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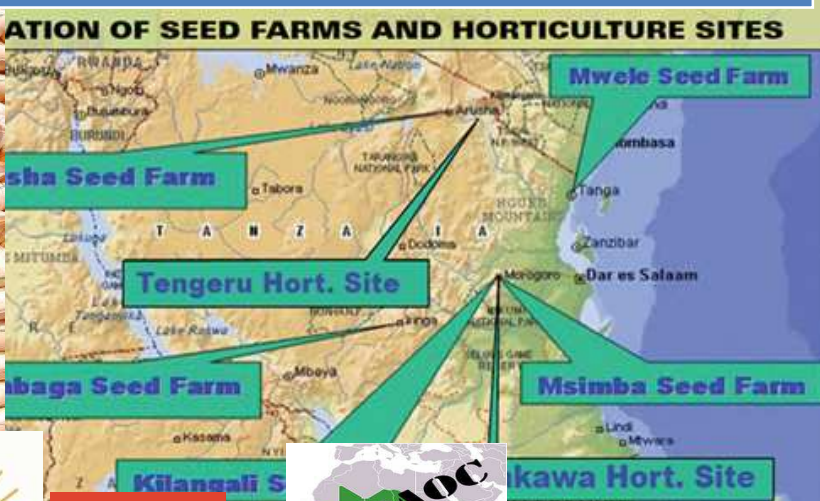
INSARD

Including Smallholders in Agricultural
Research for Development



Seeds and Agriculture Research Processes in Tanzania:

The case of small scale farmers' participation in setting research agenda



A Scoping Study report on

Seeds and Agriculture Research Processes in Tanzania: *The case of small scale farmers' participation in setting research agenda*

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ABBREVIATIONS/ACRONYMS

AATF	African Agricultural Technology Foundation
AGRA	Alliance for Green Revolution in Africa
ANSAF	Agricultural Non State Actors Forum
ARD	Agricultural Research for Development
ARI's	Agricultural Research Institutes
ASA	Agricultural Seed Agency
ASARECA	Association for the Strengthening of Agricultural Research in Eastern and Central Africa
ASDP	Agricultural Sector Development Program
ASDS	Agricultural Sector Development Strategy
ASPs	Agricultural Service Providers
AVRDC	African Vegetable Research and Development Centre
AVRDC	Asian Vegetable Research and Development Centre - African Regional Program (AVRDC-ARP)
CAADP	Comprehensive African Agriculture Development Program
CABI	Commonwealth Agricultural Bureau Institute
CCARDESA	Center for Coordination of Agricultural Research and Development for Southern Africa
CGIAR	Consultative Group on International Agricultural Research
CHOLIMA	Agricultural Research Institute, DAKAWA
CIMMYT	International Centre for Maize and Wheat Research
CIP	International Potato Centre
CORDEMA	Client-Oriented Research Development and Management Approach
COSTECH	Commission for Science and Technology
CSOs	Civil Society Organizations
DADPS	District Agricultural Development Plans
DRD	Division of Research and Development
DUS	Distinctness Uniformity and Stability
EAAPP	East African Agricultural Productivity Program
EAC	East African Community
EAFRO	East African Agriculture and Forestry Research Organization
ECABREN	East and Central Africa Bean Research Network
ESAFF	Eastern and Southern Africa small scale farmers' Forum
EU	European Union
FAO	Food and Agriculture Organization
FARA	Forum for Agricultural Research in Africa
FOs	Farmer Organizations
FSA	Farming Systems Approach
FSR/SE	Farming Systems and Socio-economics
FSR-E	Farming Systems Research and Extension approach
FY	Fiscal Year
GDP	Gross Domestic Product
GRET	Professionals for fair development in France
HOPE	Harnessing Opportunities for Productivity Enhancement

HORT	Horticultural Research and Training Institute in Tengeru
HQ	Headquarters
IAR4D	Integrated Agricultural Research for Development
ICRISAT	International Centre for Research in Semi Arid Tropics
IFAD	International Fund for Agricultural Development
IFS	International Fund for Science
IITA	International Institute for Tropical Agriculture
INSARD	Including Smallholders in Agricultural Research for Development
INTSORMIL	Sorghum and Millet Research Support Program
IPGRI	International Plant Genetic Resources Institute
IRRI	International Rice Research Institute
ISFNM	Integrated Soil Fertility and Nutrient Management
JICA- TANRICE	Japanese International Cooperation Agency Tanzania Rice
JICA	Japanese International Cooperation Agency
KATC	Kilimanjaro Agricultural Training Centre
KATRIN	Kilombero Agricultural Research and Training Institute
LGA	Local Government Authorities.
MAFC	Ministry of Agriculture Food Security and Cooperatives
MALD	Ministry of Agriculture and Livestock Development
MLFD	Ministry of Livestock and Fisheries Development
MVIWATA	Mtandao wa Vikundi vya Wakulima Tanzania
N	Nitrogen
NARI's	National Agricultural Research Institutes
NARS	National Agricultural Research System
NEPAD	New Partnership for Africa's Development
NERICA	New Rice Cultivars for Africa
NGO's	Non Governmental Organizations
NPGRC	National Plant Genetic Resources Centre
NPT	National Performance Trial
NRI	National Research Institute in the United Kingdom
P	Phosphorous
PPP	Public- Private Partnership
PASS	Programme for Africa's Seed System
PBR	Plant Breeders Rights
PELUM	Participatory Ecological Land Use Management
PID	Participatory Innovation Development
PVS	Participatory Variety Selection
QDS	Quality Declared Seeds
REPAOC	Network of National Platforms of NGOs in Western and Central Africa
RRCoE	Regional Rice Centre of Excellence
RYMV	Rice Yellow Mosaic Virus
SADC	Southern Africa Development Community
SUA	Sokoine University of Agriculture
TARP II	Tanzania Agricultural Research Project

TASTA	Tanzanian Seed Trade Association
TCCIA	Tanzania Chamber for Commerce Industries and Agriculture
TOAM	Tanzania Organic Agriculture Movement
TOSCA	Tanzania Official Seed Certification Agency
TOSCI	Tanzania Official Seed Certification Institute
TPRI	Tanzania Pesticide Research Institute
TZS	Tanzania Shilling
UDSM	University of Dar-es- Salaam
URT	United Republic of Tanzania
VDP	Village Development Plan
WARDA	West African Research and Development Authority
WDP	Ward Development Plan
ZARDEF	Zonal Agricultural Research Development Fund
ZARDI	Zonal Agricultural Research Development Institute
ZIELU	Zonal Information and Extension Liaison Unit

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Executive Summary

Agriculture occupies a very important place in the lives of Tanzanians as well as the national economy. Seeds are not only a strong symbol for food sovereignty and biodiversity, but also one of the important elements to strengthen small scale farming communities. In Tanzania there are two types of seed systems: the formal system, which is market-oriented and is developed by the public and/or private sectors, and the family or community production system which is based mainly on seed self-provisioning exchanges and gifts among neighbors, and the informal market. The later is a result of many years of farmers' selection and is rich in agribiodiversity.

INSARD, has an **overall objective** to ensure an informed participation of a broad range of smallholder farmers, civil society organizations in the formulation and implementation of ARD policies and practice in Tanzania. To fulfill this, this study contributes through conducting a Scoping Study on Seeds and Agriculture Research Processes in Tanzania: the case of small scale farmers participation in setting research agenda.

Under the Seed legislation, a regulatory framework for control of the quality of seed produced, imported, exported and used by the farmers in Tanzania is provided. The law provides for a compulsory seed certification, laboratory seed testing, variety evaluation and registration under the control of the Tanzania Official Seed Certification Institute (TOSCI). The legislation also recognizes other regional harmonized seed systems, including the East African and quality declared seeds (QDS) regional systems.

Components and key participants in Tanzania's seed system are identified.

The number of private companies doing seed business in Tanzania has been growing every year. In 2005 there were less than 16 companies and today there are more than 55 companies and enterprises doing seed business. The majority of the companies doing seed business are members of the Tanzania Seed Trade Association (TASTA), formed in 2002. This study identifies a number of constraints facing the seed industry are identified.

The Division of Research and Development (DRD) of MAFC is the leading National Agricultural Research System (NARS) institution in Tanzania with the mandate to oversee all matters related to agricultural research. It comprises a network of sixteen agricultural research centers located in seven agro-ecological zones. Currently the DRD has a total of 393 scientists in relevant research disciplines.

Government provides research funding although low with extra support from development partners and regional and international organizations

Research needs are identified from District Agricultural Development Plans (DADPs), regional and international priorities; national identified priorities; and through addressing major outbreaks in the agricultural sector in the country e.g. plant disease outbreaks.

Status on production and research programs are discussed on maize, rice, sorghum and beans. In research programs farmers and other stakeholders are involved in selecting a technology package in a participatory manner e.g. using Participatory Variety Selection (PVS).

It is estimated that the potential demand for improved seed in Tanzania is about 120,000 tons per annum while the actual demand is estimated at 60,000 tons per annum. Only 28.6 thousand tons were made available to farmers through formal seed

system in 2011/2012 and out of this, 14,000 tons of seeds were produced locally and the rest of the demand met through imports or use of farm saved seeds. Availability of seeds from Private sector increased in the recent past. To fill the gap which the formal seed system cannot supply, the rest comes from family or community production system (informal seed system). Not much work has been done by researchers to collect, evaluate and characterize these local varieties. There are various reasons behind these reasons.

Currently research and extension are under two different Ministries creating large gaps when addressing many issues in agricultural development. Farmer organizations are weak and do not have massive support to influence change in addressing their demands. To improve demand drivenness, research and extension in the public sector are institutionalizing CORDEMA which emphasizes demand driven research. Stakeholders set the research agenda and influence the selection of research projects and resource allocation.

There are positive field experiences from the private sector – particularly NGOs (e.g. PELUM, PROLLINOVA and ENVIROCARE) who are working with utilizing the local agribiodiversity.

Policy and ongoing research lack major inclusion of issues of local agribiodiversity and the associated local knowledge. The biggest challenge is that of changing mindsets. Initial observations have indicated that there is will and commitment from all key actors.

It is essential to develop a sustainable program which embarks on the following:

- Building capacity on Participatory Innovation Development (PID) approaches for farmers and development practitioners from partner organizations. This has to go along with strengthening use of farmer led and participatory documentation methodologies.
- Identification and documentation of local agribiodiversity innovations for experience sharing and scaling up.
- Influencing the improvement of government policies to create favorable environment for farmer centered processes and participatory approaches that recognize local innovation systems and PID approaches. These policies should also encourage institutionalization of PID and farmer centered approaches into research, extension, education and development institutions
- Establishing and strengthening effective multi-stakeholder collaboration and platforms for successful implementation of the program. These platforms have to recognize that the existence of inter/multi -disciplinary teams enhances the capability of addressing various issues for innovation.
- Building partnership through learning, interaction among and between individuals and stakeholders. The learning process sometimes goes beyond technology into institutional evolvement and their interactions as well as social. In establishing these platforms; care has to be taken by starting with those who will take the lead e.g. research and some selected extension organization/s (note that most NGOs are in extension) and farmers. Others may join later. This is one way of providing mechanisms for uptake pathways leading to up-scaling and out-scaling.

1. Introduction

Agriculture occupies a very important place in the lives of Tanzanians as well as the national economy. It is estimated that the country is and can be fully self-sufficient in food and in good years and a net exporter of cereals if there is a reasonable environment for farmers including reliable and sustainable supply of seed. It should be noted that seeds are not only a strong symbol for food sovereignty and biodiversity, but also one of the important elements to strengthen small scale farming communities. In Tanzania there are two types of seed systems: the formal system, which is market-oriented and is developed by the public and/or private sectors, and the family or community production system which is based mainly on seed self-provisioning exchanges and gifts among neighbours, and the informal market. The later is a result of many years of farmers' selection and is rich in agribiodiversity. Agribiodiversity results from the interaction between the environment, genetic resources and the management systems and practices used by culturally diverse peoples resulting in the different ways land and water resources are used for production. It therefore encompasses the variety and variability of plants which are necessary to sustain key functions of food production and food security. Tanzania has a rich agribiodiversity which has not been tapped by researchers. Farmers are the owners of the agribiodiversity and its associated local knowledge. Unfortunately agricultural researchers have been trapped in the formal seed system and have forgotten the informal seed system which continues to feed Tanzanians. It is time now to bring the two systems together to improve food security, improve seed supply and conserve the agribiodiversity for the benefit of the whole world.

1.1 Project Background Information

INSARD (Including Smallholders in Agricultural Research for Development) is an EU-funded project working towards making it easier for civil society organizations (CSOs) – both non-governmental organizations and farmers' organizations - to be actively involved in influencing agricultural research for development (ARD) systems in Africa. The project is geared to bridge the gap between researchers and smallholder farmers when setting priorities for research. The project is implemented by six lead partners, three from Europe and three in Africa:

- **Tanzania:** ESAFF (Eastern and Southern Africa small scale farmers' Forum); **Zambia:** PELUM Association (Participatory Ecological Land Use Management); **Senegal:** REPAOC (Network of National Platforms of NGOs in Western and Central Africa); **The Netherlands:** ETC Foundation; **France:** GRET, Professionals for fair development.

The Tanzanian INSARD Process

ESAFF together with other likeminded organizations in Tanzania; (MVIWATA, PELUM Tanzania, TCCIA, ANSAF, TOAM, SUA and SWISSAID) is in the process to prepare brokerage platforms that will bring together small scale farmers, agriculture researchers, CSOs representatives and policy makers. The platforms will focus at local level (selected communities around the Agriculture Research Institutes - ARIs) "Ilonga in Morogoro and Hombolo in Dodoma". While at national level, a Multi-stakeholders National Conference on Research in Agriculture will be organized. **The overall objective** is to ensure an informed participation of a broad range of smallholder farmers, civil society organizations in the formulation and implementation of ARD policies and practice in Tanzania.

Specific project tasks:

- (a) Conducting a scoping study on the status of research and research institutes in Tanzania and the way how smallholders are included in setting research priorities in Tanzania.
- (b) Organizing local brokerage between farming communities and surrounding ARIs to developed research outlines on local seeds (maize, sorghum, beans or rice) which draw on interactions between researchers and CSOs/FOs, firmly based in farmers' own demands
- (c) Jointly defining research priorities and strategy to clearly communicate this to other stakeholders and ARD fora
- (d) Organizing a national consultative forum on ARD and the state of local seeds research in Tanzania
- (e) Creating awareness on the importance of farmer demand research on local seeds
- (f) To document and appreciate smallholders owned research and utilization of local seeds. Influenced priority setting for research institutions as through tripartite platforms/brokerage.

This study contributes to specific objective (a) above involving conducting a Scoping Study on Seeds and Agriculture Research Processes in Tanzania, the case of small scale farmers participation in setting research agenda.

1.2 Methodology of the study:

The assignment was carried out mainly through a desk study for literature review on policies and other related documents to collect information. Interviews with selected sampled seed stakeholders and informal discussions with researchers and stakeholders in Dar es Salaam and Morogoro regions were also done.

Specifically, the informal discussions were done with seed stakeholders in the Ministry of Agriculture Food Security and Cooperatives (the Seed Unit of the Ministry of Agriculture and Food Security (MAFC, Senior officers and researchers in the DRD, Register of Plant Breeders Rights (PBR)), Sokoine University of Agriculture researcher and plant breeder, seed regulatory bodies namely Tanzania Official Seed Certification Institute (TOSCI), ENVIROCARE, and farmer organizations including MVIWATA and PELUM. Due to time constraints it was not possible to visit all relevant stakeholders.

Specifically, the task involved:

- i. Outlining of the Tanzania Policy regime on seeds and policy related to research on seeds
- ii. Providing an overview of Agriculture Research Institutes (ARIs) systems in Tanzania
- iii. Examining the trend towards financing agriculture research and Agriculture Research Institute (ARIs) in Tanzania in the last decade and providing the status of research on food crops (maize, rice, sorghum and beans) in Tanzania (How needs for research are identified, who initiates the processes, where research is conducted – The ARIs and research duration). Exploring Farmer self initiatives on seed research, production and multiplications
- iv. Giving status of seeds used by smallholder farmers and factor behind their seed selection (own seeds, purchased, from ARIs)
- v. What could be done to promote farmers demand driven research
- vi. Conclusions and recommendations on how to improve smallholder farmers' participation in setting research priorities at different levels in Tanzania.

This report responds to the tasks given above.

2. Tanzania Policy regime on seeds and policy related to research on seeds

During the colonial era, the focus of agricultural research in Tanzania was on the major export crops: coffee, cotton, sisal, tea and tobacco. After getting independence, the focus of agricultural research was directed to food crops and livestock produced by smallholder farmers. Networks of publicly funded research stations and substations were established in the major agro-ecological zones under the Department of Research of the Ministry of Agriculture and Livestock Development (MALD). Research on certain commodities and disciplines such as maize, sorghum and millet, sugarcane and animal diseases was undertaken at a regional level by the East African Agriculture and Forestry Research Organization (EAFRO) of the defunct East African Community (EAC) till 1977. In 1983 the first National Agricultural policy was developed. This was followed by the Agricultural and Livestock policy of 1997 which also mandated the encouragement and facilitation of national and local seed production, conditioning and marketing. The role of indigenous knowledge in seed management is also given emphasis. After inception of the 1997 policy; the production of quality declared seeds (QDS) at the farm level was initiated.

Liberalization of output markets was followed by revisions to the Seed Act to harmonize it with the new policy approach. The Tanzanian law allows and encourages seed to be produced at village level under what is termed Quality Declared Seed (QDS). Under the QDS system, the village community selects farmers to produce seeds of various crops to be sold to other farmers at affordable prices. The QDS system approach appears encouraging as it has resulted in lowering seed prices to farmers.

Plant Protection Act was put in place in 2001 with an objective of providing for the protection of new plant varieties in order to promote plant breeding activities that will stimulate, facilitate and improve agricultural research in the country, through the grant and regulations of plant breeder's rights and the establishment of a plant breeder's rights registry, which is entrusted with the obligations of granting plant breeders rights.

As a result of partnership and consultation between the public and private sectors, Tanzania boasts of a well-defined seed industry with all necessary legal and institutional frameworks in place. The country has two legislations which ensure production and supply of quality seeds to farmers. They are the Seed Act of 2003 and the Seeds Regulations of 2007 which govern seed production and trade related issues and the Plant Protection Act of 1997 which governs plant quarantine or phytosanitary issues.

Under the Seed legislation, a regulatory framework for control of the quality of seed produced, imported, exported and used by the farmers in Tanzania is provided. The law provides for a compulsory seed certification, laboratory seed testing, variety evaluation and registration under the control of the Tanzania Official Seed Certification Institute (TOSCI). The Institute is also responsible for Distinctness, Uniformity and Stability (DUS) testing and the National Performance Trials (NPT) which are necessary tests for variety release and registration. Under the system, locally bred varieties are tested for three years/seasons before being released for commercialization. Varieties released in other Eastern African countries whose seed systems are harmonized with that of Tanzania, need only one season of verification before being registered. The legislation also recognizes other regional harmonized seed systems, including the East African and quality declared seeds (QDS) regional systems.

This Tanzanian law is considered reasonable enough to achieve its ambitious targets on quality seed production and supply. However it is becoming more and clearer that the informal seed system is not taken care by these policies sufficiently.

Components and key participants in Tanzania's seed system.

- **Local variety breeding**

This is done in the 12 Agricultural Research Institutions (ARIs). The ARIs are zonal and focus on crops and issues

relevant to their particular agro-ecologies. The extent of actual breeding work taking place varies between research institutions. There is also an active bean research program at Sokoine University.

- **Seed certification**

New varieties are then submitted to the Tanzania Official Seed Certification Institution which has its headquarters located in Morogoro for DUS tests and then for NPTs (for two years).

- **Production, processing, regulation and distribution of foundation seed**

The five government foundation seed farms which are Arusha, Mwele, Dabaga, Kilangali, Msimba and horticultural sites at HORT Tengeru and Dabaga (*see annex 1 for locations*) are then responsible for the production, processing and distribution of foundation (basic) seed – using breeder seed supplied by the ARIs. The seed farms have recently been transferred to the Tanzanian Seed Agency. TOSCI carries out inspection of foundation seed production. Breeders in ARIs also produce foundation seed.

Production and processing of certified seed is carried out by a mixture of public and private sector institutions. Private companies produce local hybrid and OPV varieties of maize; oil crops (sunflower and sesame), sorghum and legumes (including mainly beans and vegetables). The majority of private sector seed production is carried out by contract farmers and then the processing is then done manually or with limited mechanization by the seed company. Certified seed for other crops (e.g. millet, rice, cow peas) as well as more commercial crops are produced by the government seed farms. Some certified seed production is also carried out by registered farmers using Quality Declared System (QDS). Production levels are relatively low.

- TOSCI carries out quality assurance of certified seeds through both field inspection (for isolation and characteristics) and sampling (for purity and germination).

- **Marketing and Promotion**

Private seed companies are free to directly distribute and market their seed in well labeled branded bags through stockists or farmers going directly to the foundation seed farms, or NGO involvement. Distribution of seed and other inputs is mainly by private agro-dealers (around 90% of all inputs in Tanzania).

The Ministry of Agriculture Food Security and Cooperatives is reviewing the seed act and expectations are that weaknesses and needs for improvement mentioned in this study will be addressed.

2.1 Private Sector Participation and Role of TASTA

As a result of the new seed policy, the number of private companies doing seed business in Tanzania has been growing every year. For example, in 2005 there were less than 16 companies and today there are more than 55 companies and enterprises doing seed business (see Annex 2 of this report). There are companies that deal with both local production and importation of seeds of major food crops as well as horticultural crops. The majority of the companies doing seed business are members of the Tanzania Seed Trade Association (TASTA), formed in 2002 which is headed by Mr Bob Shuma from the Private Sector and is the Executive Secretary.

TASTA has been very instrumental in leading the private sector in lobbying and undertaking consultations with the public sector that has led to revision of Tanzania's legal framework to allow for a more competitive and viable seed industry. It is expected that formal seed sector is poorly developed like Tanzania the private-public partnership (PPP) could be an engine to agricultural revolution.

There are challenges and opportunities in production and marketing seeds in this PPP arrangement. The challenges include: minimal promotional efforts of new public varieties; mistrust of farmers on local seed companies; maintenance breeding is a major challenge to public breeders as the certified varieties increase; limited know how in the seed value chain i.e. policies, laws, regulations; low capacity of local seed companies and prominence of small scale farmers and diverse agroecology. The Government must protect its varieties from biopiracy through fingerprinting techniques and local private seed companies have to be strongly linked with the local government authorities.

Constraints facing the seed industry

1. **Local variety breeding:** The local indigenous germplasm owned by farmers who have the local knowledge is not given due emphasis in the whole industry.
2. Breeders lack funds to carry out breeding and maintenance of germplasm adequately particularly maintenance of breeder seed.
3. **Certification, regulation and variety registration:** Charges by TOSCI; (they do not cover the full inspection costs) may be costly for breeders. TOSCI's faces constraints which are financial, human and infrastructure capacity. Indigenous local varieties and cultivars are not recognized in the whole process. Owners of the local indigenous and cultivars germplasm not known/ recognized/ acknowledged
4. **Foundation seed production: These are in** Arusha, Mwele, Dabaga, Kilangali, Msimba use very old processing machinery. The links with purchasers of foundation / certified seed (particularly for non-commercial varieties) is relatively ad hoc.
5. **Seed production:** Contract farmers supplying seed companies do not have access to the finance industry to either get loans or grants to purchase irrigation equipment and other inputs. For example ASA has 43 seed production contract farmers.
6. **Marketing and promotion:** There is a general lack of awareness of, and demand for, improved varieties of seed. This impact on the depth of marketing and promotional activity is required to encourage farmers to adopt new varieties.
7. **Distribution:** The coverage of agro-dealers in rural areas is poor in some areas, resulting in limited use of agri-inputs by a large proportion of the population. As with other countries, there are also problems with adulterated materials. This in turn undermines farmers' trust in agro-dealers and in the use of agri-inputs.
8. **Policy:** The whole policy does not recognize the agri-biodiversity which is maintained by local farmers and the local and indigenous knowledge they own. It is important to note that farmers have for a long time breeding their own varieties for their own circumstances. It is also quite true that farmers do not have any control on the policy which is supposed to take them out of poverty.

3. Overview of Agriculture Research Institutes (ARIs) systems in Tanzania

The Division of Research and Development (DRD) of MAFC is the leading National Agricultural Research System (NARS) institution in Tanzania with the mandate to oversee all matters related to agricultural research. It comprises a network of sixteen agricultural research centres located in seven agro-ecological zones. The research centers include Ilonga, KATRIN, Dakawa/Cholima, Kibaha, Mlingano and Mikocheni (Eastern Zone); Maktupora and Hombolo (Central Zone); Ukiriguru and Maruku (Lake Zone); Selian and HORTI-Tengeru (Northern Zone); Naliendele (Southern Zone); Uyole and Kifyulilo (Southern Highlands Zone) and Tumbi (Western Zone).

The main functions of the DRD are (i) to conduct and co-ordinate agricultural research programs in Tanzania in accordance with the national agricultural policy and research priorities; (ii) to recommend the use of research findings; (iii) in collaboration with extension services, to make sure that the research recommendations reach the farming community, especially smallholder farmers; and (iv) to collaborate with other related national, regional and international research institutions.

3.1 Current Status of Agricultural Research

Research Capacity

Currently the DRD has a total of 393 scientists, of whom 48 are PhDs, 165 MSc degree holders in relevant research disciplines while the remaining are BSc degree holders. These scientists are supported by 225 technicians. There are sixteen strategically located research institutes with adequate land and basic infrastructure for conducting research. Also, DRD has accumulated knowledge, information and technologies that have been developed over many years of research. These provide a number of options that can be modified and deployed to respond to client-demands and needs. It has a strong capacity for client-orientation which has been developed through many years of adopting participatory and farming systems approaches. This provides a good base for mainstreaming value chain and innovation systems approaches in future research and development activities. In addition, the institution has developed linkages within the NARS and with local stakeholders, development partners, regional and international institutions.

Achievements

The DRD has made significant achievements during the past decade in technology development and transfer in the areas of variety development, agronomy research, value addition and utilization, soil and water management, biotechnology and several socio-economic recommendations. For example, in the last 50 years, 236 improved varieties of different crop species have been released that are high-yielding, tolerant to diseases, pests and drought. Throughout that time the research system has produced adequate breeder's seed for multiplication of foundation seed by agricultural seed agencies which are eventually made available to seed companies. Other accomplishments include improved small scale processing technologies; integrated pest management technologies, agroforestry technologies and fertilizer recommendations. These technologies have contributed to increased yields, productivity and incomes and have also averted the country from potential major food shortages.

3.2 Stakeholder Involvement in Research and Technology Transfer

Through the farming systems approach (FSA), participation of stakeholders has been emphasized in technology development and transfer. The approach involves characterization and analysis of farming systems and client groups to enhance research targeting, provision of a systems orientation to research, enhancement of coordination with various stakeholders including extension services and promotion of farmer participation in all stages of research.

The FSA has been enhanced by adopting client-oriented research development and management approach (CORDEMA) which is used to ensure improved management including stakeholder involvement in the implementation of agricultural research: Client perceptions and needs became the driving force in the determination of the research agenda, as well as the production and dissemination of user-friendly research products.

One of the criticisms the research system is receiving from stakeholders is that technologies developed through research activities do not adequately reach end users to bring about the impact to the farming community. In response, a system has been put in place to ensure that developed technologies are disseminated to intended stakeholders. For example, the zonal information extension liaison units have been set up to enhance linkages among research, extension and farmers. The units play a major role in establishing research demand from stakeholders; also packaging and disseminating developed user-friendly technologies to stakeholders. Also, the zonal agricultural research funds have been established whose research projects focus on clients needs that are approved by stakeholders themselves.

Under these approaches, the implementation of research activities is governed by a greater control by farmers and other clients in cooperation with the public sector agencies and with a significant increase in the contribution of private agricultural service providers (ASPs) to extension delivery. Various strategies and means employed to facilitate technology transfer include testing technologies with farmers and extension staff; farmers' field days; farmer field schools; agricultural shows, various publications: newsletters, posters, leaflets, booklets, success stories and fliers; mass media including web-based agricultural information portals.

Challenges

Despite the achievements that have been realized, there are still challenges that DRD is facing. They include: (i) low competitive advantage of the DRD to compete for resources with existing and emerging private and semi-autonomous research institutions (both local and international); (ii) being a department of the ministry, DRD lacks independent legal status; (iii) frequent and often unproductive institutional changes which have resulted into poor research coordination and management; (iv) loss of qualified and skilled manpower through brain drain; (v) weak research-extension-farmer linkages leading to poor dissemination of research outputs; and (vi) inadequate capacity of up- and out-scaling technologies including seed.

3.3 Efforts to Improve Agricultural Research

i. Enhancing Research Focus

Efforts to improve agricultural research in Tanzania include adopting a research system based on agro-ecological zones, improving research-extension-farmers linkages; adopting a farming systems approach and client oriented research. In addition, there have been regular research priority-setting processes at national level and within each agro-ecological zone.

ii Improving Research Funding

The current challenge in the research system is due to low budgetary allocations. However, there are several initiatives to improve the situation. Currently, the government is funding agricultural research through the ASDP and recurrent budgetary allocations. For the past decade the government budget approved for DRD has been in the average of 24% of the total actual budget requirement. For the DRD to function efficiently and effectively, the Government will have to increase its budget for research activities quite substantially. The DRD will require government commitment to provide adequate funds for core research operating costs, capacity building, administrative and personnel emoluments.

The government has recently committed itself to raise the budget for research to 1% of the GDP. During the fiscal year 2010/11 initial funds under this arrangement amounted to TShs.19b (earmarked for both MAFC and MLFD) disbursed to COSTECH which is coordinating the fund. To date, part of this fund (TShs.1.2b) is supporting long-term training for 45 researchers (33 MScs and 12 PhDs).

Under ASDP basket fund arrangement, public agricultural research funding mechanism has moved towards performance-based funding through competitive agricultural research funds and contract research. For instance, the establishment of Zonal Agricultural Research Development Fund (ZARDEF) for the seven zones gave emphasis for writing research proposals on competitive basis that would ensure high quality research results with greater participation of key stakeholders in research agenda. Two zonal committees comprising of representatives from various stakeholders in the respective zones were formed to manage and monitor the funds. However, the funding for ZARDEF is purely donor dependent and it entails huge administrative costs to process the project approval system especially to cater for committee meetings. This implies that with the current financing arrangement the Fund would not be sustainable.

3.4 Future Outlook

The DRD will continue to involve research stakeholders in determining the future agenda through emphasis on client-oriented demand-driven farming systems and product value chain approaches. More emphasis will be given to mobilizing adequate resources to support research efforts. These will be realized if there is an effective and efficient research structure. Therefore, the DRD as a leading and strategic institution in NARS is in the process of being transformed into an institution that shall provide dynamic and focused leadership in order to achieve the agricultural sector vision, goals and objectives. Improved human resource capacity development through staff training and retention and attracting competent staff.

3.5 Links with regional and international programs and initiatives

Agricultural research involves the participation of regional and international programs and initiatives for the reason of effectiveness, collaboration and tapping technology experiences from elsewhere. The DRD and its successor will continue to align itself to regional and international programs/strategies/organizations such as the New Partnership for Africa's Development (NEPAD) and related Comprehensive African Agriculture Development Program (CAADP), the Forum for Agricultural Research in Africa (FARA), the Association for the Strengthening of Agricultural Research in Eastern and Central Africa (ASARECA), the East African Community (EAC), the Center for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), the international agricultural research organizations such as the Consultative Group on International Agricultural Research (CGIAR) and the Asian Vegetable Research and Development Centre - African Regional Program (AVRDC-ARP) located in Arusha.

4. The trend towards financing agriculture research and Agriculture Research Institute (ARIs) in Tanzania in the last decade

4.1 Research Financial resources

The public agricultural research budget is supported by both the government of Tanzania (Local budget) and the Development Partners (foreign budget). Tanzania has traditionally been highly dependent on donor contributions for agricultural research. However, there has been increased commitment by government to funding. The government has recently committed itself to raise the budget for research in the country to 1% of the GDP (all sectors including medical, industry, agricultural research, etc). This commitment started to be implemented during FY 2010/11 though it has not gone above 0.5%. Under this commitment, in the financial year 2010/11 a total of TZS. 30 billion was allocated to all sectors. In agricultural research this covered long term training of 43 researchers, implementation of research sub-projects and renovation of research infrastructure (screen houses, laboratories) for seven research centres to a tune of with Tsh 1.4 billion. A total of 33 MSc and 11 PhD researchers were recruited in 2010/11 at the Sokoine University of Agriculture (SUA) in Tanzania.

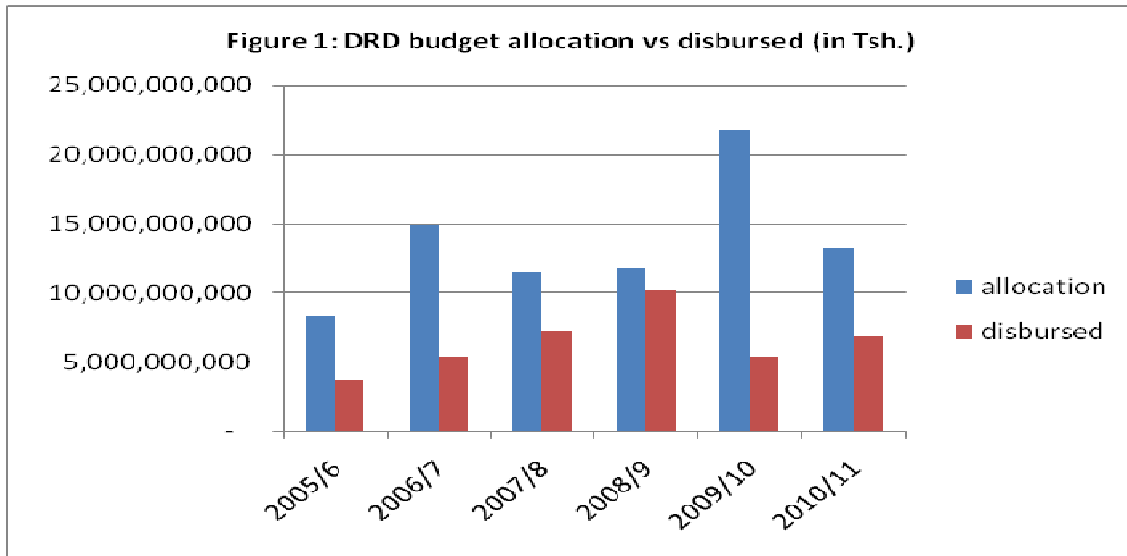
Research work done by COSTECH, 2010 indicates that 0.02 percent of National GDP is used for financing research in all sectors. If staff salaries (personnel emoluments) are included it rises to about 0.05 percent of GDP. On the other hand, current government budget allocation and expenditure to public research have remained low; standing at less than 0.5 percent of Agricultural Gross Domestic Product (Ag. GDP), which is less than African region average of about 0.75 percent. Under NEPAD, as agreed under the Maputo Declaration in early 2003, African countries including Tanzania, had committed to increase their support to agricultural development to at least 10 percent of national budgetary resources, and to spend at least one percent of the GDP on research. The DRD receives an average of 10 percent of the total Ministry of Agriculture allocation per year.

4.2 DRD budget allocations

The government allocation to public agricultural research has been less than 34 percent of estimated actual requirement for research operating costs. For example, at the formative stages of ASDP, it was estimated that resource allocation for agricultural research would increase by 20 percent per year over the five years. When ASDP (2006/7) was initiated, the overall budget for seven competitive Zonal Agricultural Research and Development and Extension Funds (ZARDEF) was estimated at Tshs. 2.25 billion annually for the first 7 years. However, actual payments did not match these pledges, standing at an average of Tshs. 1.35 billion. This funding was expected to come from donor's commitments to research budget and, it was considered that by the seventh year, 80 percent of research funding would be allocated through the ZARDEFs. On top of this the government has been allocating local counterpart funds for research at a much lower level.

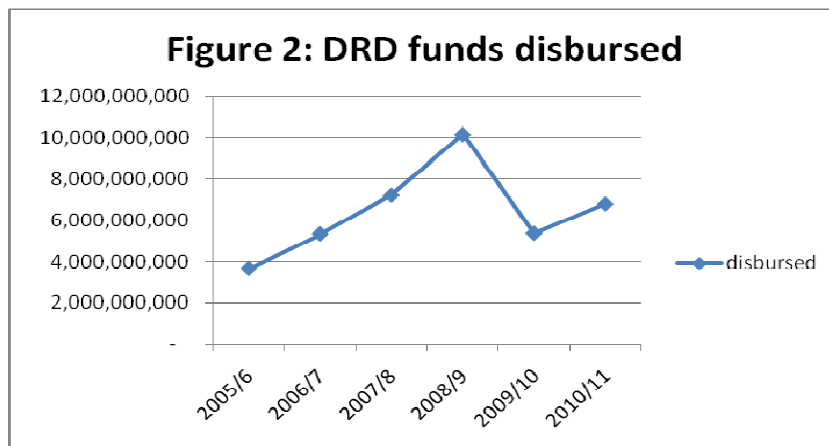
However, the anticipated funding levels have not been realized, with funding becoming less and less over the years. For instance, in the first year of ASDP (FY 2006/7) only about Tshs. 0.802 billion was disbursed out of Tsh. 7.2 billion approved (see Table 1). In the following year (FY 2007/8), Tshs 2.6 billion was disbursed against the approved 6.9 which accounts for about 37%. However, there was improvement for ASDP funds disbursement in the subsequent years. In recent years, disbursement has remained robust in the average of more than Tshs. 4.0 billion (e.g. Tshs. 4.6 billion in FY 2007/8, Tshs, 4.34 billion in 2008/9, Tshs, 4.0 billion in 2009/10 and 2010/11). This amount of funds was received from development partners (foreign funds). The World Bank support though ASDP is likely to decline further in the next two years due to some donors' withdrawal of funding

through the Basket fund arrangement. For instance, in the financial year 2011/12 only Tsh. 2,280,157,300 has been allocated against the approved budget of Tsh. 4.0billion in the FY 2010/11 which is about 43 percent reduction.



Source: DRD budget document review (2012)

The Trend for the past five years of DRD funds disbursement in nominal terms has been erratic increasing from year 2005 to 2008 and then declining in the year 2009 (Figure 2). The decline was due to non disbursement of recurrent funds by government particularly research operating costs. There has been no disbursement of research operating costs up to year 2011. The increase in the FY 2010/11 is mainly due to the commencement of Eastern Africa Agricultural Productivity Program under World Bank Funding. Under this project which is mainstreamed within ASDP is aimed at establishing a Regional Rice Centre of Excellence (RRCE) in the country at a total cost of US \$ 30 million for over five year period.



Source: DRD budget document review (2012)

The table 1: Research expenditure by costs, 2009-2011 (in thousands of current prices, Tsh)

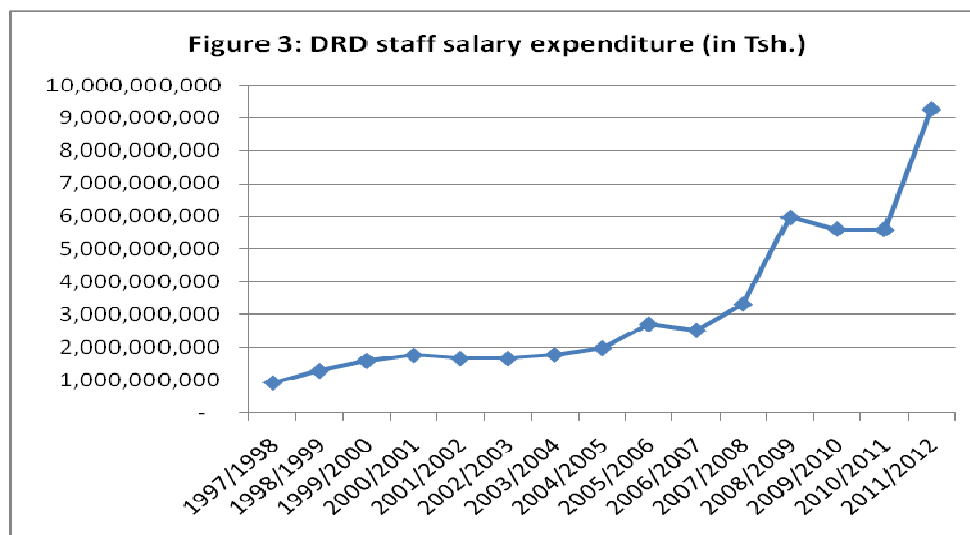
	2009	2010	2011
Salaries and personnel emoluments	5,779,966	5,597,985	7,425,081
Operating and program costs	7,991,487	6,755,942	6,883,163
Capital costs	740,000	1,180,000	1,238,000
Total	14,511,453	13,533,927	15,546,244

Source: DRD budget document review (2012)

Table 2: Sources of research funding, 2009-2011 (in thousands of current prices, Tsh)

	2009	2010	2011
Government (core funding)	5,804,581	6,651,147	7,149,838
Government (other)	0	0	0
Loans from development banks	6,029,000	4,735,065	5,206,700
Bilateral and Multilateral donors	937,634	766,875.6	1,148,384
Commodity levies/ producer organizations	791,213.4	783,657.4	1,384,422
Sale of goods and services	949,025	597,182	656,900
Other			
Total	14,511,453	13,533,927	15,546,244

Source: DRD budget document review (2012)



review (2012)

The government researchers' salary structure has improved slightly in the last few years but is still low compared to their counterparts in the other public semi-autonomous institutions (TACRI, TRIT, and COSTECH).

As the DRD's overall budget is tied closely to personnel costs, which are more than 42 percent of the DRD

total government budget allocation, salary increases have a significant impact on the total amount of funding available for operating costs. The tremendous increase in year 2010/11 is a result of improvement of scheme of service of agricultural researchers in the country by 80 percent.

4.3 Development partners support to research

In 1998, the World Bank renewed its support for Tanzanian agricultural research with the Tanzania Agricultural Research Project (TARP II, 1998/99-2002/03). With the project budget of US \$ 21 million, the project emphasized client-oriented, demand-driven applied and adaptive research (World Bank, 1997). Under the project, the seven zonal centers for research under Research and Development Division (DRD) were given greater autonomy to plan and implement research. Specific budgets were allocated to each institute and responsibility for managing those funds was accorded to the Zonal Directors of Research and Development (ZDRDs) dubbed as zonal-autonomy.

There have been impressive attempts to expand potential sources of funds to agricultural research institutions while making research more demand-driven and client oriented. The funding for research has been improving with the beginning of Agricultural Sector Development Programme (ASDP) under basket fund arrangements whose actual implementation started in FY 2006/07. The Program is funded by various development partners including the World Bank, IFAD, JICA, Irish Aid and European Union until 2013. In general the funding for agricultural research has been growing at a slower rate since inception of ASDP.

Under ASDP, public agricultural research funding mechanisms moved towards performance-based funding through competitive agricultural research funds and contract research. There was strong belief that the quality of research systems would increase under competitive funding arrangement. For instance, under ASDP, the establishment of Zonal Agricultural Research Development Fund (ZARDEF) for the seven zones gave emphasis for writing research proposals on competitive basis that would ensure high quality research results with greater participation of key stakeholders in research agenda. However, while competitive funding may entail high administrative costs, there are also other some limitations of this arrangement as there was concern about what happens to the researchers who would not be awarded in this grants system. In addition, the funding for ZARDEF is purely donor dependent – what about if the development partners pull out. It would imply that with the current financing arrangement of the Fund would not be sustainable.

4.4 Support from regional and international organizations

DRD has well established linkages and collaboration with regional and international organizations such as FARA, ASARECA, CCARDESA, CIP, ICRISAT, CIMMYT, INIBAP, CIAT, IITA and other research institutions in the CGIAR. Linkages are also established in: (a) research information exchange (FARA, FAO, CTA, ASARECA, IPGRI, CABI etc) (b) research grants (IFS, , Bill and Melinda Gates Foundation, Farm Africa, AATF, AGRA etc.) (c) Networking (ICRISAT, SARNET, CIMMYT, WARDA, etc.) (d) Scientific meetings, workshops, and conferences. Currently, main institutions providing financial support to collaborating ARI institutes is shown on Table 2. The support is provided direct to research activities at the respective zonal research institutions of DRD.

Table 3: International Institutions collaborating with National Research Institutes

International Institution	Research Programme	Collaborating National Institution
ICRISAT	Sorghum, millet, chickpeas, groundnuts, pigeon pea	Ilonga, Hombolo, Ukiriguru, Naliendele, Selian
IITA	Roots & Tubers (Cassava, sweet potato, yams), grain legumes (soya beans and cowpeas)	Kibaha, Ukiriguru, Uyole, Ilonga
AVRDC	Horticultural crops	Hombolo, Tengeru
CIMMYT	Maize, wheat	Ilonga, Selian, Hombolo, Tumbi
McKnight Foundation	Beans, cowpeas, oil seed	Uyole, Ilonga, Naliendele
CIAT	Beans	Selian, Uyole
CIP	Sweet and round potatoes	Ukiriguru, Uyole, Horti-Tengeru
NRI	Sesame	Naliendele
IRRI	Risce	Katrin/Cholima
JICA	Rice	Ukiriguru, Uyole, Katrin
ECABREN	Beans	Selian
CRS	Sweet potato, cassava	Ukiriguru, Uyole
PROGRA	Maize and beans (seed systems)	Selian, Uyole
AGRA	Maize, beans, soils	Uyole, Ukiriguru, Maruku
ASARECA	All research programmes	All research zones

5. Status of research on food crops in Tanzania (How needs for research are identified, who initiates the processes, where research is conducted).

5.1 How needs for research programs/projects are identified and who initiates the processes:

There are various ways in which needs for research are identified. These are discussed below:

i. Using the Development of District Agricultural Development Plans

Decentralization and democratization processes in Tanzania have given more autonomy and power to local authorities and communities. More than before, clients of research and end-users of agricultural technologies are likely to ask for good research results and want value for the money they invest.

In the Agricultural Sector Development Program, District Agricultural Development Plans (DADPs) are intended to facilitate communities and districts to plan for agricultural development. The objective is to impart community members with skills on how to identify agricultural problems, their causes, effects and possible solutions using participatory approaches. Planning starts at the village level by producing a Village Development Plan (VDP). Village plans are then assembled at the ward level to compile a Ward Development Plan (WDP). Finally Ward Development Plans are compiled to produce District Agricultural Development Plans (DADPs). In these plans issues requiring research are also identified and dealt with ARIs. At the research institution level research is decentralized, stressing client orientation and the effective delivery of productive, profitable and sustainable technologies for smallholders through the recent introduction of the "Client-Oriented Research and Development Management Approach (CORDEMA) across the entire Tanzania NARS. CORDEMA finds its roots in the Farming Systems Research and Extension approach (FSR-E). The overall goal (i.e. general objective) of the CORDEMA is to increase the level of client orientation of agricultural research and development institutions through improved management and organization. Within the CORDEMA there is a Zonal Information and Extension Liaison Unit (ZIELU) based at ZARDI to assemble, assimilate and disseminate information and communication materials. This Unit is supposed also to assemble researchable problems from the Districts and particularly from the District Development Plans. The ZIELU sends this information to researchers who thereafter develop research programs which are discussed through various steps and fora and authorized for implementation by various stakeholders.

ii. Addressing regional and international priorities.

Agricultural research involves the participation of regional and international programs and initiatives for the reason of effectiveness, collaboration and tapping technology experiences from elsewhere. DRD aligns to regional and international programs/strategies/organizations such as the New Partnership for Africa's Development (NEPAD) and related CAADP, the Forum for Agricultural Research in Africa (FARA), the Association for the Strengthening of Agricultural Research in Eastern and Central Africa (ASARECA), the East African Community (EAC), the Southern African Development Community's (SADC) upcoming Center for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) and the international agricultural research organizations such as the Consultative Group on International Agricultural Research (CGIAR).

iii. Addressing major outbreaks in the agricultural sector in the country e.g plant disease outbreaks

iv. Addressing national identified priorities.

DRD has developed national research priorities as follows:

- **Priority One:** Maize, rice, tomatoes, cassava, beans sorghum, sunflower, groundnuts, sweet potato, banana, and cashew nuts.
- **Priority Two:** Cabbage, onions, cotton, mangoes, citrus fruit, indigenous vegetables, pineapple, pigeon pea, avocado, sesame, cowpea, sugarcane, pearl millet, wheat, apples, spices, passion, Irish potatoes, chick pea, coconut, sisal, and grapes.
- **Priority Three:** Pears, carrots, pyrethrum, finger millet, peppers, oil palm, soybean, green gram, mushroom, lab-lab, cocoa, barley, cucurbits, pawpaw, safflower, yams, and bambara-nut.
- **Others** which may be of interest but not listed include botanicals for pest control, cut flowers, aloe vera, rubber, macadamia nuts, litchie, underutilized crops, jojoba and emerging crops for biofuel such as jatropha.

v. Zonal FSR/SE Diagnostic activities:

The Zonal Farming Systems and Socioeconomic units constantly conduct diagnostic activities in priority farming systems annually. These are done in a participatory manner involving stakeholders in agricultural development. They form a reliable basis for getting researchable issues.

Research is done in the Zonal ARIs as indicated in table 2 below.

Table 2: Agricultural Research Institutes in MAFC

Zone	Regions	Research Institutes	Crops
Eastern	Dar es Salaam, Morogoro, Pwani, Tanga	Ilonga-Kilosa (Zonal HQ), KATRIN-Ifakara, Dakawa-Morogoro, Mikochehi-DSM, Kibaha-Pwani, Mlingano-Tanga	lowland maize, simsim, cowpeas, pigeon peas, sorghum
Western	Kigoma, Tabora	Tumbi-Tabora	Agroforestry, maize, rice, sorghum
Northern	Arusha, Kilimanjaro, Manyara	Selian-Arusha (Zonal HQ), HORTI-Tengeru-Arusha	maize, wheat, beans, pigeon peas, indigenous vegetables, Fruit propagules
Southern Highlands	Iringa, Mbeya, Rukwa, Ruvuma	Uyole-Mbeya (Zonal HQ), Kifyulilo-Mufindi, Seatondale-Iringa	Maize, Beans, Soyabean, Wheat, horticultural crops, potatoes, rice
South	Lindi, Mtwara	Naliendeke-Mtwara	Cashewnuts, cassava, simsim, groundnuts, sorghum
Central	Dodoma, Singida	Makutupora-Dodoma (Zonal HQ), Hombolo-Dodoma	Sorghum, millets, grapes
Lake	Kagera, Mara, Mwanza, Shinyanga	Ukiriguru-Mwanza (Zonal HQ), Maruku-Bukoba	Cotton, rice, chickpeas, banana, cassava, maize
Sokoine University of Agriculture	Morogoro		Cereals, legumes, horticultural crops including fruit propagules

5.2 Status on production and research on a few selected crops:

5.2.1 Maize

Maize is grown in almost all the regions of Tanzania Mainland. Planted area increased from 2,570,147 hectares in 2005/06 to 3,050,714 hectares in 2009/10 agricultural year. Average yield of maize increased from 1.3 tons per hectare in 2005/06 to 1.6 tons per hectare in 2009/10 agricultural year. Areas planted and yields vary between years depending on rainfall and availability of inputs. However in the recent past the general trend has seen increasing areas of cultivation and moderate increases in average yields.

Maize research in Tanzania

The current maize national program focus and project on ground is to improve productivity at all nodes of the maize value chain. This is in response to the low average national production which is now about 1.6t/ha. Maize production in Tanzania has a number of intractable stresses i.e. biotic and abiotic which are modulated by climate change and therefore the research program has geared its efforts such that these stresses must be responsive to mitigating effects of climate change. The Water Efficient Maize for Africa (WEMA) project located in Central Tanzania has strengthened these efforts.

The trend of varieties released in the recent past has been an average of 5 per year over the past five-ten years from local & foreign companies. The local maize seed industry is about 70% deficit nationally.

Funding levels from the Government has been low for a number of years. Fortunately this gap is filled foreign funding through various projects.

Manning levels are low and do not meet needs of the Maize Improvement Program and requirements. Most needs are in the Southern Highland Zone with a **geographical coverage of 28% of Tanzania**. Breeders, agronomist, entomologist, pathologist, socioeconomist, food or feed/nutrition analyst, biotechnologist, etc, etc, etc are required to fill the gap.

5.2.2 Rice

In Tanzania area planted with **rice** has been increasing in the last few years (5 – 7 years). This increased to 1,136,287 hectares in 2009/10 with highest average yields of 2.4 tons per in 2006/07 agricultural year. This increase is attributed to increase in the area cultivated, use of fertilizers under inputs voucher system, enough rainfall distribution as well as increase in the use of irrigation.

The National Rice Research Program is coordinated from ARI KATRIN in Ifakara and focuses on: high yielding potential varieties with acceptable grain qualities; uniform medium plant stature and short to medium growth duration; non lodging and non-photosensitive for double cropping in small scale irrigation schemes; resistance to emerging diseases like RYMV, blast and insect pests such as African Rice Gall Midge; breeding rice varieties suitable for different rice agro-ecosystems of Tanzania and to resistance/tolerance to biotic and abiotic stress factors such as diseases, drought, salinity etc.

The main breeding approaches are: conventional breeding in collaboration with ARI Chollima (DAKAWA); mutational breeding in collaboration with Sokoine University of Agriculture and International Atomic Energy Agency; molecular markers assisted breeding which has been used in selection of breeding lines developed for RYMV resistance collaboratively implemented between ARI-KATRIN

and ARI Mikocheni; and introduction of suitable varieties developed in International Institutes such as IRRI, Africa Rice Centre (AfricaRice).

Rice research activities which have been conducted in recent years include:- germplasm collection and maintenance (400 rice germplasm are being maintained); genetic enhancement to increase productivity in rice through breeding e.g. resistance varieties to RYMV disease in Tanzania. Lowland NERICA rice evaluation trial; upland NERICA multi-location trials; determination of the optimum N and P rates in lowland rice in the Eastern zone; determination of the optimum plant spacing, N and P rates in upland rice in the Eastern zone; Evaluation of Green Super Rice (irrigated hybrid observational nurseries and rainfed lowland inbred observational nurseries); participatory variety (PVS) selection of IRRI lines (medium maturing high yielding varieties and aromatic types); participatory variety selection (PVS) of Upland NERICA varieties; evaluation of 36 Lowland NERICA varieties (A collaboration with Africa Rice); and blast evaluation trial (testing materials from Africa Rice Centre for reaction to blast in the field in hot spot areas)

At regional level, the National Rice Research Program as the host of RRCoE coordinates rice research projects in the region (Kenya, Tanzania, Uganda and Ethiopia). Currently 8 regional rice projects are on-going.

Varieties released in the recent past include: TXD 85, TXD 88 and TXD 306 (SARO 5) (Released in 2000); NERICA 1, NERICA 2, NERICA 4, NERICA 7 and WAB 450-12-2-BLI-DV4 (all upland NERICAs, released in 2009).

Funding levels: KATRIN/National Rice Research Program is now a Regional Rice Centre of Excellence (under EAAPP), a World Bank-funded project funding to a tune of US \$30 million for a period of four years. Other sources are from collaborative research with other partners especially the CGIAR centres such as AfricaRice, IRRI.

Manning levels and requirements: Grossly, the program runs short of manpower in all areas/specialties. The requirement, available and shortage is as summarized in the table below:

Human resource status and projection by 2015¹

Category	Requirement	Available	Shortage
PhD	16	2	14
MSc	25	5	20
BSc	26	5	21
Field Officers/Technicians	42	7	35
Support staffs	38	10	28
Total	147	29	118

¹ These projections are based on vision to make KATRIN a fully-flagged Regional Rice Centre of Excellence

ARI KATRIN coordinates and has rice research activities at ARI- Dakawa (Cholima) – Morogoro, ARI-Uyole, Mbeya - Southern Highlands Zone, ARI-Ukiriguru – Mwanza, ARI-Tumbi – Tabora, SUA (Sokoine University of Agriculture) Morogoro, Kizimbani Agricultural Research Institute (Zanzibar) and has collaborative activities with JICA- under the TANRICE project, IRRI, Africa Rice Centre, KATC (Kilimanjaro Agricultural Training Centre) and various District Local Government Authorities (LGA).

5.2.3 Sorghum

Sorghum is a drought tolerant crop grown mostly in Central, Lake and Southern Zones. Area planted with sorghum fluctuated from one year to another. Area planted with sorghum decreased from 874,220 hectares in 2008/09 to 618,369 hectares in 2009/10. This is equivalent to 29.27% decrease. In 2009/10 sorghum production recorded highest in Mara region followed by Singida, Dodoma and Shinyanga producing about 532,464 tons which is two thirds of the national production.

The sorghum research program is coordinated from ARI Hombolo (Central zone) with other activities at ARI Ukiriguru (Lake zone), ARI Ilonga (Eastern zone), ARI Naliendele (Southern zone), ARI Tumbi (Western) and of late ARI Selian (Northern zone). The program focus is on having a continued commitment to uncover new knowledge and technologies geared to enable sorghum farming community across the country to produce economically (profitably). Currently the program has few projects that are externally funded and collaborative all aiming at improving the status of the crop in Tanzania especially going by the prevailing climatically changes including:

- **HOPE** – Harnessing Opportunities for Productivity Enhancement in Sorghum and Finger millet (ICRISAT lead and Funded by Gates Foundation) and ending in 2012/13.
- Sustainable intensification of sorghum-legume system to improve livelihood and adaptation to climate change in Semi-Arid areas of Eastern and Central Africa (ASARECA Funded) ending this year/season – 2012/13
- Development of a Robust Commercially Sustainable Sorghum for Multiple Uses (SMU) Value Chain - Support the development, demonstration, uptake and use of new high yielding and adapted sorghum cultivars for multiple uses. This project is yet to take off.
- Integrated Striga Control in Sorghum – Lead by Purdue University funded by Gates Foundation
- Sorghum production and utilization technology transfer in the central corridor of Tanzania – Nebraska University (Funded by INTSORMIL). This is a one year project for 2012/13

There have been minimal funds from the Government with a major dependence on external funding e.g. ASARECA (SLI) has supported at a tune of 191,000 USD for four seasons; and the technology transfer project received a total of USD 23,500.

The sorghum program within DRD has five 5 researchers and five technicians nationally while in actual sense the requirement is double of what is available for researchers and thirteen technicians

5.2.4 Beans

Bean research program

The program has a focus on bean improvement (variety improvement) covering the following improvement thematic areas: tolerance to drought and poor soils; disease and insect tolerance; market acceptance; processing such as scanning and fastness to cook and good culinary factors. Other areas are improvement in agronomic practices in areas of planting methods and spacing; soil fertility management; harvesting and storage are included in agronomic practices. Integrated Soil Fertility and Nutrient

Management (ISFNM) is also one of the areas being researched. Plant protection activities include IDM/IPM, diagnosis. Beans **socio-economics research include** baseline studies, adoption studies, marketing, and value chain analysis. The SUA also conducts bean research as explained below.

Bean varieties released in recent years at ARI Uyole are Calima Uyole (2011), Njano Uyole (2009), Uyole 04 (2004), Urafiki (2004), Uyole 03 (2003) and Wanja (2002).

Bean research funding levels are generally low. There are donors/partners that fund research but these are project based with time limitations and it may not be suitable for research which take longer like variety development

In the program there is some improvement in manpower available but younger scientists and more technical staff are needed

SUA Bean Research Program

Bean research at Sokoine University of Agriculture has two phases. The first phase concentrated on disease resistance and released some varieties. The second phase is now concentrating on multiple disease resistance using local germplasm – i.e. improving the kablanke variety which was released earlier. Other bean research projects at SUA include:

- i. Improvement of nitrogen fixation of the local germplasm – dealing with over 100 races
- ii. Improvement for bruchid (storage pest) resistance using wild type varieties
- iii. Community seed production
- iii. Beans and climate change: improving drought resistance using local cultivars and a few introductions from CIAT.
- iv. Seed policy node project: reviewing the seed act to propose improvements

6. Farmer involvement in agricultural research and demand drivenness

Involvement of farmers in technology generation and dissemination is crucial. Farmers are involved in selecting a technology package in a participatory manner. Example of this involvement is Participatory Variety Selection (PVS). DRD has ensured that farmers and other stakeholders are involved at all stages of the research cycle i.e. production, testing, promotion and distribution. Participatory variety breeding is a prerequisite because breeding is goal oriented. Researchers are now aware that they are addressing needs of end users so their concepts and needs must inform the empirical breeding discipline. Although this is happening, there are some questions which have not been answered – what is the extent of inclusion of the local agrobiodiversity in research programs? It seems the choice, experience and the depth of use of the participatory methods and tools may answer some of these important questions. This is an area where research has to make an assessment to provide more evidence.

The DRD which is the largest institution in NARS adopted the Farming Systems Approach to move away from conventional research into demand driven research. Farming Systems and Socio- economic Research involves a series of activities including: identification and mapping farming systems, classifying and analyzing client groups to enhance research targeting; providing a systems orientation to research; enhancing coordination with various stakeholders including extension; promoting farmer participation in all

stages of research; monitoring, analyzing and documenting dissemination and adoption of technologies; preparing farm budgets; providing information concerning the impact of technologies and return to research investment and analyzing institutional and policy-induced constraints to technology development at farm level.

Through the farming systems approach (FSA), participation of stakeholders has been emphasized in technology development and transfer. The FSA has been enhanced by adopting Client-Oriented Research Development and Management Approach (CORDEMA) which is used to ensure improved management including stakeholder involvement in the implementation of agricultural research.

The DRD took all these steps to ensure that technologies developed through research activities adequately reach end users to bring about positive impact to the farming community. To achieve this, implementation of research activities should be governed by a greater control by farmers and other clients in cooperation with the public sector agencies.

Currently the aim is to transform smallholder agriculture into successful rural agribusinesses that are profitable and in which agricultural surpluses can be marketed. This is the reason why the ASDP has adopted the Value Chain principal so as to empower farmers to engage themselves into agribusinesses. This is another important step in strengthening demand drivenness in agricultural research. So far the DRD has trained over 350 researchers in Farming System Approach since mid 1990s.

7. Status of seeds used by smallholder farmers and factor behind that selection

Seed production levels and requirements

It is estimated that the potential demand for improved seed in Tanzania is about 120,000 tons per annum while the actual demand is estimated at 60,000 tons per annum. However, only 28.6 thousand tons were made available to farmers through formal seed system in 2011/2012 and out of this, 14,000 tons of seeds were produced locally and the rest of the demand met through imports or use of farm saved seeds. Given the availability of suitable land and other production potentials, Tanzania should be able to be self sufficient in producing quality seeds in the country that will be used by Tanzanian farmers and the excess exported to other countries.

Since the early 1990s, when the economy was liberalized, the seed Industry of Tanzania has been growing as a result of partnership between the public and private sectors. During this period the private sector has taken the lead in seed production, marketing and distribution, and foreign and local seed enterprises have taken deliberate efforts to increase availability of quality seeds in the country through internal production programs and importations.

Availability of seeds and use

Availability of seeds from Private sector increased from 8,748.25 tons in 2005/06 to 14,536.42 tons in 2009/10. While Public Sector decreased from 1,728.92 tons in 2005/06 to 1,608.37 tons in 2009/10. This increase of seeds availability from private sector and decrease for public sector is equivalent to 66% increase and 7% decrease for private and public sector respectively. Generally the availability of seeds and use increased from 10,477.17 tons in 2005/06 to 16,144.79 tons in 2009/10. This change is equivalent to 54% increase. For individual crop seeds, the availability was as indicated below:

Maize seeds: Nationally increased from 8,766.16 tons in 2005/06 to 13,323.51 tons in 2009/10. This change is equivalent to 52% increase of maize seeds that were available to farmers. Maize seed production from research centers in the Southern Highlands, Northern, Lake and Western Zones are estimated to be in the levels over the past five years is as indicated in table 4 below:

Table 4: Pre basic maize seed production from research centers over the past 5 years.

S/No	Year	Quantity produced /sold (kgs)
1	2007/2008	1500
2	2008/2009	1427
3	2009/2010	3087
4	2010/2011	3433
5	2011/2012	6516
	Total	15963

Sorghum seeds: Nationally sorghum seed production increased from 341.8 tons in 2005/06 to 1346.06 tons in 2009/10. This increase is equivalent to 293 % increase. Production of seeds is undertaken solely mainly by Tanzanian Agricultural Seed Agency

(ASA). Research does no longer produce seed for the farmers. ARIs within DRD are no longer producing on commercial basis but only for research purposes.

Beans seeds: Nationally bean seeds decreased from 233.83 tons in 2005/06 to nothing tons in 2009/10. This situation indicates that farmers in 2009/10 used their own beans seeds to grow beans than in 2006/07 when more beans seeds were available in the country. Seed production and quantities at ARI Uyole in the Southern Highlands includes breeder seeds in quantities of 4 tons-8 tons of 6-8 varieties per year and 70-80 tons of 5-6 varieties per year other bean seeds.

Paddy seeds: Nationally rice seed production increased from 225.6 tons in 2005/06 to 784.93 tons in 2009/10; a change of 248% increase of paddy seeds that were available to farmers. Seed production of Pre-Basic seed from ARI KATRIN amounted to 8.9, 7.8 and 26.7 tons respectively for the years 2010, 2011 and 2012. Rice seed produced at KATRIN is sold to ASA while some is distributed to farmer seed production groups.

Table 5: Seed information for maize, rice, beans and sorghum (2006)

Crop	Source of foundation seed	Formal sector production (% of total available)	Formal sector distribution channel	Volume of seed made available through the formal sector (mt)
Maize	Seed Farms	Seed companies (97.5%); Seed Farms (2%); QDS (0.5%)	Agro-dealers / QDS / NGOs	12,000 mt
Rice	Seed farms / NARIs	Seed Farms (90%), QDS (10%)	Agro dealers / Seed Farms	250 mt
Beans	Seed farms / NARIs	Seed farms, Seed companies, ARIs, QDS	Agro-dealers, Seed Farms, QDS	525 mt
Sorghum	Seed farms / NARIs	Seed companies (99%) Seed farms (1%)	Agro-dealers	2,800mt

From the previous data, it is clear that there is a big gap between what is produced from the formal seed system and made available to farmers. It is therefore true that farmers use more seeds from the informal sector. Definitely most of the seeds are farmer seeds. This implies that farmers are using mostly their local materials or recycled improved varieties. From the figures available: if the demand for improved seed is 60,000 mt; only about 50% is available and probably farmers who need improved seed but do not get would go for recycled improved seed. And if the potential is about 120,000 tons per annum, and the actual demand is estimated at 60,000 tons per annum, then farmers using their own local or indigenous seed would amount to 60,000 mt per annum. In certain cases farmers do not depend on the formal sector at all for seed supply. This is very clear that in 2009/10 as no bean seed was available from the formal sector. Farmers had to depend on their own local sources. Farmers use their own local or indigenous varieties for various reasons. Not much work has been done by researchers to collect, evaluate and characterize these local varieties. There are various reasons behind these reasons. These reasons could be:

- No or few collections done. Some collections done are not in the country
- The National Plant Genetic Resources Centre (NPGRC) in Arusha is not fully functional with funding and staffing constraints. The NPGRC is part of the SADCC Plant Genetic Resources Program. Agreement on International Plant Genetic Resources for Food and Agriculture has not been domesticated in Tanzania. — if in place would create awareness and stimulation.
- Most Researchers are not aware of the good qualities inherent in local cultivars.
- Overall research funding for this type of activities is weak
- Participatory approaches are pushed by scientists and not farmers

8. What could be done to promote farmers demand driven research?

Currently there is a very strong inconsistency in the way the Government is supporting farmers. A good example is the existence of too many programs using the same farmers with almost the same objectives. A good example is the existence of TASAF, DADPs, SAGGOT e.t.c. This causes a lot of confusion at the farmer level with a feeling that the public system is not outcome focused

Research and extension are currently under two different Ministries creating large gaps when addressing many issues in agricultural development. These should be put together to lessen the gap between them.

Farmer organizations are weak and do not have massive support to influence change in addressing their demands. If farmers are well organized they will be able to command agricultural services to become more farmer oriented. Such organizations can enforce accountability of extension services to farmers/clients which has a number of weaknesses. FOs also are able to change mindsets of service providers.

When FSR-E was adopted in the DRD in the mid seventies it led to the inclusion of farmers and extension staff in the identification, implementation and assessment of research. FSR-E has three major steps – diagnosis, experimental and dissemination. Research institutes have taken important steps towards demand-driven research and influenced the organisational culture of research institutes and changed attitudes of scientists. This went on further and DRD adopted CORDEMA which fully embraces FSR-E and other participatory technology development approaches. FSR-E focuses primarily on the research project cycle while CORDEMA gives additional emphasis to management and organizational issues with the objective of creating an enabling environment for farmer-oriented and sustainable research. Addresses critical areas like stakeholder involvement, networking, liaison activities, production of attractive and client-friendly output, information management and the management of human, financial and physical resources. In this context CORDEMA emphasizes Demand driven research. Stakeholders set the research agenda and influence the selection of research projects and resource allocation. Also gives emphasis on Diversification of research supply. More suppliers of technology are brought into the research arena. At the same time Diversifies demands. Not only public extension, but also farmer groups, producer organisations, the private sector, agro-industry and NGOs express research and information needs.

These are areas of management and organisation of agricultural research that need to be addressed to improve the level of client orientation of an agricultural research institute and hence promote farmers demand driven research. The areas are: Improving Internal organisation of research institutes which implies Human resource management and Financial management and the second major area is improving Relations with stakeholders implying improving linkages and collaboration Research planning, monitoring and evaluation; and output production, dissemination and information management. Various activities can be implemented under these areas. Activities which may be more relevant to this study may be listed as constantly adapting staff competences to stakeholder needs; maintaining effective public relations; organizing active stakeholder involvement; acquiring research assignments and diversifying sources of funding, actively developing (inter)national networks; initiating assessment of research needs; planning and targeting research in a participatory manner, conducting farmer focused and farmer based research; organizing an efficient progress reporting system; producing user-friendly output; effectively disseminating research results and recommendations; and organizing information management. The activities mentioned here are relevant to all stakeholders but may be the initiator could be research. Of late multistakeholder platforms at the grass root level have proved to be very effective in improving farmer demand driven research. The major problem so far has been changing mindsets of all stakeholders involved in the research continuum. Stakeholders involved in this continuum are many when viewed from value chain approach. It may take more effort to bring both the private sector and some public institutions in this scenario. Efforts have to be increased on awareness creation and changing mindsets of stakeholders.

8.1 Experiences, reactions and suggestions from stakeholders.

Already some NGOs (e.g. PELUM, PROLLINOVA, ENVIROCARE) have started programs on producing selected local plant seeds with farmers. These local seeds are first identified in a participatory manner with local farmers. In certain cases researchers from ARIs have been invited and participated. The idea and principle is identifying local varieties which are preferred by farmers and are performing well and eventually producing seed to fill the gap of seed supply at a reasonable cost. Although these developments are encouraging it seems (as pointed out by TOSCI and SUA) that seed production at the community level has to use seed which has been registered/released. The question is “do researchers have to purify local seeds before been accepted for farmer multiplication?” Some suggest that other ways have to be sorted out to qualify registration – one option is to analyze the possibility of releasing based on farmer and researcher preferences.

The approach of using Quality Declared Seed (QDS) was/has been very successful. It continues to fill the seed supply gap in many districts but discourages the use of local cultivars. The approach has few constraints e.g. field isolation distances and the need to purchase fresh seed every after two years for most crops. TOSCI has expanded its offices and now is in Morogoro (HQ), Njombe, Arusha, Ukiriguru Mwanza and soon will establish an office in Naliendeke Mtwara. Even with this expansion, expectations have not been met to cover all the regions

The experience of ENVIROCARE is that this activity would normally start with a combination of approaches and methods which may include: awareness campaigns; focus group discussions at village level, producing leaflets indicating the pro and cons; training on policy and identifying areas which do not include farmers; understanding the kind of local seeds available including seeds fairs; building relationships with researchers; training on seed multiplication.

Researchers have more concerns with local cultivars. Fortunately they all agree that local varieties are good and have big potential in future. They need further improvement to do well e.g. local bean cultivars are highly susceptible to diseases and it has been observed that yields of improved beans can be twice as much as that of local cultivars. Researchers also agree that local varieties have good genetic traits e.g. in beans; some have good storability qualities after cooking. There is a worry that if registered origins have to be established. It becomes even more difficult to establish/recognize ownership because same type of local cultivars are available everywhere. The major questions is how do farmers fit in the current PBR registration process

Researchers observe that many collections on germplasm have been done uncoordinated. Although this is happening, researchers have not taken on board the issue of agribiodiversity as expected. The National Plant Genetic Resources Center has a lot of constraints making it unable to cope with the current needs and developments. For the NPGRC to become more efficient and part of the global effort the IPGRI procedures have to be domesticated in Tanzania through enacting an act on plant genetic resources. Again, there is a feeling among stakeholders that NPGRC which is in Arusha has to be linked with the Vice President’s Office which is the overseer of biodiversity and conservation. It is expected by doing so; NPGRC will become more effective and develop a more comprehensive program. Biosafety Regulations of 2009 under the Office of the Vice President guide management and control of risks associated with biotechnology, particularly research on genetically modified organisms (GMOs). The Biosafety Regulations are made under the Environmental Management Act, 2004 (EMA) which, among other things, domesticates various international agreements, including The Convention on Biological Diversity (CBD), 1992 and the Cartagena Protocol (CP) on Biosafety, 2000 of which Tanzania is signatory. Tanzania has also developed its National Biosafety Framework (NBF) since 2007.

While research and most public stakeholders have not given priority to local cultivars/varieties, there are also other important issues to deal with e.g. GMO transboundary movement across borders poses a threat to the existing agrobiodiversity. There is also need to revisit the biosafety act to incorporate issues not well taken on board to reflect current developments and needs.

There are fake seeds available with stockiest on the market which is a major problem. Sometimes sources of seeds on the market are not known. TOSCI can do little as it is embedded in the seed act. TOSCI has to be transformed to take on issues of regulating marketing of seeds. There has to be an institution (either TOSCI or create another body) and be given powers to regulate quality standards of seed in the market. Probably for the time being, seed supply companies should start to prepare seed packaging materials with special 'codes' to minimize unscrupulous seed business.

9. Conclusions and recommendations on how to improve smallholder farmers' participation in setting research priorities at different levels in Tanzania.

From the foregoing chapters it is quite clear that there is a lot of work on research and policy development which has been done and continues to grow. This work lacks a major inclusion of issues of researching and promoting local agribiodiversity and the associated local knowledge. Fortunately some stakeholders and particularly NGOs have taken up the issue seriously. There are encouraging results from these NGOs. Farmers are the owners of the agribiodiversity and local knowledge. They have been using these two important resources to survive under their own circumstances for centuries. On the other side the public and private sector have been working hard to promote their services although not able to fill the required gap in terms of quantities and farmer preferences.

The biggest challenge is that of changing mindsets as quickly as possible. It may take time for all to change mindset to work in this new proposed setting. Initial observations have indicated that there is will and commitment from all key actors. The agricultural sector has to develop to meet farmer needs and expectations.

There a number of stakeholders involved in research and policy development. It is obvious that several disciplines are required to work together to bring the necessary outputs. Interdisciplinary collaboration involves the cooperation between researchers in several disciplines, together with stakeholders and potential users of research results, with the objective of getting a more comprehensive understanding of the complexity of development problems in tapping the local agribiodiversity and knowledge.

Ongoing work (both in the public and private sector) provides learning platforms. It is essential to develop a sustainable program which embarks on the following:

- Building capacity on Participatory Innovation Development (PID) approaches for farmers and development practitioners from partner organizations. PID approaches have to include systems as one of major entries in agricultural development. This has to go along with strengthening use of farmer led and participatory documentation methodologies with particular emphasis on bridging the gap towards sufficient seed availability and focusing on an improved use of the local agribiodiversity.
- Identification and documentation of local agribiodiversity innovations for experience sharing and scaling up.
- Influencing the improvement of government policies to create favorable environment for farmer centered processes and participatory approaches that recognize local innovation systems and local agribiodiversity. These policies should also encourage institutionalization of PID and farmer centered approaches into research, extension, education and development institutions
- Establishing and strengthening effective multi-stakeholder collaboration and platforms for successful implementation of the program. Seed systems multi-stakeholder platforms at various levels (at National and lower levels where agribiodiversity is still existent). These platforms have to recognize that the existence of inter/multi-disciplinary teams enhances the capability of addressing various issues for innovation.
- Building partnership through learning, interaction among and between individuals and stakeholders. The learning process sometimes goes beyond technology into institutional involvement and their interactions as well as social. In establishing these platforms; care has to be taken by starting with those who will take the lead e.g. research and some selected extension organization/s (note that most NGOs are in extension) and farmers. Others may join later. This is one way of providing mechanisms for uptake pathways leading to up-scaling and out-scaling.

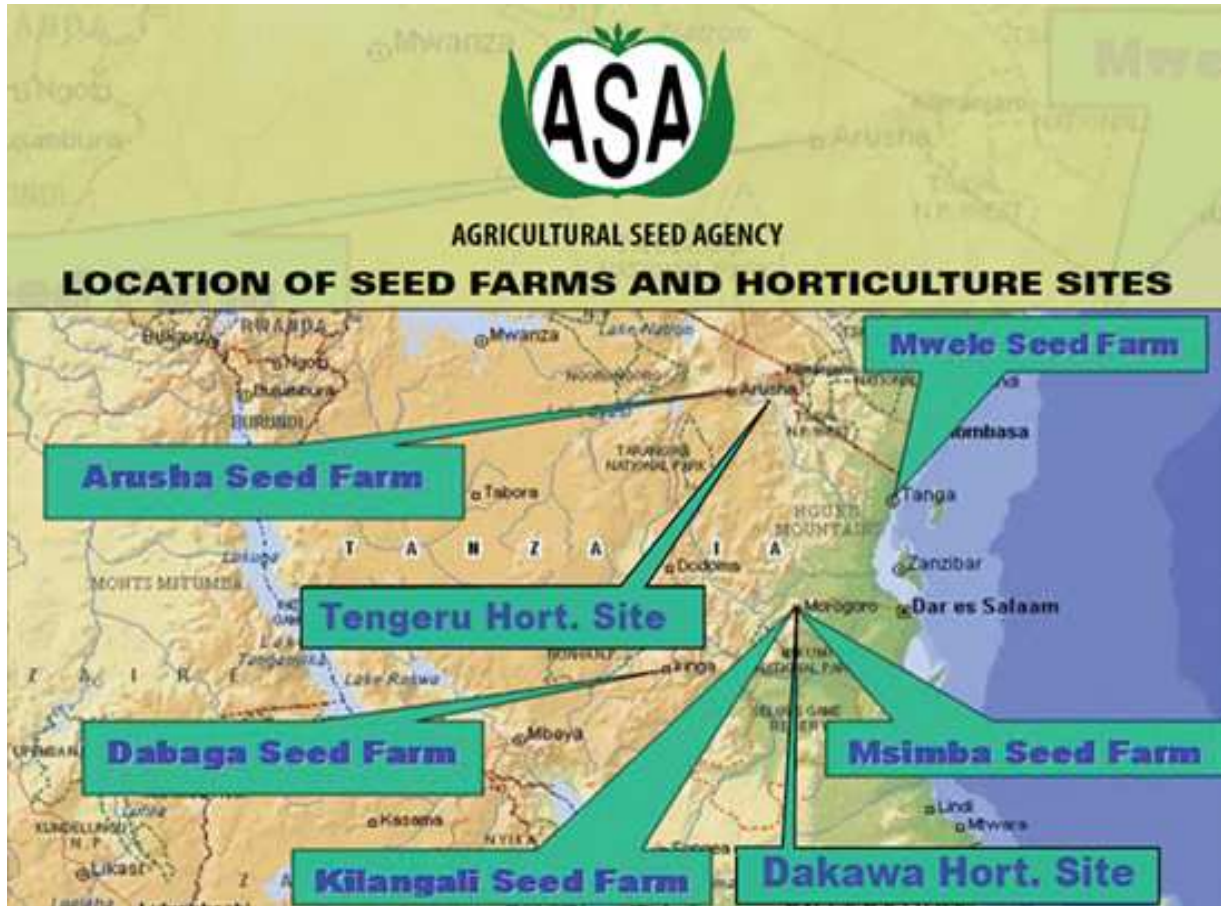
Institutions and People Interviewed and Consulted.

1. **Mr. Canuth Komba:** Ag Head Seed Unit – Ministry of Agriculture Food Security and Cooperatives, PO Box 9192, Dar es Salaam
2. **Plant Breeders Rights Register**
3. **Twalib Njohole:** Principal Agricultural Officer- Seed Unit – Ministry of Agriculture Food Security and Cooperatives, PO Box 9192, Dar es Salaam
4. **Mr. Partick Ngwediagi:** Plant Breeders Registrar, PBR Office, Ministry of Agriculture Food Security and Cooperatives, PO Box 9192, Dar es Salaam
5. **Dr. Omari Mponda:** Principal Agricultural Research Officer and Groundnuts Breeder, Naliendele Agricultural Research Institute, Mtwara
6. **Dr. Hussein Mansoor:** Assistant Director – Crop Research, Division of Research and Development, Ministry of Agriculture Food Security and Cooperatives, PO Box 2066, Dar es Salaam
7. **Mr. Audax Rukonge** – Director, Agricultural Non State Actors Forum
8. P. O. Box 33562 Dar es salaam, Tanzania. Senga Road, Plot 566, Mikochoeni A. Tel: +255 22 2771566 / 2775970 Fax: +255 22 2773217 Email: ansaf.tanzania@gmail.com.
9. **Mr. Laurent Kaburire:** Programme Officer, Mtandao wa Vikundi vya Wakulima Tanzania(MVIWATA) (National Network of Farmers Groups in Tanzania) P.O. Box 3220 Morogoro, Phone/Fax: +255 23 261 4184, Official Email: mviwata@morogoro.net, Personal Mobile: + 255 754 542 650 or +255 655 858 731.
10. **Prof. Dr. Susan Nchimbi:** Deputy Director Research and Post Graduate Studies and Beans Breeder, Sokoine University of Agriculture, Morogoro, Tanzania.
11. **Abdallah Ramadhani** (0784 311179): Envirocare, P.O.Box, Dar es Salaam, Telephone:+255 22 2775592/ 2701407, Email: envirocare@cats-net.com
12. **Theresia Nicholas Shayo:** Senior Research Officer and ag Officer Incharge at the time of visit, Tanzania Official Seed Certification Institute, Morogoro.
13. **AA Mushongi, PhD** – Principal Agricultural Research Officer and Maize Plant breeder, Uyole Agricultural Research Institute, Mbeya
14. **Dr. CS Magata:** Principal Agricultural Research Officer and Beans Breeder, Uyole Agricultural Research Institute, Mbeya
15. **Mr. Abel Letayo:** Principal Agricultural Research Officer and Sorghum Program Coordinator, Hombolo Agricultural Research Institute, Dodoma
16. **Dr Jerome Mhase Katrin:** Principal Agricultural Research Officer and Rice Breeder. KATRIN Agricultural Research Institute, Ifakara, Kilombero.

1. References

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- ii. **Kirway T. N., N. M. Lema, S. D. Lyimo, R. O. Kileo, B. W. Kapange, C. Schouten and T. Schrader** (Editors) 2003. Farming System Approaches Training Manual Volume 1. URT, MAFS, DRD/ KIT Dar es Salaam.
- iii. **Kirway T. N., N. M. Lema, S. D. Lyimo, R. O. Kileo, B. W. Kapange, C. Schouten and T. Schrader** (Editors) 2003. Farming System Approaches Training Manual Volume 2. URT, MAFS, DRD/ KIT Dar es Salaam.
- iv. **Lema, N. M., C. Schouten and T. Schrader (editors) 2003. Managing Research for Agricultural Development.** Proceedings of a National Workshop on Client Oriented Research, 27th – 28th May 2003, Moshi, Tanzania. URT, Ministry of Agriculture and Cooperatives, Dar es Salaam and Royal Tropical Institute Amsterdam.
- v. **Lema, N. M., R. O. Kileo, C. Schouten and T. Schrader. 2003. The Client Oriented Management Approach: background and Introduction to the Conceptual Framework.** In Lema, N. M., C. Schouten and T. Schrader (editors) 2003. Managing Research for Agricultural Development. Proceedings of a National Workshop on Client Oriented Research, 27th – 28th May 2003, Moshi, Tanzania. URT, Ministry of Agriculture and Cooperatives, Dar es Salaam and Royal Tropical Institute Amsterdam.
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- xiii. **URT. 2008. The Plant Breeders' Rights Regulations. Government Printer,** Dar es Salaam
- xiv. **URT. 2003.The seeds act,** Government Printer, Dar es Salaam
- xv. **URT. 2007. The seeds act regulations,** Government Printer, Dar es Salaam
- xvi. **URT. 2008.Tanzania variety list updated,** Government Printer, Dar es Salaam
- xvii. **URT. 2010. The public private partnership act,** 2010 Government Printer, Dar es Salaam

Annex 1:



Annex 2: LIST OF SEED COMPANIES/INSTITUTIONS

S/N	Name of Seed Company	Postal Address	E-mail Address/Tel/Fax Nos.	Contact Person/s (Managing Directors)
1.	Zanobia Seeds Ltd. Reg. No. 08038 (20/8/2010)	P.O. Box 114 Arusha	E-mail: dodomatransport@hotmail.com or dodomaltd@myarusha.com Tel.: 027 - 2503489/2503948/ Fax: 027 - 2506323	Sardul Singh. Mand and Rajinder Singh Mand (0754 720111)
2.	Monsanto (T) Ltd. <i>c/o Kibo Trading & Services</i> (Trade mark Dekalb) Reg.No. 08022 (5/3/2010)	Plot 06 Block A Esso Road, P. O. Box 1280, Arusha	E-mail: muschicasmir@yahoo.com kibotrading@yahoo.com Fax: 027 - 2544249 / 254889 Tel: 027- 2548702	Mr. Mosi - Moshi (0754266790) Mr. Mushi Casmir -Arusha (0754-266790)
3.	Krishna Seed Co. Ltd. Reg.No. 08029 (28/4/2010)	P. O. Box 7304 Arusha	Fax: 027-2531268/0784829744/ Tel: 027 - 2531268 / 2503794	Mr. Atya(0784390341)
4.	East African Seed (T) Ltd. Reg.No. 08024 (5/3/2010)	P.O. Box 14455, Arusha	E-mail: easeed@cybernet.co.tz or pragnesh@easeed.com http://www.easeed.com/ Tel: 027 - 2502756/Fax: 027 -2504184	Mr. Pragnesh Lotia 0789589589/ /0755810136
5.	Kibo Seed Company (T) Ltd. Reg.No. 08010 (5/3/2010)	P.O. Box 25, Arusha	E-mail: kiboseed@habari.co.tz Fax: 027 - 2508179/ Tel: 027 - 2503259 / 2508179/ DSM Tel.: 0784-410540/ 022-2182965/ Mob. 0744-370057	Mr. Michael Ngugi/(07877641938)/ Mr Hezekiah Keitany (0754078761)
6.	Suba Agro Trading and Engineering Co. Ltd. (SATEC) Reg. No. 08027 (9/4/2010)	P.O. Box 14702 Arusha	E-mail: satec2000tz@yahoo.com/ Tel: 027-2547020 / 2548541 Fax: 027-2548541 / 2547020	Mr. Mahenye Muya (0786217666)
7.	Alpha Seed Company Ltd. Reg.No. 08012 (5/3/2010)	P.O. Box 1743, Moshi	E-mail: mongiast@africanonline.co.tz Tel.027 - 53535/ Fax: 027- 50893	Mrs Mariam H. Mongi (0784377097)
8.	Mbegu Technologies Limited Reg.No. 08011 (5/3/2010)	P.O. Box 1743, Moshi	E-mail: mbegutech@yahoo.com /Tel.027 - 53535/ Fax: 027- 50893	Prof. Hussein. Mongi (0784 377097)
9.	PANNAR Seed Ltd. Reg.No. 08016 (5/3/2010)	P.O. Box 10677, Arusha	E-mail : zakayo.owenya@pannar.co.tz Tel./Fax: 027 2504669	Zakayo J. Owenya (0754 269638) 0788808540
10.	Rotian Seed Co. Ltd. Reg.No. 08013 (5/3/2010)	P. O Box 11584, Arusha	E-mail: rotian@cybernet.co.tz /Tel: 027 - 2548253/ Fax: 027 - 2548208	Mr. S. Bruinsman/Mr. A. Shelembi (0784 312565 / 0748 429267)
11.	Multiflowers Ltd. Reg.No. 08042 (15/10/2010)	Themi Industrial Area P.O. Box 4387, Arusha	E-mail: info@arushacutting.com Tel.: 027 - 2501792/2549091/2, Fax: 027 - 2504214 / multiflower@info.co.tz	Mr. Hans Baart
12.	Pop Vriend (T) Ltd. Reg.No. 08021 (5/3/2010)	Industrial Area, Njiro Hill, Plot, P. O. Box 35 Arusha	E-mail: pvt@habari.co.tz /Mobile tel. 0744 - 483456/ Tel: 027-2544114/2184 Fax: 027 - 2548270	Mr. Tadei Joseph /Mr. Ekko Oosterhuis (0754 - 483456)
13.	Tanseed International Limited. Reg.No. 08043 (12/10/2010)	P. O. Box 140, Njombe P. O. Box 1456 Moro	E-mail: tanseed@yahoo.com /Tel: 026 - 2782354/ Fax 0732-930107	Mr. Mashauri (0784 352412)
14.	FICA Seeds (2002) Ltd. Reg. No. 08033 (10/8/2010)	P. O. Box 10558 Arusha Plot. 38 Azimio Street	E-mail: fica.project@mail.com / Tel: 027 - 2500609/Fax 027 - 2500611 E-mail: fica@habari.co.tz	Mr. G. L. Minja (0754 822505)

15.	Circle H. Ranch LTD (22/2/2006)	P.O. Box 16 Arusha	E-mail: hoops@bushlink.co.tz	Mr. G. Hoops (0784 780099/100)
16.	Selous Farming Limited (Reg. No. 08031 (2/7/2010))	P. O. Box 298 Mafinga, Iringa	Mob:0754276028	Dr Ben Moshi
17.	Rockem Tanzania Limited	P.O. Box 2003, Dar es Salaam	E-mail: Tel: 0754 266143	Mr. Kikota (0754 266143)
18.	STRAD Fumigation Company Limited, (20/12/2006)	P.O. Box 2525, Dodoma	E-mail: gasana2000@yahoo.com	Mr Gasana/ (0784 410184) Mr Steven Henrick (0754486730)
19.	Enza Zaden Africa Limited, (27/7/2004) Reg. No.08039 (20/8/2010)	P.O. Box 2750 Arusha	E-mail: manager@enzazaden.co.tz / Website: www.enzazaden.nl/ Tel: 027 2553454/Fax: 027 - 2553017	Directors: Mr. Vencent Van Bentum/ Mr. Stuart Miller
20.	Mount Meru Seed Company (11/10/2004) Reg.No. 08014 (5/3/2010))	P. O. Box 7094 Arusha	E-mail: choundry@mountmeru.co.tz / Tel: 027 2504035/2509865-7 Fax: 027 2544220/2544221	Mr. Choundry (0717666777) Mr. Jimmy 0784399269
21.	IFFA Seed Company (T) Limited (17/9/2007) Reg.No. 08015 (5/3/2010))	P.O. Box 398 Arusha	E-mail: mohamoud_2005@yahoo.com/ Mob. 0754699050 Tel. 027 2506625/ Fax 027 2506627	Mr. Mohamoud
22	Highland Seed company Ltd Ref. No. 08025 (9/4/2010)	P. O. Box 2604 Mbeya	E-mail: hsglimited@yahoo.co.uk/ Tel. 0754446720/ 025-2500080	Mr Justine A. B. Mwiga
23	Northern Seed Company Ltd. (5.2.2008) Reg.No. 08017 (5/3/2010)	P.O. Box 802 Moshi	E-mail: northernseed@hotmail.com/ Mobile: 0787178558	Mr Shangali A. Alson
24	Meru Agro-Tours & Consultants Co. Ltd (27.6.2008) Reg.No. 08018 (2/2/2010)	P.O. Box 13867 Arusha	Tel./Fax +255-0732972346/ E-mail: meruagro@yahoo.com Mob.: 0754688642/0784688642	Mr Watanga C. Goryo
25	FAMCO Seed Ltd (27/6/2008)	P.O. Box 7103, Arusha	Mob. 0787695234	Mr. B. N. Odedra
26	BRAC Tanzania (11.8.2008) Reg.No. 08019 (5/3/2010)	P.O. Box 105213 Dar es Salaam	E-mail: salam_2007@yahoo.com Tel. 022-2647280	Mr. Abdus Salam 0786939624
27	Morogoro Agribusiness Centre Ltd (29.1/2009)	P.O. Box 2043 Morogoro	Tel.023-2600716/ Fax: 023-2600717	Mr. Kusanya F. Shindika (CEO)
28	Kagera Seed Farm Ltd (26/3/2009)	P.O.Box7908 Bukoba	Tel 0754898770, 0787188672	Dr .Omar Suedi
29	Aminata Quality Seeds and Consultancy Ltd. (23/3/2009) Reg. No. 08054 (14/6/2011)	P. O. Box 6115, Tanga	Mob. 0784801909 Fax: 0272645060	Mr Omari Salum Mduruma
30	Tropical Seeds (EA) Limited Reg. No. 08001 (14/8/2009)	P. O. Box 12867 Mbeya	Email: tropicalseeds70@yahoo.com Mob: 0784750800, 0713750800, 0764600077 Fax 0252552612	Ordran L. Chaula
31	RIIK Zwaan Afrisem Limited Reg. No. 08002 (25/8/2009)	P.O. Box 12345 Arusha	Tel:027-2553444/ Fax:027-2553319/ Mob: 0784957833 E-mail: info@rz-afrisem.com	Harald Peeters
32	Marnico (T) Limited Reg. No. 08002 (25/8/2009)	P.O. Box 738 Arusha	E-mail marnico@habari.co.tz/ Tel. 0272503597	Maarten Martinus van der Meer

33	Farm Products Limited Reg.No. 08005 (25th /11/2009)	P.O. Box 695 Moshi	Tel. 027 0732973163/ Mob. 0784352727	Managing Director Wilfred A. Shangali
34	FMG Agriculture Limited Reg.No. 08004 (25th /11/2009)	P.O. Box 110 Sumbawanga	Mob. 0754766260 and 0762314826	Fredrick T. Nyiringanyo
35	RJJK Zwaan Q- Sem Ltd Reg. No. 08006 (15/12/2009)	P.O. Box 12345 Arusha	Email: . info@q-sem.com	Harald Peeters
36	Mukpar Tanzania Limited Reg.No. 08008 (2/2/2010)	P.O. Box 38597 Dar es Salaam	Email: mitcorporate@zantel.com tinushah@zantel.com Mob. 0763763763 Or 0787 211562 Tel. 022-2152747	Director Tina Shah Others E.Masanja
37	Kipato Seed Limited Reg. No. 08007 (25/8/2009)	P.O. Box 388 Makambako, Njombe	Tel:026 2730030 Mob. 0786074946	Director: Andrew Mahenge
38	Agriseed technologies Ltd Reg. No. 08023 (5/3/2010)	P.O. Box 6560 Morogoro	Mob. 0754467284, 0753354331	Dr Mbwaga
39	Bytrade Tanzania Ltd Reg. No. 08032 (5/3/2010)	P.O. Box 3491 Dar es Salaam	E-mail: info@bytrade.org Tel. 022 2773 338 Fax 022 2773 401	Dr Diwani
40	Dirma Holdings Ltd Reg. No. 08033 (2/7/2010)	P.O.Box 12699 Arusha	E-mail: dirma@yahoo.com Mob. 0784 931530	Mr. Charles G. Gapchojiga
41	Bajuta International (T) Ltd Reg. No. 08030 (2/7/2010)	P.O. Box 12103 Arusha	E-mail: bajuta@habari.co.tz Tel. 027 2548829, Fax. 027 250 8811	Mr. Gesso H. Bajuta
42	Mocrops Tanzania Limited Reg. No. 08035 (20/8/2010)	P.O. Box 4201 Dar es Salaam	Email: mocrops@gmail.com Tel & Fax 0222775616 Mob. 0754644276	Mr. Richard Benson
43	Namburi Agricultural Company Ltd Reg. No. 08036 (20/8/2010)	P.O. Box 15875 Arusha	E-mail: apmgonja@yahoo.com Mob. 0754 481790	Dr. A. Mgonja
44	Seed Co Tanzania Ltd. Reg. No. 08040 (30/8/2010)	P. O. Box 12281 Arusha	Mob. 0763815470 & 0763853863	Mr. Brighton Karume 0763815470 Ms. Lisa Marcussen 0763853863
45	Agricultural Seed Agency Reg.No. 08041 (16/9/2010)	P.O Box 364 Morogoro	Email: firmin.mizambwa@gmail.com Tel. 0232600134/2600239 Mob. 0787515162	CEO Dr. Firmin Mizambwa
46	Kisimbaguri Estates Ltd. Reg.No. 08022 (5/3/2010)	P.O. Box 10 Songea	Mob. 0767037149 fonawishart@iwayafrica.com	Mr. Fiona Van Aardt
47	Mayo (1999)Co. Ltd Reg.No. 08046 (5/11/2010)	P.O. Box 7796 Dar es Salaam	Tel. 022-2120684 Mob.0784601044 Email: mayoeleef@yahoo.com	Managing Director Mr. Bakuza M. B.
48	Mtanga Farms Ltd Reg.No. 08047 (5/11/2010)	P. O. box 23482 Dar es Salaam	Tel. 022-266079 Fax. 022-266075 Mob. 0754295514 Email: main@jilango.com	Director: R. A. Ghau
49	Kamal Seeds & Research Ltd Reg.No. 08048 (14/1/2011)	P.O. Box 10392 Dar es Salaam	Tel: 0222124511 Email: info@kamalagro.com	Managing Director Gagan Gupta

50	Tanzania Crop Care Ltd Reg.No. 08049 (4/3/2011)	P.O. Box 1183 Arusha	Tel 0787465941 E-mail: tcclarusha@gmail.com	Country Head Jimmy Philip
51	Sagera Estates Limited Reg.No. 08050 (4/3/2011)	P.O. Box 117 Tanga	Tel 0272646847 Fax 0272644076/ Mob. 0787144097/ E-mail: opertions@agriafrika.co.tz	General Manager Rajiv Bopiah
52	Kilimo Markets Limited Reg.No. 08051 (4/3/2011)	P. O. Box 12974 Arusha (Karatu)	Mob. 0788934870E-mail: danieljcharles@gmail.com	Managing Director Daniel Charles
53	Seed Resources of Tanzania Ltd Reg.No. 08053 (11/4/2011)	P.O. Box 12611 Arusha	Mob. 0773766555 Tel. 0272544852	Managing Director Anselim W. Minja
Companies for seed bean production				
1	Fil Ltd. (Seed Producers/Exporters/Marketing)	P. O. Box 56 Arusha	E-mail C/O: tasta02@hotmail.com Tel: 027 – 2509933 Fax: 027 - 2544426	Chief Executive Sadiq Esq 027 – 2509933 0744 – 315222
2	Liborius Gehrken Africa Ltd. (Coffee/seed producers/Exporters)	P. O. Box 2418 Arusha	Mobile: 0744 – 699496 / 0744 – 476744 Fax: 027 - 2508896	Chief Executive Michael Gehrken 0744 - 476744
3	Mringa Estate (Coffee/bean producer/ Exporters)	P. O. Box 34 Arusha	E-mail: mringa@habari.co.tz Tel: 027 – 2505509 Fax: 027 - 2505509	Chief Executive D. Mahon 027 - 2505510
Seed Stockists/Agro-dealers				
1	Tanganyika Farmers Association Limited Reg. No. 08037 (20/8/2010)	P.O. Box 3010 Arusha	Tel. 027-2544872 Fax. 027-2548213	Mr. Kisamba
2	Mwapongo Stockist Agrovet and General Supplies Reg. No. 08002 (25/8/2009)	P. O. Box Kahama		Mr.Mwapongo
3	K.K. Agrovet Reg.No. 08026 (9/4/2010)	P.O. Box D salaam		Mr. Kiyamba
4	Shedafa Agro Inputs Supplies Company Ltd Reg.No. 08052 (4/3/2011)	P.O. Box 5218 Mwanza	Mob: 0754563318/0786138376 E-mail: dshedafa@yahoo.com	Mr. Shedafa
5	Isaya Agrovet Reg. No. 08028 (9/4/2010)	P.O. Bix ..Kahama		Mr. Isaya

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