Poor mechanisms to understand quality standards required to access to market					
1.Establish public-private linkages to patronise calls for showcasing innovation projects	Sensitise stakeholders via consultative fora regarding the need to conduct innovation inventories			National governments, Private industry task force	Small agri-entrepreneurs, NGOs, public
	Establish a Public-Private partnership among institutions to identify, analyse and value innovation. Funding can be stirred via the private Corporate Social Responsibility projects. Sectoral Competence Clustering should be applied to identify and assess existing research outputs/ innovations which can be out-scaled.			Private industry task force, rural development institutions, advanced research institutions, HE institutions, extension/ demonstration offices	Small agri-entrepreneurs, NGOs, public
Case example The **CTA Top 20 Innovations Programme** is a practical example of a regional initiative (ACP) innovators talent hunt. An innovators think-tank consisting of high level policy-makers, academicians, researchers, legal and financial advisers to screen and assess submissions can be considered. Showcasing the innovations which occur at local level within communities, universities, small entities can be harnessed and up-scaled to create wider development impact, provided that advisory, financing and investment modalities are institutionalised.					
2. Establishment of funding mechanisms to finance innovations	Introduce funding mechanisms that will help to finance innovations in the forms of (i) Agricultural and Development Banks and (ii) application of subsidies on specific products and services which fall under innovation schemes			NGOs Micro-finance institutions and micro-insurance agencies Governments	NGOs, public
	Develop microfinance sector, including micro-credit and other group-based lending mechanisms institutionalised			National government, supported and coordinated by women and youth NGOs and driven by the microfinance institutions	NGOs, public
	Develop benchmark indicators to categorise potential customers into practically identifiable criteria to define market segments and corresponding financial products			NGOs Micro-finance institutions and micro-insurance agencies Development banks	NGOs, public

Case examples

The case of microfinance institutions, pioneered by the Grameen Bank, in Bangladesh is a good example of non-government organisation-led operations where the government directly and indirectly provided major policy and material support to develop one of the largest microfinance sectors in the world.

3.Establishment of commodity exchange market centres	Establishment of commodity exchange market centres for the trading of economically important commodities. The pre-requisite to enable this action include: harnessing the human resources to drive the commodity market sub-sector & setting up of warehousing facilities	PPP	NGOs, farmers group, cooperatives and public
	Institutionalisation of commodity differentiation requirements for exchange markets: farmers will be exposed to the notion of price discovery, and can opt for market segmentation.	Ministries of finance/ economic development & planning	NGOs, farmers group, cooperatives and public
	Establishment of traceability and standards criteria for products to access international markets e.g. for commodities falling under the Africa Growth and Opportunity Act (AGOA)	National government, standards& assay agencies/bureau	NGOs, farmers cooperatives and public
	Introduction of market information systems services	Public-private and/or private holding systems	NGOs, farmers group, cooperatives public

Case examples

- The Ethiopian commodity exchange market, ECX which currently trades three commodities: coffee, sesame and white beans.
- The Rwandan EAX markets which trade minerals and agricultural commodities.
- Agricultural information systems via mobile phone services : iCOW, M-Farm, M-Pesa, Kilimo Salama

1.0 Introduction

1.1 Background

Food and nutrition security (FNS) is a complex, multi-dimensional challenge requiring a multi-sectoral (agriculture, health, environment, science, education and trade) approach and multi-disciplinary collaboration, well-equipped facilities (including laboratories and processing, storage and packing plants), highly motivated, well-trained and creative human resources and public and private investments and partnerships.

1.2 Objective

The objective of the International Forum was to develop a three-year Roadmap for the ACP region which:

- Defines policy intervention;
- Mobilises broad-based stakeholder engagement; and
- Reconciles public and private sector to promote investment.

1.3 Approach

The International Forum used an evidence-based approach featuring keynote presentations by diverse experts and showcasing the CTA Top 20 innovations brought about by farmers, extension specialists, scientists/researchers and entrepreneurs in order to improve livelihoods of small-holder farmers and expand the area of activities of other economic sectors in the ACP countries. Growth attracts growth, and growth secures wealth creation and socio-economic development. From this perspective, focal areas to be addressed to unleash STI and sustain inclusive development were addressed and further explored during plenary discussions and working group sessions.

1.4 Expected results

Participants in the Forum sought to:

(i) identify the key science, technology and innovation (STI) governance issues;

(ii) target the means to leverage higher education, research and development to enable innovation with accompanying successful investment and commercialisation; and

(iii) prioritise issues and perspectives on innovation systems in support of inclusive growth and effective strategies that benefit smallholder farmers

2.0 Overview of Technical Sessions

2.1 Opening Session

2.1.1 Welcome and Introductory Remarks

Mr Michael Hailu, Director of the CTA, opened the workshop and welcomed the participants. He reviewed some of the commonalities concerning the FNS challenge in the ACP countries and mentioned the CTA's engagement in the promotion of cross-border learning partnerships in a number of focal areas such as business skills development, financial management, nutrition-sensitive agriculture, ICTs, greater participation of youth and women in agribusiness, climate smart agriculture, policy analysis and advocacy, and knowledge management. Mr Hailu advocated for the strengthening of national government policies and capacity-building of regional networks in order to create enabling frameworks to allow Science, Technology and Innovation to permeate all sectors of the agricultural and food value chain. Such actions would build resilience to address food and nutrition security.

2.1.2 Setting the Scene

The Global Food and Nutrition Security Challenge and the ACP Context - Judith Ann Francis, Senior Programme Coordinator, CTA, Netherlands

The first contributor to the International Forum, Judith Ann Francis, Senior Programme Coordinator, deliberated on the temporal evolution of the definition of food security i.e. from the four pillars namely: food availability, accessibility, utilization and stability to include an ecological dimension.. She further referred to the 2013 EU Food and Nutrition Security Implementation Plan. Based on recent research work undertaken on analysing the impact of Africa-EU and Pacific–EU STI cooperation, she highlighted the multi-dimensional nature of the FNS challenge, the implications for measuring impact and the need for targeted multi-sector response and policy cohesiveness.

2.2 Key messages and discussions

2.2.1 Focus 1: The Enabling Policy and Institutional Environment

Five presentations were given in this session.

Governance of science, technology and innovation for food and nutrition security *- Prof John Mugabe, University of Pretoria, South Africa*

1. The first keynote presentation in this session was delivered by Prof John Mugabe, University of Pretoria, South Africa. His main emphasis pertained to the priority level that food and nutrition security should be given by national governments in the ACP countries. His driving argument was that food crisis interventions should not only be viewed as a food security issue *per se* but as matter of national security. The speaker stated the example of Kenya whereby access to food is considered as a basic human right as stipulated in the country's Constitution.

2. Prof Mugabe posited that there is a need for a robust institutional framework to address the governance of STI which must encompass **three pillars**: (i) high transparency, (ii) accountability mechanisms coordinated via inter-sectoral or inter-governmental bodies and (iii) public participation.

3. It was argued that some countries which demonstrate what is considered lack of good governance, with low indices democratisation, are nevertheless in some cases showing high economic gains. The speaker emphasised the benefit of having **an intrinsic culture of effective public participation** which creates an enabling environment for good policy implementation. Under governance conditions where the public is aware that they have ownership of the policy outcomes which have cross-sectoral implications for improving livelihood, decision makers ensure that implementation is enforced, thereby enabling actions are taken.

4. Based on the experience gained in African countries regarding the STI policy process, it was stated that conceptual clarity at the policy formulation stage is a fundamental factor to consider for ACP countries which are embarking on STI to address FNS. Again emphasis was laid on the governance of the STI policy which should specifically focus on (i) implementing FNS policy from a rights-based approach, (ii) transparency and accountability as democratic safeguard mechanisms to facilitate implementation (iii) the adoption of the innovation systems approach in addressing FNS which must be backed by the development of food security STI indicators to measure impact. The number of specific plant varieties released suited to a particular region was given as an example of a **specific STI indicator** in contrast to currently used indices such as the number of and classification of research scientists in a particular national/regional research programme. It was further argued that there are different culture-specific routes to create the enabling environment for successful policy formulation and implementation. For example, it is recognised that English-speaking Africa and French-speaking Africa share different policy making viewpoints. It was therefore suggested that national and sub-regional anthropological specificities should be taken into account where these can bridge the gap between policy formulation and policy implementation.

5. The speaker responded to several questions pertaining to the role, effectiveness and opportunities for stakeholder participation. It was stated that, currently, the standard of public participation is not specifically measured in STI policy and is only broadly addressed under human-centred development indices. In countries with strong activist movements, the public play active roles to influence the type of policy they demand to improve their livelihood. In other countries, public participation is quasi-inexistent and it is generally acceptable for the public to be informed of policy decisions decided *a priori* by government. It is under such conditions that effective **enabling mechanisms for public participation should be institutionalised** to ensure implementation: compulsory accountability and transparency requirements have the potential to spearhead public participation in STI policy-making.

6. One participant mentioned that, as a consequence of globalisation and regional integration, a widening of the gap between policy formulation and policy implementation is to be expected as policies are increasingly being developed at regional level either by regional economic communities and/or organisations e.g. the African Union. Such policies have to be domesticated to enable their implementation and the lack of stakeholder/public participation was reiterated as cumulatively contributing to poor STI implementation. Prof Mugabe responded by categorising the **STI policy into implicit and explicit policy processes**. Implicit STI policy involves budgeting and subsequently comprises of good governance and accountability aspects. Explicit STI policy generally constitutes of statement of intents and may fall short of actions. The key to mitigate this shortcoming is to back the STI policy with time-bound action plans followed by strategic accompanying measures.

7. It was stated that in many instances, the opinion of the small-holder farmer in the choice of phasing out of some technologies, had not been sought. In this regard, Prof Mugabe was requested to share his views about the factors which determine the efficacy of a good STI policy from an end-user (small-holder farmer) perspective. The speaker explained that good governance of STI policy is achieved when the farmers and the population are placed at the centre of development. The key is to have a strong implementation policy designed for **effective mitigative mechanisms for action to address operational difficulties**.

8. The concluding comments regarding this keynote speech pertained to the policy implementation difficulties. A claim was made that in many countries, the FNS situation is worsening with declining investment in agriculture, increasing demand for food, declining uptake of agricultural activities by the youth. Under these conditions it is difficult to influence decision-makers to acknowledge the need for investment in agriculture, science and technology, without which innovations cannot be unleashed.

Food and Nutrition Security challenges in Ethiopia and the role of the Ethiopian Agricultural Transformation Agency (EATA) in facilitating technology access and adoption *- Seife Ayele, Director, Technology Access and Adoption Program, Ethiopian Agricultural Transformation Agency, Ethiopia*

9. The presentation of Dr Seife Ayele provided a practical example of **STI policy implementation** in the agricultural mechanisation value chain. The specific case demonstrated the research, development, effective technology transfer of a mechanised row planter to optimise teff (*Eragrostis tef)* seed sowing in Ethiopia.

10. The intervention specifically focused on the importance of each component in the **implementation of the agricultural mechanisation value chain** to ensure uptake of new/improved technology by the small-holder farmers. Implementation, apart from R&D, was deemed as a critical key to provide farmers with technological innovations. This entails a rigorous process comprising model testing and identification of specific

needs for technical adaptation and/or modification in order to maximise functional efficiency prior to engaging in the different value chains (e.g. ensuring spare-parts availability) for sustainable large-scale multiplication of the implements.

11. In view of the fact that the findings on the design of the mechanised row planter were outsourced to a US-based company, questions were raised by the participants regarding the ownership of the IPR. Dr Ayele clarified that the findings from the initial phases of the experiments performed in Ethiopia were shared with the US private company in order to improve the row planter for additional efficiency and flexibility. However, the IPR belongs to the Ethiopian research organisation, Ethiopian Agricultural Transformation Agency (EATA).

12. Answering a question pertaining to the affordability of the small-holder farmers in adopting innovative mechanisation technologies, Dr Ayele maintained that the working idea is to target a **service delivery approach** after engaging farmers in the identification, assessment and uptake across the mechanisation value chain. The installation of a contractor-based service ensures that each farmer has access to the teff row planter such that the need to invest in ownership, and the associated cost thereof, of the implement is eliminated.

Controversies of intellectual property rights in Food and Nutrition Security *- Dr Isaac Rutenberg, Director, Centre for Intellectual Property and Information Technology Law (CIPIT), University of Strathmore, Kenya*

13. Dr Rutenberg introduced the International Forum to the controversies associated with fulfilling the **requirements of IPR in addressing FNS**, which is controlled by private entities, considering the fact that access to food and agricultural commodities is a fundamental human right.

The importance of **exclusive agricultural data ownership** and the difficulty met by subsequent manufacturers to replicate experimental trials for generic commodities' production, due to the protection of original data, were also mentioned. The speaker also introduced the International Forum to the latest major potentially controversial change in agriculture in developed countries since the introduction of genetically modified (GM) crops. He referred to a new concept called prescriptive planting, which is a system that uses precision farming that combines remote-sensing and other cartographic techniques with climate data to indicate which seeds to plant and how to cultivate them in each patch of land. It raises profound questions about ownership of the information on which the service is based as well as privacy disputes.

Moreover, reference was made to the use of patented GM products, such as the herbicide Round Up and Bt crops. The use of these products is regulated by international agreements such as the Cartagena Protocol on Biosafety which was ratified by the United Nations Convention on Biological Diversity. However, the long term-effect of their applications remain contentious and uncertain as well as the debate linked with the significant risks on the environment or human health.

An analogy was drawn to compare the concerns associated with the discovery of antibiotic resistance associated with the use of penicillin 80 years ago and today's uncertainty regarding the uncertainties linked with GMO products; implying that risk perception should not undermine further research in order to improve the knowledge base of GMO products' mode of action. It was suggested that countries should implement policies that widen the range of GMO products they utilise in order to dispel risks associated with relying solely on a single product (e.g. 80% of herbicides use in Burkina Faso is from a single product); hence, the need for **national biosafety regulatory frameworks**.

14. To a question based on the ways and means to balance the use of public funding and the requirements involved in the commercialisation of innovations, Dr Rutenberg explained that there is a need to create regulatory frameworks to enable funding institutions and organisations which benefit from public funding to address **IP challenges** following successful commercialisation of their innovations. In the US, for instance, the innovator farmers can retain the IPR but this is rarely the case in Africa. More, specifically biosafety frameworks were invoked as important components of research to catalyse development capacity.

15. Sharing his personal experience as a small-holder farmer, one participant commented that the problem of lack of STI adoption by small holder farmers is partly due to (i) the lack of clarity on the innovation, (ii) its usefulness and (iii) the method of identification of the problem by the experts. The uptake of innovation depend on how clear and appropriate the innovations (viz. effectiveness of GM products) are to the end-users (small-holder) and, it is therefore crucial that research problems ought to be identified in consultation with farmers.

Harnessing the power of higher education for global Food and Nutrition Security - *Ms Roseanna Avento, University of East Finland, Finland*

16. Ms Avento defined FNS and then, stated that while in the developed countries food is wasted at the consumer level; in the developing world food wastage occurs at the production level. In her speech, she linked the effectiveness of the education system in producing the competent human capital required to change the enabling environment towards promoting innovation to achieve FNS through **infrastructure improvement** and **life-long professional learning and skills development**.

She then emphasised on the need for **cross-sectoral innovative partnering** to create improved and integrated food value chains at the small-holder level. A key issue which emerged from her intervention and which is very relevant in the context of STI in FNS is the need to **share common grounds in specifying the goals of the stakeholders within an innovation model emanating from international development efforts**: the technology providers (e.g. universities from developed countries) vs the end-users (small-holder farmers).

17. Upon a request to share her opinion about whether small-holder farmers have benefitted from STI via support from European higher educational institutions, Ms Avento acknowledged that there is evidence of success stories in instances where their requirements have been **tailor-made** to address their specific needs and interests. The case of mobile fish processing plants in Central Asia was referred as a successful example of out-of-the-box STI involving partnering between higher education institutions from a Finnish university and local private aquaculture companies in the concretisation of innovations to improve aquaculture productivity and eventually, the livelihood of small-scale fish farmers.

18. Speaking from the point of view of a farmer and as an academician, one participant stated that the **bottom-up approach**, as showcased by the CTA via the Top 20 Innovations, should more effectively lead to advancement and in eventually assisting farmers to improve their livelihood via agribusiness incubators. The role that farmers can play to create **farmer demand-driven research** was highlighted and the experience of the NUCAFE coffee business model in Uganda (Table 1) was shared in this regard.

Research, Higher education and Innovation: Implications for public policy - *Prof Merle Jacob, University of Lund, Sweden*

19. Professor Jacob's key message to address STI for achieving FNS centred on the importance of **holistic development in education**, which is a constitutional right, to **create impact**. Her intervention focused on the urgency to define and shape long-term national strategic plans for the entire education value chain from **primary to tertiary levels** across the ACP region. It was deemed imperative that **governments invest their own resources** to ensure quality in education in order to endow the future human capital with the necessary STI acuity to address national priorities and challenges.

20. In the light of this requirement, one participant wanted to know which additional dimension is necessary to redefine quality education. Prof Jacob mentioned that there is a current tendency to regard education as a social entitlement. However, in order to unleash development, STI is needed across all economic sectors. Therefore, it was strongly suggested that the aim of education should be defined in such a way that it supports **functional diversity** to stimulate knowledge-base creation and cross-sectoral investments in innovations that address national priorities.

21. Prof Jacob expressed the view that **public funded HE** needs to be allocated with specific resources **to conduct research of national priority relevance** while also ensuring nation-wide competence development through quality education, involving effective teaching and learning which is vetted by audited quality assurance exercises. The introduction of performance-based allocation funding was suggested as a means to establish a sustainable mechanism of action in this regard.

22. It was suggested that as means to counteract the effect of brain-drain, **diaspora resources** can be tapped via external evaluation processes of HE and research organisations with the aim of promoting institutional innovations in the ACP countries.

23. Following a discussion from various participants, it was agreed that the conventional essentialist approach is no longer valid to spearhead **knowledge and innovation awareness** which can respond to FNS priorities. Given that it was agreed that education is a fundamental right, the need to holistically develop a continued education system – primary, secondary, tertiary, is recognised. Hence, the education value chain has to be re-thought.

Prof Jacob posited that **research is not the only pre-requisite for innovation and ensuring economic growth in all economic sectors** but it is necessary in order to enhance and maintain sustainable knowledge systems. **Systematic data gathering** is an important exercise, which can be undertaken by HE institutions, to drive decision-making at the level of policy formulation, to specifically **identify disciplines which require life-long professional development**. The outcome of such probing exercise could serve to support institutional innovation in universities via the creation of hybrid institutions geared towards the provision of continuing professional development and outreach activities.

2.2.2 Focus 2: Leveraging Higher Education, Research and Innovation

This session was comprised of two keynote address and three presentations.

Research, Innovation and Entrepreneurship *- Prof Ameenah Gurib-Fakim, Managing Director, CEPHYR , Mauritius*

1. The session began with the first keynote address given by Prof Ameenah Gurib-Fakim. Her intervention was centred on the **potential for research, innovation and entrepreneurship in Africa**. She provided a description of her personal STI experience as an academician and how she successfully bridges her phytotherapy research with nutraceutical production as a "sciento-preneur". She acknowledged that currently, Africa faces major constraints for the commercialisation of its research output such as **poor access to venture capital** but is optimistic about the continent's prospect to embark on STI. Prof Gurib-Fakim singled out Africa's real **demographic opportunity**: having the youngest trainable population. She emphasised on the promotion of gender equality in accessing (Science, Technology, Engineering and Mathematics) **STEM education** and in improving the image of the agricultural sector beyond the outmoded traditional perception in the light of the major challenges, with expected disproportionate impacts, facing the continent such as the climate change, HIV-AIDS epidemic, etc.

2. Participants were interested to learn about **the structure and staff composition of the Centre for Phytotherapy Research** (CEPHYR) Ltd. Prof Gurib-Fakim explained that the CEPHYR Ltd is a private company which has been incorporated in 2009 with the head office located in Mauritius and three overseas branches in India, Europe and South

Africa. The research work is focused on plants and their potential application in the field of cosmetic, nutrition and therapy. The staff members consist of young graduates as well as students on training. Moreover, fresh graduates are given the opportunity to obtain short-term job training via the national Youth Employment Programme. CEPHYR Ltd is part of a holding of companies which has CRO status (Contract Research Organization) and conducts clinical trials both on behalf of pharmaceutical and cosmetic industries.

3. Addressing a question pertaining to her company's covenant on **IP issues**, the keynote speaker mentioned that the phytotherapy research centre focus is on the utilisation of plants within an **international framework**, namely the Nagoya Protocol, whereby each country has sovereignty on its biological diversity. The centre is very active in **salvaging traditional knowledge** (TK) associated with plant genetic resources.

4. One participant commented that it would be highly relevant to identify the degree of political interest, if any, behind the **custody of African plant resources** and the type of institutional infrastructure which could be designed to take the responsibility for the systematic characterisation of these plant resources. It was suggested that the African Union could be a competent ally in endorsing this type of agenda. Prof Gurib-Fakim supported this statement by adding that national governments should create the appropriate **regulatory framework to document and protect the biological diversity and plant genetic resources** and to shift away from the mindset that African traditional plant knowledge is an informal sector.

5. Concern was expressed over the fact that there is a perception that STEM education is expensive to implement even though it is recognised as being part of the solution to improve education. The keynote speaker mentioned that emphasis should be laid on more practical teaching and learning methodologies (hands-on experimentation) e.g. via the Microscience project of the UNESCO and the Scientix La Main à la Pate initiative of the EU rather than focusing on the theoretical components only. Moreover, the aim should also be to **increase the interest of young people in STEM subjects** so as to promote gender equality, scientific literacy and positively influence their choice of a scientific career. In order to enable this, there should be capacity building for science education to enhance the development of scientific thinking and experimental acuity for pupils.

6. Responding to a question on the means to make the youth 'fit for purpose' and enhance food and nutrition security, the speaker stated that with the projected population explosion in Africa, only one sector can absorb the active population entering the job market. There should be a **shift away from the stereotype portraying of the agricultural sector** via a farmer handling historical tools and to make the sector as a trendy, promising and income generating career path.

7. It was argued that the development of plant-based remedies for diabetes lags behind the development of cosmetics from indigenous plants. Prof Gurib-Fakim clarified that the research output obtained from the plant-based remedies for diabetes was performed under a former role as an academician and the results of the experiments are of public domain nature. The Centre International de Développement Pharmaceutique (CIDP), as any private company is profit-driven and the research in cosmetics is highly market-oriented which enables CEPHYR Ltd., which exists as the sister company, to invest and focus on its main mission which is biochemical characterisation of traditional plant genetic resources.

Science and Innovation: Lessons in commercializing University Research outputs: The case of anthuriums, hot pepper and cocoa in the Caribbean - *Prof Pathmanathan Umaharan, Director, Cocoa Research Centre, University of West Indies, Trinidad and Tobago*

8. The second keynote speaker, Prof Umaharan, Director of the Cocoa Research Centre, University of West Indies, Trinidad and Tobago shared his early research experience as a successful cowpea breeder which led to increased *Cercospora*-free yields. He mentioned, however, that the research outcome was not translated into sustainable technology diffusion and adoption actions. This was attributable to a number of factors which were overlooked in the STI model such as different requirements for in-field cultural operations such as staking, a weak seed bank structure, consumer preference for long-pod variety, lack of absorptive capacity of the local market to deal with surplus, amongst others.

A **triple-helix farmer-centric model** was introduced to the International Forum as a means to unleash STI. According to Prof Umaharan, university research should engage **farmers' participation**, be aligned with **market development needs** and exploit the **comparative advantage** of food and agricultural products. His current work involves the setting up of a cocoa innovation centre at the University of the West Indies in Trinidad and Tobago, with particular emphasis on research geared towards product and market differentiation. Another initiative of Prof Umaharan's research and innovation model is exemplified via the bioengineering of anthurium flowers with specific focus on the development of blue-coloured flowers in order to benefit from comparative market advantage. The components of the triple-helix approach shaped deliberations as described further.

9. Prof Umaharan was requested to elaborate on the cross-case study factors that would drive successful innovations. He emphasised on the **early inclusion** of the three elements (i) farmer participation, (ii) understanding of market information and (iii) consideration of emerging consumer preference of food and agricultural commodities, in the innovation model design. Moreover, he posited that the national research policy and the universities' research agenda should be mutually aligned. This is particularly important in developing countries to enable universities to engage in research with subsequent potentially successful commercialisation.

10. Responding to a question on which component(s) of his innovation model would drive profitability in the context of FNS, the keynote speaker elaborated that apart from the production aspect of biomass creation (increased productivity), an innovation system should create enabling tools and processes to make the farmers effective in meeting the dynamic requirements of markets e.g. **value addition**.

11. Upon a request to express his views on which element(s) determine the present focus in the setting up of the cocoa innovation centre, the keynote speaker maintained that the management of the centre requires both **infrastructure and personnel relationship aspects**. The aim is to bring all stakeholders who share common goal together to achieve a set of agreed pre-defined objectives. In order to enable this, governments needs to make policies which are in tune with the needs of universities, private sector and farmers. This requires a multi-faceted system based on the **value chain approach** and is applicable for other crops as well.

12. A comment was received pertaining to the need to re-examine the aim and purpose of breeding programs in African countries from the proposed farmer-centric model's perspective. Reference was made to the breeding of rice in Africa that has had low adoption rates. It was agreed that **breeding for biomass production is not the only focus for successful innovation** and adoption: other factors such as organoleptic properties are emerging.

Enhancing commercialisation and strengthening the linkages between universities and public research institutes with the private sector - *Dr Maurice Bolo, Director, The Scinnovent Centre, Kenya*

13. According to Dr Bolo, there is evidence that universities and public research institutions (PRIs) in the ACP are not the locus of innovations. He proposed that the roles of research institutions should be re-addressed considering the novel linkages, opportunities and challenges which have emerged under the STI-led economic system. He referred to the recent findings of the United Nations Economic Commission for Africa (UNECA) to point out the relevance of existing innovation policies which are however characterised by lack of targeting potential to enable appropriate implementation. This was principally attributed to the **absence of measurable indicators** and support for monitoring and evaluation exercises which impede effective benchmarking of these policies. Another highlight of Dr Bolo's speech dealt with the existence of **IPR tensions**. According to data gathered by his organisation, IPR applications from local firms/universities in Kenya face challenges such as longer processing time and high rates of rejection. Dr Bolo proposed the need for a paradigm shift in the way in which universities and PRIs conduct research for commercialisation on the African continent. It was suggested that **new incentives and reward structures** have to be established.

14. Referring to the speaker's proposition for a paradigm shift for universities and PRIs for commercialisation of research, one participant sought some clarifications as to

whether, in the context of clear stakeholder role definition, **commercialisation** should be exclusively transformed into the private sector's priority. Dr Bolo responded by upholding the importance for **private sector linkages**. Such measures would offset the current low patent acceptance levels of universities. The Kenyan example of private sector linkages with universities and the locally established pharmaceutical industry in the field of HIV-Aids research was given as a practical example.

15. Sharing his views on the means to effectively bring about personal change among university scientists to enhance the effectiveness of universities in driving STI, the speaker affirmed that this will depend on how the researchers assess the institutional environment in which they operate. Dr Bolo suggested that researchers should adopt the role of "sciento-entrepreneurs", improve or revise their socialisation and/or networking expertise so as to develop the appropriate set of skills that would enable them to communicate beyond their peer community. Increasingly, **research and commercialisation focus is moving towards multi-disciplinary fields**.

16. A proposition was made regarding the fact that, as a means to allow flexible operations of their public arms, universities might create companies to manage businesses in the form of contractual obligations with co-funding private partners and to specify the requirement for public use of research outcomes in exchange of their support. Dr Bolo acquiesced that the way forward could be to create entrepreneurship department for **outreach activities** with technology transfer sub-offices.

17. One participant commented that some private sector associations encounter major challenges and frustrations when universities are engaged to conduct policy or business-related assignments as these institutions of higher learning lack the capacity to undertake such work as either they are not linked to the realities of the field or to current trends in agricultural development (e.g. CAADP). This supports the notion that many public and private organisations do not rely on data and/or research outputs generated from some universities, hence leading to the **weakening of institutional linkages**.

Supply chain management and food security during crises - *Prof Gyonki Kovacs, Supply Chain Research Institute, Hanken School of Economics, Finland*

18. Prof Kovacs referred to the components of the FNS conceptual framework in order to demonstrate how the element of **stability** determines the other elements of the framework namely utilisation, accessibility and availability in the food and agricultural system from a **humanitarian supply chain logistics perspective**. She distinguished between the short term needs immediately following a disaster occurrence which is to provide rapid response to contain the impact of the disaster and the rehabilitation phase whereby the aim should be to address problems from a long-term perspective such as the post-disaster **restoration of the sustainability of agricultural productivity and supply chain**. The importance of early warning systems and monitoring and evaluation systems was highlighted.

She stated that innovations are required in order to ensure security of supply during disaster relief efforts in the aftermath of crises. These can be categorised **into process-based, product-based and business model innovations**. Examples of process-based innovations include (a) early mechanisms for (i) weather systems and (ii) supply chain scalability to establish early actions strategy; and (b) systems integration of permanent and temporary supply chains as part of preparedness efforts.

Prof Kovacs posited that **logistics** is the most important element in any crisis relief effort, and it is the one that makes the difference between a successful and a failed operation. But it is also the most expensive part of any disaster relief costing as much as 80 % of the total expenditure. In the context of STI for FNS, the speaker suggested that innovations such as the development of robust food preservation techniques which maintain stability of the food product in the absence of cold chain storage are required to improve energy efficiency and reduce the cost associated with post-harvest shelf-life maintenance.

Prof Kovacs also mentioned the **tensions** which can potentially arise with respect to the sourcing of food supply due to the increased social vulnerability in the aftermath of a disaster such as the decision to opt for imported vs. local food, price hikes, disruption of locally established diets either for medical reasons (e.g. in the case of HIV-AIDS patients) or due to cultural inappropriateness of certain food items. From this perspective, business model innovations which would entail a *quasi* elimination of logistic cost, such as voucher-based programmes or the application of procurement matrix perspectives whereby retailers are attributed the role of first respondent in the disaster relief programme, to ensure security of supply in the short-term, would be highly relevant.

19. During the deliberations, Prof Kovacs affirmed that presently Africa lacks the institutional capacity to address both slow-onset and sudden-onset destructive actions and their subsequent impact on FNS. She acknowledged the **need for preparedness-enabling policies** in the ACP region that would define the strategies to enable strategic implementation of successful operational responses which would be determined via **effective scalability of supply chains**.

20. Responding to a participant's query about the existence of current circumstances whereby local institutions have been supported to pre-empt disasters in the context of climate change, Prof Kovacs mentioned the Bangladeshi example whereby, the transport infrastructure has been modified to reduce logistical cost in order to **improve widespread access to disaster preparedness measures** due to frequent flooding.

21. Acknowledging a comment from one participant, Prof Kovacs stated that early warning system and supply chain management scalability can be adopted as a **tool for optimising planning in farming systems** and not solely as a disaster management or response tool provided the enabling environment exists. The speaker attributed the inability of researchers to solve drought and food crises effectively in Africa due to the **lack of knowledge-base development in supply chain logistics**. Moreover, the discipline is not taught in most universities and is quasi-inexistent in African educational institutions.

22. Upon a request to share her supply chain management perspective on the management of the current Ebola outbreak in West Africa, Prof Kovacs mentioned that humanitarian supply chain logistics occur under complex and rapidly evolving circumstances; hence the need to be institutionally prepared to address disaster events. She further consolidated the previous suggestion in response to a question based on **determining the level of strategic manoeuvring** required to prioritise between (i) humanitarian and (ii) development policy issues; and highlighted the importance of **relevant out-scaling**, which can only be achieved via **systematic data collection and efficient interpretation**.

23. One participant shared the view that the African Risk Capacity (ARC) is a multi-billion dollar weather based risk programme that can be used to determine how the African continent **manages risks in agricultural systems**.

FOODSECURE: Agricultural commodity markets and commodity exchanges: Recent research findings *- Ms Gierdien Meijerink, Wageningen University and Research Centre, The Netherlands*

24. This intervention showcased the recent findings based on the setting up of **agricultural commodity markets and exchanges in Africa**, with a case study example from Ethiopia. Ms Meijerink referred to the FNS pillars – availability, access, utilisation and stability – to assert that neither production nor technology alone is enough to address FNS in the ACP countries. She used the evidence of the Ethiopian commodity market ECX, which has given farmers access to real time pricing information, improved profits and productivity, reduced market segmentation and boosted export quality, to advocate that commodity exchanges and/or local markets with regional functions can contribute as **a tool for managing farm risks for small-holder farmers** and are important in addressing FNS. Private sector involvement from the early phases of the research was reckoned to be critical.

25. The discussion which followed pertained mainly to the **limitations** of commodity markets. Thus, a comment was made about a major shortcoming of the ECX market which lies in the requirements of the traded commodities to be highly standardised (quality graded) and specific. Reference was made to the trading of livestock which cannot be standardised. Further, in response to a query pertaining to the fact that the commodity exchange markets focus only on industrial crops and as a result, do not respond to famine situations, Ms Meijerink maintained that this is because of the risks involved in setting the pricing mechanism under disaster conditions.

2.2.3 Focus 3: Innovation systems

This session consisted of a single presentation by Prof Röling.

Innovation Systems: Towards effective strategies that benefit smallholder farmers - The COS-SIS Experience Prof Niels Röling & Prof Arnold van Huis, Wageningen University and Research Centre, The Netherlands

1. Prof Roling's intervention showcased his appreciation of the outcomes of the "Convergence of Science: Strengthening agricultural innovation systems" (COS-SIS**)** in unlocking the potential of small-holder farming in three western African countries namely Benin, Ghana and Mali. His main message was geared towards the notion that while diagnostic research is essential to the formulation of relevant research questions and selection of entry points for effective intervention, **technology development alone cannot expand small-holder's opportunities significantly**. His in-field experiences indicate that farmers quickly abandon technologies that required conditions for effective use that are beyond their control. Therefore, institutional changes that enable small-holder level innovation need to be embedded in agricultural policy, administration and management at the national, district and local levels.

He stated that working at the interface between the farmer and the agro-ecological context is no longer sufficient. There is a need to understand the **interactions** among farmers, between producers and consumers, and among actors in the value chains, political systems and international trade. To support this argument, he illustrated how careful analysis of the phenomenal growth in productivity in the United States, France and the Netherlands (the world's three largest agricultural exporters by value) shows that the creation of enabling institutional context and the institutionalisation of value chain concepts preceded agricultural productivity growth by decades.

Another key component of Prof Röling's presentation to the International Forum referred to the **non-sustainability of the Business Model of Agronomy** (BMA). This was attributable to the fact that over time, only farmers who can attain economies of scale would remain in business in the longer term, a phenomenon which goes against meeting the challenges of achieving food and nutrition security.

2. Several participants stated that the COS-SIS is a good example of islands of success. Prof Röling was requested to enlighten the audience regarding the correct approach which is required to enable up-scaling, promote impact, and to ensure the sustainability of institutional change beyond the interventions. He acquiesced that successful up-scaling depends on the pre-established enabling mechanisms set in place to function after the innovation has been tested. Prof Roling's also mentioned that late adopters of technology may also innovate and/or adopt innovations provided **sustainable enabling policy conditions** are set in place. There is a need to create a **niche regime landscape** to promote genuine political commitment that would mobilise state actors at the community, district and provincial level to develop a common perspective towards maintaining the sustainable impacts of the proven innovation. They should be assigned pre-defined roles within their organisations to assist farmers in dealing with the challenges of the innovation. Such institutional support can play key role in building the farmers' confidence towards adoption and hence, successful up-scaling.

3. Prof Röling shared one participant's viewpoint on the fact that some innovation models have inherent shortcomings when the problem of **absolute poverty** is overlooked. This is because extremely poor farmers might not be able to adopt new technologies as they have more pressing livelihood priorities such as ensuring that more basic short-term needs are fulfilled. Hence, there is a need to build farmers' institutions comprising of non-farm actors such as government bodies, researchers, NGOs in order to stimulate sustainable adoption of STI by the small-holder community.

4. Addressing a question pertaining to the criteria used to determine (i) the **components of innovation models** and (ii) the modalities regarding the involvement of **scientific research institutions** to increase productivity and quality beyond the baseline levels, Prof Van Huis mentioned that such decisions can be driven by applying the **bottom-up approach**. One of the best ways to improve the efficiency and hence the opportunity for large-scale adoption of innovation outcomes is when the end-users i.e. farmers are proactive in communicating the bottlenecks that they encounter with researchers. The speaker gave the example of palm oil production in Ghana whereby farmers were able to improve productivity via the inclusion of neem (*Azadirachta indica*) oil in the value chain: the locally produced neem oil pesticide was eventually produced by a women cooperative. Therefore, innovation models can evolve to improve productivity by adding new components in the innovation model, with the support of research institutions, to **strengthen the value chain**.

5. With respect to the previous point, one participant emphasised on the importance to create a **global platform** to firstly capture and then to adapt and operationalise innovative ideas and best practices which emerge from within agricultural communities. It was suggested that such an approach would have a wider impact on the global small-holder food and agricultural sector: working from and within grass root level would address issues of participation and relevance that precipitate adoption.

6. A participant heralded that innovation systems are important to solve Africa's pressing needs for effective value chain especially at the level of post-harvest handling, processing, distribution and marketing. The successful recognition of the importance to implement STI solutions by the small-holder farmers should ideally be **anthropologically harnessed** by instilling **innovation-consciousness within communities**.

Issues and perspectives on Innovation systems, inclusive growth and effective strategies that benefit small-holders

An integrated panel discussion, comprising of John Mugabe, Merle Jacob, Niels Röling, Arnold van Huis and Judith Francis, ensued from a human-centred development approach with specific focus on effective strategies that benefit small-holder farmers in the ACP region.

1. One participant expressed the view that agricultural productivity in some East African regions is not yet fully tapped. Farmers produce for foreign markets yet, local food requirements are met through imports. In this regard, a query was made about the ways the local institutions can be strengthened to develop a **compelling incentive-based policy** which would encourage actors in the agricultural production value chain to be motivated to **boost local food production**. In his response, Prof Mugabe stated that institutional change is not a pre-determined phenomenon. Rather, it has to be stirred through **targeted advocacy actions** to demand constitutional change in similar ways that have been achieved by environmental and biodiversity activism. He proposed that NGOs have the potential to mobilise constituencies across Africa to demand more accountability from policy-making bodies. This would create the enabling mechanisms to ensure that policies are not only formulated but also implemented.

2. As a rejoinder to the previous response, one participant added that there is a need to systematically **address poor collaboration among national institutions** as this hampers the implementation of innovation mechanisms.

3. In his concluding remarks, Prof Mugabe reiterated the importance of developing **conceptual clarity** in defining STI policy for FNS. He also emphasized on the need for **STI-specific parameters** that will enable the optimal benchmarking and governance of the operationalisation of STI policy implementation.

4. In their comments, various participants emphasised that there is a need for **competent think tanks to inform governments and intergovernmental bodies of the specific contingencies to be put in place to address STI implementation**. The need for multi-sectoral functional efficiency was highlighted by Prof Jacob, whether in technology diffusion schemes, higher education and research institutions. Prof Mugabe added that the foremost pre-requisite to achieve this over-arching goal is to shift away from the input-output policy approach and to consider the promotion of good governance practices which primarily involves improving budget and financing as well as cohesive analysis of the existing body of policies to spearhead innovation in FNS.

2.2.4 Focus 4: Novel Pathways to Innovation: Scaling Up & Scaling Out

The International Forum applied the evidence-based approach to demonstrate that S&T innovations are occurring in the ACP countries (Table 1). A team was convened to document the innovations that benefit smallholder farmers as the CTA Top 20 Innovations that Benefit Smallholder Farmers via a cross-learning write-shop. A total of 28 participants, drawn from countries in Africa, the Caribbean, the Pacific (ACP) and Europe, attended. They included 19 case authors, experts (one editor, one designer, two translators, four technical experts) and a facilitator.

The CTA Top 20 innovations are not confined to the domain of agricultural sciences and engineering only, but cuts across disciplines such as finance, management and

information and communication technology. The innovation projects fall within five thematic areas:

1. Finance and Management Innovations
2. Pest and Disease Management Innovations
3. Equipment Innovations
4. Production Innovations
5. ICT and Extension Innovations

Currently, the innovations are in use in limited ACP countries and serve to uphold the potential for addressing FNS through enhanced agricultural performance and value addition, beyond the traditional notion that that agriculture is a social sector, to give it a competitive dimension as a promising business sphere. The showcased innovations serve to establish the potential for scaling out and provide an illustrative framework of the type of developmental state mechanisms to be mobilized in order to provide further evidence to fine-tune and employ IPR protection, where applicable, to the research outcomes in order to scale-up, diffuse and promote adoption.

A participatory approach was used in the form of a World Café session to allow the Forum participants to discuss different views and share new ideas related to specific challenges of each innovation. The aim was to identify ways and means for up-scaling and out-scaling to create wider impact. The requirement for further research was assessed as well as opportunities to develop rights protection. The inputs provided by the participants were recorded as shown in Table 1.

Table 1: CTA Top 20 Innovations that Benefit Small-Holder Farmers

Innovation	Can it be scaled out?	How can it be scaled out?	How can it be scaled up?	What more evidence/research is needed?	IPR Issues
Production Innovation					
Low cost feed for semi-commercial chicken farmers (Papua New Guinea)	Yes	Training of farmer organisations in other ACP countries	Establishment of additional feed mills	Chicken growth rate efficiency Nutrient composition of the feed	Yes, the process
Local fertilizer for soil fertility (Malawi)	Yes, product standardisation is a pre-requisite	Achievement of a protocol for the standardised mixture Establishment of a compost distribution plan	Demonstration to farmers/women groups Support farmers in packaging & branding	Physico-chemical product characterisation Evidence of sustained beneficial effect in different soil types	None
Cowpea then maize: innovative approach to intercropping (Ghana)	Yes	Farmer field school Establishment of partnerships	Information dissemination via farmer field school & demonstration centres	Yes, opportunities to be adapted for prescriptive planting research Other crops which can be intercropped Applicability for different soil types	None

Innovation	Can it be scaled out?	How can it be scaled out?	How can it be scaled up?	What more evidence/research is needed?	IPR Issues
Improved beans (Kenya)	Yes	Establishment of seed bank with the involvement of farmers is a pre-requisite	Difficult, unless seed availability is ensured via an effective distribution system	Assessment of commercialisation & consumer feedback Seed degeneration studies Develop more bean products to address malnutrition Social & economic evaluation	Yes, cultivar
Finance and Management Innovations					
The farmer ownership model: Uganda's coffee revolution (Uganda)	Yes	Engage participation of non-product owners e.g . ICT providers Showcase demonstration of success	Partnering with private sector Creating enabling environment to attract private investors	Compare with other models worldwide Produce more value added products	None
Producer business group model for value addition (Kenya)	Yes	Partnering at international level Include more groups, develop strategy to stabilise the cooperative	Partnering at international level Determining farmers be involvement across the entire value chain Marketing the innovation	Creating an independent branding Ethical marketing Conduct survey to affirm farmer satisfaction with returns/connect with academia	Yes
Pest and disease management innovations					
Aflatoxin reduction for Haitian peanut farmers (Haiti)	Yes	Create awareness	Partnering with other actors Designate a generic status - can be used for other crops and in other countries	Long-term storage studies to assess organoleptic and nutritional	None
Bio-herbicide: eco-management of water hyacinth (Mali)	Yes	Partnering with private sector Creating awareness: documenting the success story	Partnering at regional and continental level where hyacinth is a problem, stakeholders and private sector	Large-scale research with partners in other countries where hyacinth is a problem	Yes
Natural protection for stored onion seeds (Ghana)	Yes, product standardisation is a pre-requisite	Sharing and dissemination of the idea	Demonstration to farmers	Product characterisation chemical analysis	Yes

Innovation	Can it be scaled out?	How can it be scaled out?	How can it be scaled up?	What more evidence/research is needed?	IPR Issues
		Demonstration to farmers	Support farmer in identifying active ingredient and dosage		
Biological control of the millet head miner (Niger, Burkina Faso, Mali)	Yes	Creating awareness	Partnering with private sector commercialise Documenting the success story	Explore sustainability issue- willingness of farmers afford	Yes
Solar irrigation pump (UK)	Yes	Produce more units of the pump Establish a distribution plan	Documenting the success story	Render product more robust: pump water from deeper well, install battery to store solar energy for lighting	Yes
Improved crop processing with adapted technologies (Tanzania)	Yes	Trade fairs & farmer field days	Documenting of the success story Trade fairs	Quantification of benefits Make use of locally-available materials Partnering with private sector for commercialisation	Yes
Climate smart hydroponics: growing more with less (St Kitts/Nevis)	Yes	Trade fairs & farmer field days Partnering with private sector	Demonstration to farmers/women groups Partnering with private sector to commercialise	Improve affordability to small scale farmers Market research for commercialisation	Yes
ICT and extension innovations					
Rural resource centre (Cameroon)	Yes	Partnering with development actors & governments	Forging more partnerships Documenting of success stories	Identification of the sustainability of the concept and the service	-
Voice-activated information delivery (Ghana)	Yes	Expansion of services offered and for a variety of enterprise activities	Forging partnership with other actors	Market research on the opportunities to enlarge the service offered by developing products targeting specific audiences	Yes
Digital extension for Southern African livestock farmers (Zimbabwe)	Yes	Partnering with development actors	Forging partnership with other actors, intensifying awareness	Assessment of the sustainability of the concept and the service	Yes
M-fodder (SMS-sourcing) (Ghana)	Yes	Partnering with development actors	Forging partnership with other actors, intensifying	Market research on the opportunities to enlarge the service offered by developing	Yes

Innovation	Can it be scaled out?	How can it be scaled out?	How can it be scaled up?	What more evidence/research is needed?	IPR Issues
			awareness	products targeting specific audiences	
Innovative tropical weather forecasting(Ghana)	Yes	Partnering with development actors	Forging partnership with other actors, intensifying awareness	Impact assessment of the innovation	Yes

2.3 Issues and gaps for Consideration

The key issues and gaps identified during the technical presentations and the discussion sessions were assessed and summarised as shown in Table 2.

Table 2: The key issues and gaps identified from the Technical Proceedings

Issues and gaps
Governance of STI
• Poor conceptual clarity in the design of food security policies • Lack of effective public participation • Poor advocacy awareness • Absence of STI system of indicators in support of evidence-based policy
Farmers' engagement and value chain perspective
• Need to address uptake (research, development and implementation) of innovations by small-holder farmers from a value chain perspective • Need to incorporate farmers' engagement early in the innovation model – adopting a farmer centric model • Need to focus on value chain perspective beyond the farm gate: promote value addition and exploit comparative advantage of farm commodities
Controversies with regard to IPR
• Absence of regulatory frameworks to address IP challenges • Define roles of universities, PRIs and private research enterprise to dispel IPR tensions
Custody of indigenous resources
• Absence of frameworks and political will to recognise custody of African traditional knowledge, cultural and natural resources
Effective partnering
• Need to share common goals in multi-stakeholder international development efforts
Education
• Lack of functional diversity of educational systems • Poor national investment focus in the educational sector • Need for public funded HE institutions to establish research areas which address national priority • Need to provide continuing professional development and outreach activities to create enabling environment for innovation • Need to promote STEM education at all levels – primary, secondary, tertiary

Issues and gaps
Innovation systems and commercialisation • Poor understanding of the innovation process and its implications for policy design • Need to consider innovation as economic systems rather than technological systems in order to widen policy terrains that should be included in the STI category • Need a comprehensive re-articulation of the role that African universities and PRIs play to stimulate innovate • Need to assess whether national institutions/private research organisation have the necessary infrastructure – laboratories, standards, accreditation, human resources, and operation systems in compliance with international frameworks (genetic, natural resources & cultural diversity) • Need to institutionalise novel incentives and reward structures in universities and PRIs • Need to view innovation in terms of enabling interactions between market opportunities and small-holder farmers'/agri-entrepreneurs' access to knowledge-base and capabilities
Crisis management and disaster preparedness • Need for capacity-building and human capital in supply chain logistics • Lack of preparedness-enabling policies to restore the sustainability of agricultural productivity supply chain • Need to develop early warning systems to predict scalability of supply chain • Need for systematic data collection and efficient interpretation to benchmark the level of strategic manoeuvring required in prioritising humanitarian/crisis vs. development of FNS policies
Managing post-production farm risk **Setting up of commodity and exchange markets to distil distribution risk**
Comparative action research • Addressing institutional issues is a pre-requisite for small-holder farmers to adopt innovation

2.4 Working group report

In the Working Group (WG) Session on Day 2, the Forum participants were allocated to one of the three thematic questions. Three questions drove the discussions which aimed to assess the pathways that knowledge generated can be used for addressing FNS:

1. What is the relevance and effectiveness of current agricultural research and innovation policies and programmes for addressing the food and nutrition security challenge? Where should the emphasis be in the next three years?
2. What evidence is available on innovations occurring in ACP agriculture for shaping future STI policy formulation and implementation for achieving food and nutrition security?
3. How best to sharpen the STI focus, strengthen national innovation systems and increase public and private investments to effectively address food and nutrition insecurity in the future?

The participants developed a consensus position regarding possible solutions and provided working examples that could be considered. Each Group's output was presented to the plenary in the form of short PowerPoint presentations for deliberation. By addressing the three thematic questions, participants laid the foundation for the development of the Road Map which was developed in the World Café Session on Day 3.

What is the relevance and effectiveness of current agricultural research and innovation policies and programmes for addressing the food and nutrition security challenge? Where should the emphasis be in the next three years?

Participants in the WG 1 laid much emphasis on the differentiation between the relevance and effectiveness of food and agricultural policies and their conversion into national programmes. They affirmed that there is no dearth of polices but these do not respond to emerging national, regional and/or global challenges and/or are not translated into action plans which would bring the desired impact.

The guiding principle should relate to the fact that food sovereignty decisions enjoy national importance priority such that corresponding policies need ensure that cash crops and the ensuing revenues can respond to shortages in food supplies. The importance of trade and budget issues and therefore, good governance were highlighted.

Further inputs provided by participants in WG 1 are detailed hereby.

Table 3: Measures to improve policy relevance and effectiveness

Gaps in current policies
1. Need for better understanding of policy making processes and how to influence it. It can be a lengthy process. 2. There are competing policy interests: External policies often undermine internal policies 3. Policy implementation and/or coherence is a challenge 4. Need for regional, sub-regional and national policies – since countries are porous

Gaps in current policies
(scientists can move out of systems) 5. Harmonisation of policies at different levels 6. Lack of data to undertake comparative analysis of different policies 7. Need to develop competitive advantage in the context of WTO and global trade 8. Policy formulation is a challenge: Need support from institutions of higher learning/ research in policy making 9. Competing interests- e.g. influence of private sector on enforcing policies to import duty free maize 10. African institutions are weak and do not have a stance on many arrangements e.g. climate change meeting in South Africa, African countries could not reach a consensus. 11. Too many ministries that are relevant – but creates confusion and conflicts for policy implementation 12. Universities need to be proactive to generate knowledge in new areas that will influence policy 13. Inclusivity - how do we define participation? CAADP process defines clear principles, but certain actors feel left out and need capacity to drive the process, This indicates lack of relevance, and lack of harmonisation and lead to poor effectiveness 14. Policies need to be forward looking to take into account emerging trends and potential risks 15. Need for better data to understand both current and potential production trends, to be able to predict future needs 16. Existing policies should be implemented

State of STI for FNS in some ACP regions: Case examples

Uganda

- Thermo-stable vaccine to control Newcastle disease for poultry: Vaccine could not be produced commercially due to policy limitations. Scientist asked for early retirement and joined Ugandan industrial research institution and successfully commercialised the vaccine.

Suriname

- Existence of medium and long-term policy goals. It is a challenge to measure success of policies from election to election
- Absence of overarching national agricultural research program even though there are several PRIs: Ministry of Agriculture, centre of agriculture, university, rice institutions, banana industry. There is duplication of research.
- Need to strengthen capacity of professionals
- Vegetable and rice production are strong but the sector needs to improve on exports for income.
- Regional policy for FNS exists, and has been approved by CARICOM.
- Poor policy implementation and absence of targets for holding policy makers accountable.

- CARICOM is too insular - lack of cohesiveness, individual islands too small and regional approach important (e.g.rice in Guyana);
- Lack of cohesion within universities in terms of actions undertaken to address FNS

Pacific

- Regional plan covers all countries but require specific parliament endorsement by member countries.
- Excess food production and poor markets.
- Importation of lamb, fish whereas most carbohydrates are produced internally.

Emphasis for the next three years

There is a need to:

- Clarify the role of universities' engagement in STI. Evidence does not suggest that universities are the centre of innovation: One clear role of the university is to validate innovation coming from farmers
- Create more cohesion within university systems to respond within priority issues
- Universities need to be more aware of available policies
- Understand the need for quantity and quality of scientists for innovation for FNS
- Improve strategies for implementation of policies
- Strengthen monitoring and evaluation to enhance feedback loop from policy implementation to policy making
- Improve awareness of the public to enforce public policies
- Engage stakeholders in decision making to create impact on FNS: Large firm vs small firms
- Harness the bulk of budgets from internal financing
- Regional policy for farmer business models (cooperatives) with a common understanding to work around regional policies
- Hold debate at various levels and advance positions
- Increase public awareness, home garden and family planning
- Encourage youth involvement in all aspects
- Reduce high food import bill by adopting a regional approach
- Introduce appropriate model and technologies
- Greater focus on value addition and import substitution
- Define plan of action to manage excess food production (Pacific)

What evidence is available on innovations occurring in ACP agriculture for shaping future STI policy formulation and implementation for achieving food and nutrition security?

Participants in this WG 2 agreed on defining an innovation system as a set of actors collaborating to bring innovations into the market for social and economic use. Most countries have their economic/development priorities identified with elements of the innovation system in place – policies, institutions, actors, funding, etc. However the

systems are largely disjointed and dysfunctional; linkages among institutions are very weak and are characterised by lack of coordination mechanisms.

In the African continent, through the Comprehensive Africa Agriculture Development Programme (CAADP), countries have developed national investment plans which are being followed by the Regional Economic Communities (REC). There is a need to recognise diversity. The African Innovation Outlook report produced by NEPAD 2014 that covers over 20 countries indicate that systems have been put in place for collecting and reporting some innovation indicators but these are traditional input – output indicators.

Further inputs provided by participants in WG 2 are detailed as follows:

Measures to strengthen innovation systems

- Designing policies which:
  - are more targeted, specific with timelines and milestones
  - are defined by a plan of action to translate policy statements into action
  - have budgets attached to the plans/policies
  - include a monitoring, evaluation and learning framework
- Enhancing the technical capacity of the relevant staff to interpret and implement policies
- Increasing awareness and educating the public about the contents and implications of the policies
- Strengthening coordination e.g. through a coordinating agency/apex organisations
- Making data readily available – open data systems
- Developing funding instruments that foster collaborations
- Investing in incubation/business support facilities to nurture innovations to maturity
- Promoting actions within the context of regional blocks of expertise/clustering e.g. the Finnish model

Measures for increasing public and private investments

- Joint/counter-part funding by partners which provide opportunities to enhance ownership
- Commodity-specific levies e.g. In coffee, tea, cocoa etc
- Philanthropy (and tax deductions as in the US)

Evidence on innovations occurring in the ACP region

- NERICA
  - Evidence of improved productivity
  - Poor seed production and distribution system. The problem is an institutional issue.
  - Transformation of the West Africa Rice Development Association (WARDA) into the Africa Rice Center (AfricaRice) with 26 member countries
- Quality Protein Maize (QPM)

  - The President of the Democratic Republic of Congo has given 500 ha of personal land to develop the project
- Orange-fleshed potato:
  - Rich in beta carotene; Used in the Democratic Republic of Congo to fight malnutrition in children under 5 years old
  - This action has led to collective action/solidarity amongst African countries
  - Regional specialisation:
    - The East African Agricultural Productivity Programme (EAAPP) where countries undertake to establish Regional Centres of Excellence (RCoEs) for agricultural research by investing in commodities identified by ASARECA as being of sub-regional importance to mitigate food insecurity.
    - The West Africa Agricultural Productivity (WAPP) Programme which is aligned with the objectives of the Economic Community of West African States Agricultural Policy (ECOWAP).
- Regional program on sugarcane in the Caribbean
  - supported by industry levy
- Sweet potato and small ruminants production by CARDI

How best to sharpen the STI focus, strengthen national innovation systems and increase public and private investments to effectively address food and nutrition insecurity in the future?

In WG 3, emphasis was placed on the influence of entrepreneurship to drive the STI sector via public-private partnerships. A pre-requisite to achieve this goal is the creation of enabling conditions via effective capacity-building. The inputs provided by participants in WG 3 are detailed below.

Innovations occur at three levels as follows:

- Academia
- Government
- Private sector

Measures to strengthen Innovation Focus

1. Social entrepreneurs play critical role by:
   - Promoting the innovation systems
   - Making it more profitable
   - Creating linkages amongst players (actors)

2. Building the capacity of institutions to be effective and efficient
   - Raising awareness
   - Promoting decentralisation of political governance
   - Promoting partnerships and collaborations
   - Recognising the importance of data collection, management and dissemination to guide the policy-making process

- The use of social media to create awareness
- The use of technology (e.g. cell phones)

Measures for increasing Public-Private Investment

- Developing and implementing good policies
- Embarking on sustainable infrastructural development
- Improving agricultural productivity, competitiveness and promoting the establishment of organised commodity markets
- Promoting technology and putting research into practical use
- Promote public-private partnerships
- Promoting the culture of local entrepreneurship
- Improving local knowledge and skills
- Promoting the culture of philanthropy
- Promoting business angels
- Solving the problem of environmental degradation

2.5 Closing remarks

Judith Francis, reiterated that FNS is a multidimensional challenge, calling for policy harmonisation, political will, women's empowerment, capacity building, local and national ownership, multi-sector collaboration, technological and social innovation, and multi-disciplinary research. It's a balancing act in a dynamic and heterogeneous world.

According to Ms Francis, in the light of the presentations and deliberations of the International Forum, three main lines of approach emerge as guiding principles for STI policy-making:

1. To characterise the nature of tensions which deter the implementation of FNS and STI policy such as the source, incentives and trade-offs for sustainable funding initiatives;
2. To determine at which levels and scales to spearhead entrepreneurship and innovation in agriculture as well as identifying the existence, if any, of IPR issues associated with upscaling and;
3. To investigate the key governance issues and the extent of strategic intervention required to dictate the research focus i.e. whether to embark upon basic vs. applied vs. blue sky research, in overcoming barriers in STI policy implementation. A pre-requisite to achieve the latter objective would entail easy access to global knowledge as well as contributing to eliminate existing research gaps in order to target future advocacy efforts.

It was posited that a number of solutions are required such as the creation of an enabling policy environment, finding novel pathways to innovation, leveraging higher education and research and finally the development of innovation systems. A number of burning questions remain, however such as defining the real FNS issue, i.e. whether it

involves producing more of the same food or to diversify the food basket. From a human rights-based approach, the extent of public awareness regarding the urgency to sharpen STI was also mentioned. Analysing the FNS challenges from a broader perspective, Ms Francis heralded that the food and agriculture sector has emerged as an area of geopolitical inquiry and there is need to distinguish between genuine and hot air concerns around the FNS agenda.

Another factor pertained to analysing the mandate of universities in addressing the multi-dimensional developmental challenge constituting the FNS issue. Also relevant is the need to identify which innovations should be taken to scale and to subsequently examine the IPR regime associated thereof. An understanding of the structural causes of the food insecurity crisis was deemed important with special focus on situating the roles and responsibilities of national governments, the private sector and also the small-holder farmers who produce the bulk of the food commodities.

3.0 The Road Map: Setting Priorities for the future

This sections details the integrated Road Map developed from the deliberations of the International Forum based on unleashing science, technology and innovation for food and nutrition security with special focus on Africa, Caribbean and the Pacific. It has been designed to set priorities for a three-year duration. The actions promulgated are time-bound as short-term (0 – 11 months), medium term (0 – 23 months) and long-term (0 – 24 months). The Road Map addresses critical gaps in three strategic areas relevant to achieving FNS:

(i) STI Governance and Public Policy: R&D, higher education, and engaging the private sector

(ii) Taking innovation to scale and private sector engagement

(iii) Financing/Investment modalities, partnerships, incentives and reward systems

Participants were given an overall Road Map template and were requested to identify the three most relevant priority gaps. For each of the critical gaps, an over-arching empirical action item has been put forward which is then detailed via specific action items with corresponding proposed solutions and accountability targets. Case examples derived from the, the CTA Top 20 Innovations and from external sources were provided as reference to guide the decision behind the basis for the actions.

The inputs provided by the Forum participants have been integrated and further developed to produce the final Road Map.

3.1 STI governance and public policy

THREE-YEAR VISION AND ROAD MAP CONTEXT: **TO UNLEASH SCIENCE, TECHNOLOGY AND INNOVATION FOR FOOD AND NUTRITION SECURITY IN THE AFRICA, CARIBBEAN AND THE PACIFIC**

Issue /	Action Item, Time Frames			Responsibilities	
Gap Area	Short-term	Medium- Term	Long-term	Active-stakeholder	Accountability
STI Governance and Public Policy: R&D, Higher Education, and Engaging the Private Sector					
Overall action item: Empowering the civil society in promoting accountability					
Issue 1 – Limited capacity Issue 2 - Weak institutional accountability Issue 3 - Weak public awareness					
1. Capacity building	Identify a pool of experts at the local, national, regional and international level including expertise outside conventional agriculture disciplines to support capacity building.			National government via specific Working Group committees	Public
	Review educational policies/ programmes/ plans for STI and agriculture to identify gaps and synergies/complementarities; Identify relevant and applicable multi-disciplinary training needs.			Government ministries, schools, training / vocational colleges, universities	Public

	Develop training material /reference literature for specific target audiences	International/ regional/national academia, PRIs, CoEs	Public, trainers, entrepreneur, social workers
	Draw on non-formal science and local and traditional knowledge when devising integrated food, agricultural, and natural resource policies	Policy-makers, academia, researchers	Public
	Provide targeted training and exposure to improve the scale, efficiency, and responsiveness of public service delivery at the national, regional and local level; Empower citizens to participate more effectively in shaping their own development and to promote good governance and accountability.	Service providers with diverse skills and strength: universities, NGOs, PPP which support agriculture productivity programmes	Policy-makers, research staff, extensionists, legal officers, standards & controls officers, trainers, communication specialists, NGOs, public
	Bring multiple ministries together into new institutional formations	National government via specific Working Group committees	Public, farmers, entrepreneurs
Case example / Good practice The Africa Leadership Training and Capacity Building Program (Africa Lead) which is done within the framework of the NEPAD's CAADP			
2. Strengthen institutional accountability	Set-up think-tank / expert groups to identify new institutional pathways and governance structures to reorient food systems to meet STI and equitable development goals	National government, inter-institutional /industry task force	Public, PRIs, educational institutions, national/ regional/international, policy-makers
	Democratise participatory processes to dispel monopoly of participation by elite forces; Increase knowledge of frameworks/processes to link the public with state institutions by adopting a top-down & bottom-up approach; Promote policies to stakeholders at different levels and create strategies to reach local actors and M&E systems which engage farmers/entrepreneur organisations	National government, development agencies, equal opportunities commissions, farmers' group	Public, farmers, entrepreneurs
	Institutionalise mechanisms for accountability via new legislation to ensure that access to food is a right which is justifiable—actionable in court, with redress and liability enforcement mechanisms in place	National government, state law office	Public

	Conduct systematic statistical data collection and testing to create and validate open access database with the aim of updating and realigning institutional arrangements, frameworks, policies	National statistical offices, national development agencies	Public, farmers, entrepreneurs
Case example/ Good practice The CAADP Mutual Accountability Framework			
3. Create public awareness	Facilitate involvement of citizens in public policy making as a constitutional obligation by setting-up regional and continental forums to coordinate local actors	Multilateral consortium of stakeholders: national governments NGOs/interest groups	Public
	Intensify public political education to deepen and strengthen knowledgeable public participation in policy formulation; Conduct systematic media campaigns against the negative stigma of agriculture among the public, private sector, politicians; Report success stories from agriculture; engage the youth in competitions	National & regional development institutions, NGO's, universities, farmer organisations, media	Public
Case examples CTA Top 20 Innovation: The rural resource centre project: community based approach to extension Application of the comparative action research approach as applied in the COS-SIS project			

3.2 Taking innovation to scale

THREE-YEAR VISION AND ROAD MAP CONTEXT: **TO UNLEASH SCIENCE, TECHNOLOGY AND INNOVATION FOR FOOD AND NUTRITION SECURITY IN THE AFRICA, CARIBBEAN AND THE PACIFIC**

RoadMap	Action Item, Time Frames			Responsibilities	
Issue/Gap Area	Short-term	Medium- Term	Long-term	Active-stakeholder	Accountability
Taking Innovation to Scale and Private Sector Engagement including IPR issues					
Overall action item: Convergence of Public and Private Partnerships					
Issue 1 - Lack of a private sector engagement to facilitate upscaling and commercialisation Issue 2 - A fragmented IPR regime, lack of awareness regarding adherence to global standards to distil hindrance related to trans-boundary commerce Issue 3 - Lack of a supportive environment for outscaling					
1.Establishment of an enabling national platform for private sector engagement	Commission investment fora, workshops and match-making events to foster novel linkages among different economic sectors with a view to shaping innovation pathways for the food and agricultural sectors			PPP, national research organisations, ministries	Professional farmer organisations, small-holder farmers/ innovators
	Attract new entrants and service providers via business incubator schemes in the agri-food sphere. Small-holder farmers should have the opportunities to extend their role in the value chain through post-harvest value addition and marketing services			National development organisations, Industry Board	Farmers, entrepreneur, public

	Provide life-long learning to develop and dispense short courses on entrepreneurship by business schools-large agri-food organisations consortia	Private sector led & supported by business schools	Farmers, entrepreneur, public
	Inculcate the notion of IPR to current, potential and aspiring innovators through the provision of counsel e.g. in signing legal agreements with respect to the development of patentable innovations	Private foundations, philanthropists	Farmers, entrepreneur, public

Case examples

3. The Africa platform for startup funding. **Venture Capital for Africa (VC4Africa)** is the largest online community of entrepreneurs and investors dedicated to building game changing companies on the continent. Entrepreneurs have access to free online tools, mentorship opportunities and private deal rooms. The community has members in 159 countries and meetups have been hosted in more than 50 cities around the world. VC4Africa operate as a peer-to-peer network and champion an open source approach.
4. The **Forum national de la Recherche Scientifique et des Innovations Technologiques** (FRSIT) is convened every two years in Burkina Faso. It brings together various national, regional and international organisations for scientific exchange and displays the results of research and innovation to the public. The forum is an institutionalised event decreed by the government of Burkina Faso No. 95-374/PRES/MESSRS.

2. Harmonisation of IPR regime and standards through a participatory process and awareness building (Regional, International)	Align existing different national laws and policies on intellectual property rights protection with updated regional framework	Private sector, Chambers of Agriculture & Commerce	RECs such as namely AU, CARICOM, Pacific Union
	Apply policy pluralism in engaging the civil society and state actors' participation in the negotiations and processes that shape harmonisation of IPR issues	National governments, PPP	NGOs, professional farmer organisations, innovators
	Popularise information about IPRs and the larger context within which they are emerging and organise public, rural communities and scientists around requirements for agri-products standardisation	Community centres, professional farmer organisations, NGOs, media	Public, farmers, entrepreneurs
	Build capacity in IPR offices and standard setting offices	National governments, PPP, certifying bodies	Public, farmers, entrepreneurs

Case examples/Good Practice : CTA Top 20 Innovations with potential for rights protection.

1. Bio-herbicide: eco-management of water hyacinth
2. Improved beans outperform traditional varieties
3. Cassava steam dryer

3.Developmental Grant Scheme to support private sector cross-border outscaling	Form alliances with the various service providers linking technologies and the civil society to exploit entrepreneurial opportunities and drive the innovation process.	Private sector, NGOs	National rural development institution and professional farmer organisations
	Establish PPP by way of co-funding schemes from large private entities coupled with governmental support via the repayment of loans at low interest rates	private sector, NGOs	Public, farmers, entrepreneurs

	Develop an inclusive financial mechanism to ensure: (i) that small-holder farmers and innovators can protect their innovations (ii) that the poorer end-users can afford products and services derived from protected technological innovations	National government, industry development board	Public, farmers, entrepreneurs
	The contextual nature of innovation should be evaluated when assessing out-scaling opportunities given the ecological dimension associated with agricultural activities and services.	HE institutions, Research institutions, professional farmer organisations	Public, farmers, entrepreneurs
The Bio-Innovate Program Network is a multi-disciplinary competitive funding mechanism for biosciences research in eastern Africa (Ethiopia, Kenya, Tanzania, Burundi, Uganda, Rwanda). It uses an innovation systems approach, engaging new and existing actors in and outside the eastern african region in bioresource innovations, laying foundation as well as up- and out-scaling approaches for development.			

3.3 Financing/Investment modalities

THREE-YEAR VISION AND ROAD MAP CONTEXT: **TO UNLEASH SCIENCE, TECHNOLOGY AND INNOVATION FOR FOOD AND NUTRITION SECURITY IN THE AFRICA, CARIBBEAN AND THE PACIFIC**

RoadMap	Action Item, Time Frames			Responsibilities	
Issue/Gap Area	Short-term	Medium-Term	Long-term	Active-stakeholder	Accountability
Financing Investment Modalities					
Overall action item: Establishment of responsible partnerships/linkages; Incentives and reward systems					
Issue 1 - Lack of the national and regional mechanisms to identify, analyse and value innovation Issue 2 - Lack of financing mechanisms for investing in innovation Issue 3 - Poor mechanisms to understand quality standards required to access to market					
1.Establish public-private linkages to patronise calls for showcasing innovation projects	Sensitise stakeholders via consultative fora regarding the need to conduct innovation inventories			National governments, Private industry task force	Small agri-entrepreneurs, NGOs, public
	Establish a Public-Private partnership among institutions to identify, analyse and value innovation. Funding can be stirred via the private Corporate Social Responsibility projects. Sectoral Competence Clustering should be applied to identify and assess existing research outputs/ innovations which can be out-scaled.			Private industry task force, rural development institutions, advanced research institutions, HE institutions, extension/ demonstration offices	Small agri-entrepreneurs, NGOs, public
Case example The **CTA Top 20 Innovations Programme** is a practical example of a regional initiative (ACP) innovators talent hunt. An innovators think-tank consisting of high level policy-makers, academicians, researchers, legal and financial advisers to screen and assess submissions can be considered. Showcasing the innovations which occur at local level within communities, universities, small entities can be harnessed and up-scaled to create wider development impact, provided that advisory, financing and investment					

modalities are institutionalised.			
2. Establishment of funding mechanisms to finance innovations	Introduce funding mechanisms that will help to finance innovations in the forms of (i) Agricultural and Development Banks and (ii) application of subsidies on specific products and services which fall under innovation schemes	NGOs Micro-finance institutions and micro-insurance agencies Governments	NGOs, public
	Develop microfinance sector, including micro-credit and other group-based lending mechanisms institutionalised	National government, supported and coordinated by women and youth NGOs and driven by the microfinance institutions	NGOs, public
	Develop benchmark indicators to categorise potential customers into practically identifiable criteria to define market segments and corresponding financial products	NGOs Micro-finance institutions and micro-insurance agencies Development banks	NGOs, public
Case examples The case of microfinance institutions, pioneered by the Grameen Bank, in Bangladesh is a good example of non-government organisation-led operations where the government directly and indirectly provided major policy and material support to develop one of the largest microfinance sectors in the world.			
3.Establishment of commodity exchange market centres	Establishment of commodity exchange market centres for the trading of economically important commodities. The pre-requisite to enable this action include: harnessing the human resources to drive the commodity market sub-sector & setting up of warehousing facilities	PPP	NGOs, farmers group, cooperatives and public
	Institutionalisation of commodity differentiation requirements for exchange markets: farmers will be exposed to the notion of price discovery, and can opt for market segmentation.	Ministries of finance/ economic development & planning	NGOs, farmers group, cooperatives and public
	Establishment of traceability and standards criteria for products to access international markets e.g. for commodities falling under the Africa Growth and Opportunity Act (AGOA)	National government, standards& assay agencies/bureau	NGOs, farmers cooperatives and public
	Introduction of market information systems services	Public-private and/or private holding systems	NGOs, farmers group, cooperativespublic
Case examples • The Ethiopian commodity exchange market, ECX which currently trades three commodities: coffee, sesame and white beans. • The Rwandan EAX markets which trade minerals and agricultural commodities. • Agricultural information systems via mobile phone services : iCOW, M-Farm, M-Pesa, Kilimo Salama			

4.0 Conclusions

The International Forum has been a successful exercise. It brought together leading scholars, senior scientists, researchers, lawyers, policy makers, development practitioners, innovators and private sector representatives, including farmers. It has been agreed upon that FNS is a complex and multi-dimensional challenge. Most countries in the ACP region are developing economies with inherent socio-political and geographical characteristics such that trade liberalisation and industry globalisation hamper the achievement of the competitive edge. In the context of achieving FNS, the overarching aim is to induce vibrant measures to influence policy and practice through investments in science, technology and innovation. The application of new technologies and concepts to FNS involves harnessing multiple knowledge bases to develop national and regional economies with an innovation dimension.

Three thematic areas of intervention have been identified in order to unleash STI to achieve sustainable FNS in the ACP countries. These can be clustered in a transformation-response-support dynamic. The Forum has recognised the transformative power of institutions in shaping the enabling environment around farmers, entrepreneurs and innovators and the value chains for education and mechanization. Several interventions (Prof Röling, Prof Gurib-Fakim, Dr Ayele) suggest that proper institutional frameworks should be at the core of institutional capabilities development to unlock bottlenecks faced by farmers/innovators. An analysis of the nature of the innovations in the CTA Top 20 innovation support this argument whereby farmers have been successful in creating and operating finance and management innovations (The farmer ownership model: Uganda's coffee revolution, Uganda; Producer business group model for value addition, Kenya). Tensions exists. These occur at the level of commercialisation of research outputs and intellectual property rights protection and should be dispelled via effective partnerships, better role definition and the institutionalisation of equitable and inclusive regulatory frameworks.

The element of agility in STI policy is another dimension which was addressed by various speakers, from different perspectives, in order to respond to the changing and emerging social, ecological and global challenges. There is a need to advocate for STI policies which institutionalise innovative strategies such as the farmer (user) centric model with farmers'/users' engagement early in the design of research and innovation process; the creation of commodity exchanges markets since small-holder farmers in the ACP region are all too often unaware of the trading value of their commodities beyond the farm gate; and the need for preparedness-enabling policies, early warning systems and data systems structures to restore the sustainability of the agricultural system and to counteract the effect of natural/climate change/man-made crisis.

STI national policies are ineffective without associated, empowering mechanisms and capacity for implementation. It is imperative to move from a needs-based approach to a rights-based approach backed by legitimate and participatory governance systems. Conceptual clarity and the mechanisms to survey innovations were strongly advocated as important priorities for STI policy-makers. The institutionalisation of functional differentiation in education, to counteract the phenomenon of jobless growth, is clearly an important priority-setting criterion for national governments to address the long

term objectives of harnessing the human capital required for STI policy implementation in creating knowledge-based economies.

The integrated Road Map emphasises the importance of improving institutions, so that they become broadly participatory, transparent and universal. Moreover, in view of the investment backlog resulting from decades of under-investment and inequitable targeting of the agricultural sector as a pillar of economic development, it is imperative to attract investment in this sector. In this regard, the Road Map also focuses on the means to upscale institutional innovational change and to harness STI knowledge into business /social enterprises to exploit entrepreneurial opportunities, expand the agricultural value chains, supported by responsible funding mechanisms.

Unleashing STI to achieve FNS is a function of creating efficient linkages across economic sectors. While the conceptual underpinnings and empirical strength of these linkages can be debated, and may well vary across the ACP countries and over time, the question does arise as to whether the relevant policy question is the impact of STI itself on FNS that needs to be considered or the effectiveness of STI implementation in creating the targets to achieve FNS. Both issues have to be addressed.

Unleashing STI represents a new development opportunity in which economic development and achieving food and nutrition security reinforce each other.

Annex I: International Forum Programme

Day 1: October 15 2014

8:30	Registration
9:00 – 9:20	Opening Session

Chairperson – Stephen Muchiri, Eastern Africa Farmers Federation (EAFF), Kenya

Rapporteur: Nafiisa Sobratee, CTA Consultant

9:00 – 9:10	Welcome Remarks – Mr Michael Hailu, Director, CTA, The Netherlands
9:10 – 9:20	Setting the Scene: *The Global Food and Nutrition Security Cha*llenge and the ACP Context – Judith Ann Francis, Senior Programme Coordinator, Science & Technology Policy, CTA, The Netherlands
9:20 – 13:00	**Focus 1 – The Enabling Policy and Institutional Environment**
9:20 – 9:50	Keynote Presentation – *Governance of Science, Technology and Innovation for Food and Nutrition Security* – Prof. John Mugabe, University of Pretoria, South Africa
9:50 – 10:10	*Food and Nutrition Security Challenges in Ethiopia and the role of the Ethiopian Agricultural Transformation Agency (EATA) in facilitating Technology Access and Adoption* – Dr. Seife Ayele, Director, Technology Access and Adoption Program, EATA, Ethiopia
10:10 – 10:30	Discussion Q. What are the key science, technology and innovation (STI) governance issues?
10:30 – 11:00	Coffee Break
11:00 – 11:30	Keynote Presentation – *Research, Higher Education and Innovation: Implications for Public Policy* – Prof. Merle Jacob, Lund University, Sweden
11:30 – 11:50	*Controversies of Intellectual Property Rights in Food and Nutrition Security* – Dr Isaac Rutenberg, Director, Centre for Intellectual Property and Information Technology Law (CIPIT), Strathmore University, Kenya
11:50 – 12:10	*Harnessing the Power of Higher Education for Global Food and Nutrition*

	Security - Roseanna Avento, University of Eastern Finland, Finland
12:10 – 13:00	Discussion Q. What are the tensions if any in public vs private investments in higher education and research? Q. How to achieve the right balance - Basic, applied & blue sky research; research collaboration and contribution to global knowledge?
13:00 – 14:30	Lunch

Focus 2 – Novel Pathways to Innovation: Scaling Up & Scaling Out

Chairperson – Judith Ann Francis, CTA, The Netherlands

14:30 – 16:00	World Café – Innovation Stories from the Field CTA Top 20 Innovations that benefit Smallholder Farmers & a selection of CTA Caribbean Science and Agriculture Videos.
16:00 – 16:30	Coffee Break
16:30 – 18:00	Plenary Discussion Synthesis Reports from World Café Q. Entrepreneurship and innovation in agriculture at what levels and scales? What are the related IPR issues in taking existing innovations to scale?
19:00 – 21:00	Cocktail Reception
End of Day 1	

Day 2: October 16 2014

Focus 3: Leveraging Higher Education, Research and Innovation

Chairperson: Dr Yemi Akinbamijo, Executive Director, Forum for Agricultural Research in Africa (FARA)

Rapporteur: Nafiisa Sobratee, CTA Consultant

9:00 – 9:15	Summary/recap of Day 1
9:15 – 9:45	Keynote Presentation – *Research, Innovation and Entrepreneurship*, Prof Ameenah Gurib-Fakim, Managing Director, CEPHYR, Mauritius
9:45 – 10:05	*Role of Universities in the Knowledge Triangle* – Prof. Sabine Moebs, Business Information Systems, Baden–Wuerttemberg Cooperative State University, Heidenheim, Germany
10:05 – 10:30	Discussion

	Q. Leveraging higher education, research and development for innovation – How to transition from the laboratory to engaging with the private sector?
10:30 – 11:00	Coffee Break
11:00 – 11:30	Keynote Presentation - *Science and Innovation: Lessons in Commercializing University Research Outputs – the case of Anthuriums, Hot pepper and Cocoa in the Caribbean*, Prof Pathmanathan Umaharan, Director, Cocoa Research Centre, University of West Indies, Trinidad and Tobago
11:30 – 11:50	*Enhancing Commercialization and Strengthening the Linkages between Universities and Public Research Institutes with the Private Sector* – Dr Maurice Bolo, Director, The Scinnovent Centre, Kenya
11:50 – 12:10	*Supply Chain Management and Food Security during Crises* - Prof. Gyongyi Kovacs, Supply Chain Research Institute, Hanken School of Economics, Finland
12:10 – 12:30	*FOODSECURE - Agricultural Commodity Markets and Commodity Exchanges: Recent Research Findings* - Gerdien Meijerink, Wageningen University and Research centre, The Netherlands
12:30 – 13:00	Discussion Q. Potential opportunities and distributional implications of investing in R&D and HE not only as a public good and for private gain but as a commercial activity?
13:00 – 14:30	Lunch
14:30 – 16:00	Working Group Session: How can Knowledge generated be used for addressing the Food and Nutrition Security Challenge? Q. What is the relevance and effectiveness of current agricultural research and innovation policies and programmes for addressing the food and nutrition security challenge? Where should the emphasis be in the next three years? Q. What evidence is available on innovations occurring in ACP agriculture for shaping future STI policy formulation and implementation for achieving food and nutrition security? Q. How best to sharpen the STI focus, strengthen national innovation systems and increase public and private investments to effectively address food and nutrition insecurity in the future?
16:00 - 16:30	Coffee Break
16:30 – 17:00	Working Group Reports

Day 3: October 17 2014

Focus 4: Innovation Systems

Chairperson: Norman Gibson, Scientific Officer, Caribbean Agricultural Research and Development Institute (CARDI), Trinidad and Tobago

Rapporteur: Nafiisa Sobratee, CTA Consultant

9:00 – 9:15	Summary/recap of Day 2
9:15 – 9:45	Keynote Presentation – *Innovation Systems and Inclusive Growth* – Prof. Lynn K. Mytelka, Professorial Fellow, UNU – MERIT, France. Presented by Judith Ann Francis, CTA, The Netherlands
9:45 – 10:15	*Innovation Systems: Towards Effective Strategies that benefit Smallholder Farmers: The CoS–SIS Experience* – Prof. Niels Röling & Prof. Arnold van Huis, Wageningen University and Research centre, The Netherlands
10:15 – 10:30	Discussion
10:30 – 11:00	Coffee break
11:00 – 11:30	Panel Discussion – Issues and perspectives on Innovation Systems, Inclusive Growth & Effective Strategies that benefit Smallholder Farmers Judith Francis, Merle Jacobs, Lynn Mytelka, John Mugabe, Niels Röling,
11:30 – 13:00	Working Group Session Focus: Setting Priorities for the Future (Next three years) STI Governance and Public Policy – Research and Development, Higher Education and Engaging the Private Sector Taking Innovation to Scale *and Private Sector Engagement* Financing/ Investment modalities, *Partnerships/linkages; Incentives and reward systems;*
13:00 – 14:30	Lunch
14:30 – 15:30	Working Group Reports
15:30 – 16:00	World Café: The Road Map – Who will do what?
16:00 – 16:30	Coffee Break
16:30 – 17:00	Next steps and Wrap – up

Closing Remarks Judith Ann Francis, CTA, The Netherlands

Annex II: List of Participants

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Annex III: List of presentations with associated links

DAY 1 FOCUS: Enabling Policy & Institutional Environment

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John Mugabe, Professor at Graduate School of Technology Management (GSTM), University of Pretoria, South Africa

The presentation: Governance of Science, Technology and Innovation for Food and Nutrition Security - CTA FNS Forum 2014

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Seife Ayele, Director for Technology Access and Adoption, Agricultural Transformation Agency (ATA), Addis Ababa, Ethiopia

The presentation: Food and Nutrition Security Challenges in Ethiopia and the role of the Ethiopian Agricultural Transformation Agency (EATA) in facilitating Technology Access and Adoption - CTA FNS Forum 2014

-

Merle Jacobs, Professor in Research Policy at Lund University, Sweden and UNESCO Chair in Research Management and Innovation Systems

The presentation: Research, Higher Education and Innovation: Implications for Public Policy - CTA FNS Forum 2014

-

Isaac Rutenberg, Director, Center for Intellectual Property and Information Technology Law (CIPIT), Strathmore Law School, Nairobi, Kenya

The presentation: Controversies of Intellectual Property Rights in Food and Nutrition Security - CTA FNS Forum 2014

-

Roseanna Avento, Coordinator at the Department of Biology, Kuopio Campus, University of Eastern, Finland (UEF), Kuopio, Finland

The presentation: Harnessing the Power of Higher Education for Global Food and Nutrition Security - CTA FNS Forum 2014

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DAY 2 FOCUS: Leveraging Higher Education, Research, Innovation

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Ameenah Gurib-Fakim, Managing Director, Centre for Phytotherapy Research (CEPHYR), Mauritus

The presentation: Research, Innovation and Entrepreneurship - CTA FNS Forum 2014

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Pathmanathan Umaharan, Professor of Genetics, University of the West Indies (UWI), Trinidad & Tobago

The presentation: Science and Innovation: Lessons in Commercializing University Research Outputs: the case of Anthuriums, Hot pepper and Cocoa in the Caribbean - CTA FNS Forum 2014

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Maurice Bolo, Director, The Scinnovent Centre, Nairobi, Kenya

The presentation: Enhancing Commercialization and Strengthening the Linkages between Universities and Public Research Institutes with the Private Sector - CTA FNS Forum 2014

-

Gyongyi Kovacs, Director of the Humanitarian Logistics and Supply Chain Research Institute (HUMLOG Institute), Hanken School of Economics, Finland

The presentation: Supply Chain Management and Food Security during Crises - CTA FNS Forum 2014

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Gerdien Meijerink, Head of Department (International Policy, Trade and Markets), LEI Landbouw Economisch Instituut, Wageningen UR, the Netherlands

The presentation: FOODSECURE: Agricultural Commodity Markets and Commodity Exchanges - Recent Research Findings - CTA FNS Forum 2014

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DAY 3 FOCUS: Innovation Systems

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Lynn K. Mytelka, Professorial Fellow, UNU – MERIT, France

The presentation: Innovation Systems and Inclusive Growth - CTA FNS Forum 2014

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Niels Röling, Independent Research Professional, Wageningen, The Netherlands

Annex IV: Key Messages

International forum

'Unleashing Science, Technology and Innovation for Food and Nutrition Security'

With special focus on Africa, Caribbean and the Pacific

15-17 October 2014

NH Rijnhotel Arnhem, The Netherlands

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KEY MESSAGES

Judith Ann Francis,

Senior Programme Coordinator, Science and Technology Policy

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DAY 1 FOCUS: Enabling Policy & Institutional Environment

John Mugabe, Professor at Graduate School of Technology Management (GSTM), University of Pretoria, South Africa

- ST&I for human development and for FNS is a national security issue
- Political commitment exists in Africa (& C P countries) but what indicators will we use to measure impact of policies on agriculture and FNS; traditional ST&I input and output indicators are not enough
- Good Governance on ST&I means transparency, accountability and participation
- **Key message:** ***FNS and STI policies need implementation and evaluation mechanisms***

Seife Ayele, Director for Technology Access and Adoption, Agricultural Transformation Agency (ATA), Addis Ababa, Ethiopia

- Ethiopia has developed innovative productivity enhancing technologies for 5 top crops (including teff) and livestock for FNS and increased income for farmers
- Lessons learned in improving technology access & adoption: engage farmers in the identification, assessment & uptake in the mechanization value chain
- Challenges exist in scaling up – spare parts, distribution and after sales service
- **Key message:** ***Put value on indigenous crops, mechanize & engage farmers***

Merle Jacobs, Professor in Research Policy at Lund University, Sweden and UNESCO Chair in Research Management and Innovation Systems

- Education is a right and policies cannot change every 2-3 years. It is a long term investment if we want to see impact
- Need a strategy for entire education value chain from primary to tertiary
- Need good data for decision-making
- Governments must invest their own resources to ensure quality & that national priorities are addressed
- **Key message:** ***Holistic development is needed for impact***

Isaac Rutenberg, Director, Center for Intellectual Property and Information Technology Law (CIPIT), Strathmore Law School, Nairobi, Kenya

- Tensions exist around IP regime – To protect or not to protect?
- Patents can be applied to plant, genes, or methods
- Past experience show there is need to use new technologies wisely as impacts are only seen after the fact
- **Key message:** ***Competing evidence will always exist***

Roseanna Avento, Coordinator at the Department of Biology, Kuopio Campus, University of Eastern, Finland (UEF), Kuopio, Finland

- Higher Education – Who feeds the world? Small holder farmers do. Are the goals the same especially when some universities and schools in developing countries do not have the basic infrastructure?
- Finland experience – higher education is based on research & functional diversity; what real difference has international development efforts made in FNS?
- Investments also need to go into training smallholder farmers ; continuous education for all
- **Key message:** ***We need to understand the context to make a difference***

DAY 2 FOCUS: Leveraging Higher Education, Research, Innovation

Ameenah Gurib-Fakim, Managing Director, Centre for Phytotherapy Research (CEPHYR), Mauritus

- ACP must become greater knowledge producers as well as better custodians of indigenous resources (e.g. China, India)
- Convergence Innovation – In transcending research & academia, choices must be made. E.g. joining the private sector vs academic career and treating diabetes vs cosmetics
- Commercialization also means having the necessary infrastructure – laboratories, standards, accreditation, human resources
- Pay attention to genetic (and cultural) diversity and embrace STEM for empowering people
- **Key message:** ***Science by itself cannot deliver innovation***

Pathmanathan Umaharan, Professor of Genetics, University of the West Indies (UWI), Trinidad & Tobago

- Learned the hard way - Research on cowpea was initially successful: increased yields but market and infrastructure failures existed
- University research should be aligned with development / market needs. Researchers need to make a paradigm shift in setting priorities
- Adopt a farmer centric model: research should address their challenges; adopt a triple helix; build on comparative advantage – do not compete in the same areas where others are stronger.
- **Key message:** ***Build on comparative advantage & engage farmers***

Gyongyi Kovacs, Director of the Humanitarian Logistics and Supply Chain Research Institute (HUMLOG Institute), Hanken School of Economics, Finland

- FNS Pillar: Food stability - crises (e.g. droughts) affect agriculture and the food system
- Preparedness – early warning systems (M&E <5 years)
- Tensions exist – local vs imported foods; balance needed to avoid price hikes, culture
- Innovations are needed for ensuring security of supply during crises e.g. process (logistics) , product (stable without refrigeration), business model innovation (vouchers/not cash)
- **Key message:** ***Learn from the past and do better***

Maurice Bolo, Director, The Scinnovent Centre, Nairobi, Kenya

- IPR tensions: Why are IPR applications by local firms / universities in Kenya taking longer to be processed or are more frequently rejected?
- Evidence shows that universities / PRIs are not the locus of innovation. Need to rethink. Should this change?
- UNECA Report: Innovation policies are good but there is little targeting; no measurable indicators and no support for M&E
- **Key message:** ***New incentives & reward structures are needed***

Gerdien Meijerink, Head of Department (International Policy, Trade and Markets), LEI Landbouw Economisch Instituut, Wageningen UR, the Netherlands

- Remember the FNS Pillars – availability, access, utilization and stability
- Neither production nor technology alone is enough to address FNS. Need to consider markets in food security
- Commodity exchanges and /or local markets with regional function can contribute to managing farm risks
- Private sector involvement in research from the very beginning is critical
- ***Key message: Markets for farmers are important in addressing FNS***

DAY 3 FOCUS: Innovation Systems

Lynn K. Mytelka, Professorial Fellow, UNU – MERIT, France

- Where new technologies involve multiple knowledge bases, innovation frequently requires learning through collaboration in networks and consortia
- Trade liberalisation and the globalisation of industry make it difficult for new comers from the developing world to compete without engaging in a process of innovation (textile, wine)
- The development of local universities & linkages should be part of the learning and knowledge exchange infrastructure that can lead to a new wave of innovation
- The notion of a transition has been applied to the process of change in agriculture
- **Key message:** ***Recognise local concerns, interests, & needs, as they strengthen measures that are supportive of the change/innovation process***

Niels Röling, Independent Research Professional, Wageningen, The Netherlands

- Farms are small firms, which all produce the same commodities. Each is too small to affect the price.
- For smallholder farmers to stay in business they have to surf the waves of innovation and keep growing
- The Business Model of Agronomy (BMA)dominates mainstream thinking about agricultural development but it cannot support a sustainable global food system

Wrap-Up

Judith Francis, senior programme coordinator, Science & technology policy, CTA

- FNS is a multidimensional challenge, calling for policy harmonisation, political will, women empowerment, capacity building, local and national ownership, multi-sector collaboration, technological and social innovation, and multi-disciplinary research.
- It's a balancing act in a dynamic and heterogeneous world.
- Guiding questions:
    - FNS and STI policy: what are the tensions? What funding? What are the benefits? What are the trade-offs?
    - Entrepreneurship and innovation in agriculture: at what levels and scales? What are the related IPR issues in going to scale?
    - What are the key governance issues? Basic vs applied vs blue sky research? Access as well as contribution to global knowledge? How best to move forward and where do the responsibilities lie?
- We need solutions. For that, we need to:
    - create an enabling policy environment
    - find novel pathways to innovation
    - leverage higher education and research
    - develop innovation systems
- Doubts / Burning Questions/ Tensions
    - What is the real FNS issue? Produce more of the same foods? Diversify products? Are the realities known? Is the public concerned? Is this hot air, development, geo-political agenda?

- Are we putting too much responsibilities on universities? Is it the role of the university to address development challenges?
- Who is to be blamed? Governments? Private sector? What about the smallholder farmers who produce the bulk of food?
- Which innovations should be taken to scale? IPR?

- **Key message 1: *Access to food is a human* right**
- **Key message 2: *We need impact and we must avoid the blame game***

<u>Take home messages by three young consultants: Atenchong Talleh, Cédric Jeanneret and Nafiisa Sobratee</u>

STI policy for FNS must:

- **Recognize the transformative power of innovation** in shaping the enabling environment around the farmer innovators and the value chain. Related innovations:
  - CoS-SIS – CORAF/WECARD
  - NUCAFE (CTA Top 20 Innovation)
  - Farmers Business Model (CTA Top 20 Innovation)
  - CEPHYR (Ameenah Gurib-Fakim)
  - Teff row planters (EATA)

- **Understand innovation as a response** to changing and emerging social, ecological and global challenges. Related processes:
  - Cocoa research centre (UWI, P. Umaharan)
  - Supply chain management (G. Kovacs)
  - ECX commodity exchange (G. Meijerink)
  - Disaster management / climate change (G.Kovacs)
  - Aflatoxin / voice-activated info delivery (CTA Top 20 innovation)
- **Provide support**: STI / innovation national policies are ineffective without associated, empowering mechanisms and capacity for implementation and impact evaluation. Relevant mechanism:
  - Governance of STI
  - Education system: STEM at all levels, raison d'être of diploma
  - Institutionalization of functional differentiation
  - Move from need based approach of food security to

right based approach (empowerment)