



Food and Agriculture
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Report

Consultative Meeting on a Mechanization Strategy

New Models for Sustainable
Agricultural Mechanization
in sub-Saharan Africa





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Abbreviations and Acronyms

ACT	African Conservation Tillage Network
ADRAO	Association pour le Développement de la Riziculture en l'Afrique de l'ouest
AEHE	Agricultural equipment hiring enterprise
AfDB	African Development Bank
AGEVEC	Académie engins lourds et véhicules commerciaux
AGRA	Alliance for a Green Revolution in Africa
Agrievolution	Global alliance of agricultural equipment manufacturing associations
AMS	Agricultural Mechanization Service (Government of Kenya)
ANSEMAT	Asociación Nacional de Maquinaria Agropecuaria, Forestal y de Espacios Verdes (Spanish national association of agricultural forestry and green space machinery)
ANTAM	Asian and Pacific Network for Testing of Agricultural Machinery (CSAM)
ASI	Association pour le Développement de la Riziculture en l'Afrique de l'ouest (ADRAO) - Senegal River Valley National Development Agency (SAED) - Senegalese Institute for Agricultural Research (ISRA)
ATDC	Agricultural Technology Development Centre (Kenya)
AU	African Union
AUC	African Union Commission
BISA	Borlaug Institute for South Asia, India
CA	Conservation agriculture
CAADP	Comprehensive Africa Agricultural Development Programme
CASU	Conservation Agriculture Scaling Up project (Zambia)
CEMA	European Agricultural Machinery Industry Association
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Centre
CSAM	Centre for Sustainable Agricultural Mechanization (Beijing)
CUMA	Coopérative d'Utilisation de Matériel Agricole (Cooperative for the use of farm implements)
DAP	Draught animal power
DFID	Department for International Development (UK)
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign direct investment
FIVMS	Food Insecurity and Vulnerability Mapping System
FMARD	Federal Ministry of Agriculture and Rural Development (Nigeria)
FO	Farmer organization
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GES	Growth enhancement scheme (Nigeria)
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Development Agency)

GPS	Global Positioning System
HDECovA	Heavy Duty Equipment and Commercial Vehicles Academy, Ethiopia
hp	horse power
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
ISO	International Organization for Standardization
ISRA	Senegalese Institute for Agricultural Research
JHEOS	Japan heavy equipment operator school
KARLO	Kenya Agricultural and Livestock Research Organisation
L3	Leveraging leasing for livelihoods (NGO)
MR	Machinery Ring
NCAM	National Centre for Agricultural Mechanization (Nigeria)
NEPAD	New Partnership for Africa's Development
OECD	Organization for Economic Co-operation and Development
ODA	Official Development Assistance
PPDP	Public-private development partnership
PPP	Public-private partnership
PSDAMP	Private-sector driven agricultural mechanization programme (Nigeria)
REC	Regional Economic Community (of the AU)
SAED	Senegal River Valley National Development Agency
SAM	Sustainable agricultural mechanization
SDG	Sustainable Development Goal (of the UN)
SHF	Smallholder farmer
SIDA	Swedish International Development Cooperation Agency
SME	Small and medium enterprise
SMS	Short message service
SOAS	School of Oriental and African Studies, London
TAAT	Technologies for African Agricultural Transformation
THS	Tractor hire service
UNACOMA	Italian Agricultural Machinery Manufacturers Federation
UNCTAD	United Nations Conference on Trade and Development
UNCUMA	Union Nationale des Coopératives d'Utilisation de Matériel Agricole (National Union of farm machinery cooperatives)
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
WB	World Bank
ZAMITA	Zambia Industrial Training Academy
2WT	Two wheel tractor
4WD	Four wheel drive tractor

Executive Summary

Sustainable agricultural mechanization (SAM) is an essential input for the development of the smallholder farm sector in sub-Saharan Africa (SSA). The benefits of SAM range from drudgery reduction to improved timeliness of agricultural operations, increased input use efficiency, facilitating sustainable production intensification, ensuring environmental protection, and contributing to make agriculture more 'climate-smart'. SAM is also important at other levels of the food supply system, for example in post-harvest operations, processing, marketing and transportation.

Previously in SSA, mechanization efforts were largely been driven by the public sector. Today there is a need, with appropriate social and natural environmental considerations, to adopt a more holistic view of what mechanization is and learn from the errors made in the past. A cornerstone of SAM is the importance of involving the private sector (especially machinery manufacturers, suppliers and service providers). It needs to be brought to the forefront in SAM development and provision, but without neglecting the important role that the public sector and its institutions can also play.

The Consultative Meeting provided a platform to discuss SAM in general, SAM strategies and implementation options, experiences and recommended concrete lines of future action for SSA. Lessons learned from Asia and past experiences in SSA were presented, as well as various models for SAM collaboration and diffusion in SSA. This platform allowed to better understand appropriate policies that may be required to support and promote the implementation of SAM at regional and national level within SSA.

A special focus was placed on three key areas which were the subject of debate and discussion in three working groups. These were: (i) new collaborative models of public-private partnerships; (ii) modalities and approaches for establishing a global SAM knowledge exchange platform and; (iii) the establishment of regional centres or networks for SAM in SSA. The Meeting also received feedback on the on-going FAO-African Union Commission technical cooperation project that is seeking to develop a SAM strategy framework for SSA.

Consensus was reached on the following points:

- SSA has an ageing population of farmers. SAM has a clear role to play in making agriculture more attractive to youth, who otherwise migrate to urban areas;
- Skills and capacity development are essential and investment is needed from both the private *and* public sectors;
- SAM must be viable as a business. Demand aspects need to be addressed by ensuring that farmers have access to information in order to make informed choices;
- Technical service backup is vital and not always sufficiently well developed;
- Apply a value chain approach and not a focus solely on production;
- SAM needs to be accompanied by complementary services and inputs, especially finance.

In mapping the way forward, a list of concrete actions to enable SAM systems to function correctly were provided and included:

- Development of the social sector (food security, improved nutrition, and assured livelihoods);
- Conservation of natural resources and the environment;
- Identification, delivery and application of new models for public-private and private-private partnerships at regional and global levels;
- Establishment of a SAM network with centres of excellence for Africa;
- Establishment of a knowledge platform for technology exchange at a pan-African level;
- Production of a concise SAM advocacy brief targeted at policy makers and donors.

1. Introduction

1.1. Background

The large potential for agricultural production in sub-Saharan Africa (SSA) has still not been realized. One of the key development paradigms for long-term increased agricultural production in SSA is sustainable agricultural mechanization (SAM). The benefits are multi-faceted ranging from reducing drudgery, improving the timeliness of agricultural production operations, increasing the efficiency of input use, to facilitating the implementation of sustainable intensification of production systems, and making agriculture more resilient to increasingly extreme and unpredictable climatic events. Sustainable agricultural mechanization (SAM) can also be applied to the development of improved post-harvest, processing and marketing activities, enabling more timely, and concise operations, with value added to primary products. This can foster the delivery of more nutritious foods and higher value products to final consumers. Moreover, SAM has the capacity to contribute to entrepreneurial activities in rural and remote areas, through hire services that can provide much needed mechanization services to those involved in the agri-food sector. In addition, farm-based sustainable mechanization hire services can also contribute to wider development efforts, such as rural-urban transport of goods (and people), rural feeder road construction and maintenance, power for irrigation water pumping, provision and distribution of drinking water as well as the collection of bio-waste in rural, peri-urban and urban areas.

Sub-Saharan Africa (SSA) has a history of strong public sector leadership in agricultural mechanization development with weak participation from the private sector. Procurement, mechanization services (hire services) and spare parts supply have mostly been in the realm of the public sector. Over the years, differences in the priorities, perspectives and approaches between the public and private sector towards the development of agricultural mechanization have led to agricultural mechanization in SSA being largely led and run by the public sector with the private sector playing a minor role. In the long run, this approach was not sustainable as important stakeholders – such as private sector agri-machinery manufacturers, suppliers, and service providers – were neglected.

Initiatives for applying SAM to growing more food and other functions and activities designed to increase sustainability of the food system, require new thinking and perspectives. There is a primary need to see mechanization in a wider and more holistic context. There are numerous cross-cutting and cross-sectorial factors that can contribute to well-functioning, inclusive and sustainable mechanization systems. These need to be ascertained, assessed and elaborated upon and the important experiences and lessons learned need to be shared with wider audiences that can facilitate and enable a more holistic framework to support the design, formulation and implementation of targeted SAM policies.

There is a secondary need to consider mechanization as an important component of private sector development, but with an acceptance that private sector initiatives and markets cannot do the ‘job’ alone. The public sector still has a role to play in ensuring that a conducive environment exists for the development of sustainable agricultural mechanization in SSA. For example, the public sector needs to play a key role when developing SAM strategies that will guide the implementation of the planned actions. Furthermore, this will foster new and innovative models of public-private partnerships (PPP) that include the numerous opportunities provided by the share economy, (via ICT and social media platforms, for example), that can play a key role in the successful development of a regional framework for SAM.

There is also the need to consider mechanization as a complex system, intricately tied to food and livelihoods systems and not only to agricultural production. Yet the overarching question, or model, to consider is how SAM can have greater impact and positively contribute to the urgent need to align agricultural (production) systems in climate-smart ways that include adaptation and mitigation strategies. This new and PPP-based SAM paradigm will contribute to more resilient production systems in order for SSA to meet food needs and reduce heightened pressures on the natural resource base.

1.2. Objectives

The main **purpose** of the Consultative Meeting was to provide a platform to discuss and foster the development of SAM strategy options in the context of enabling partnerships, both public-private and private-private. This was implemented via the exchange of knowledge, perspectives, experiences and lessons learned in the past while identifying leverage and entry points for the sustainable development of agricultural mechanization in SSA.

The key **objectives** of the workshop were as follows:

(i) Provide a platform for public and private sector actors to meet and exchange knowledge, and articulate commitments to improve SAM in SSA for:

- Ascertaining the main needs and constraints for the dissemination and adoption of SAM in SSA;
- Defining potentials;
- Identifying key factors for developing SAM; and
- Delineating holistic SAM policy guidelines.

(ii) Devise new collaborative models for private-public and private-private partnerships in order to prepare the ground for potential investments and articulating opportunities, across a range of specific points of the agriculture and food supply systems, that can create jobs and improve livelihoods with support from the World Bank, FAO, AGRA and the industry and, as part of this, define:

- Possible pilot/ priority countries;
- Funding (immediate funding needs, finance/ co-finance options); and
- Governance issues.

(iii) Explore and consider the development of a global SAM knowledge exchange platform (ICT level) to enable the continuation of consultations.

(iv) Explore the possibility to establish a Regional Centre or Network for SAM in Africa similar to existing centres in Asia (BISA, UN/CSAM) which will help in the research, training and capacity building on technologies and practices related to mechanization along the food supply system, specifically for the region in line with the priorities of the existing and future policies.

1.3. Participation and format of the meeting

The 113 **participants** (see Annex 3 for the complete participants list) were predominantly (75%) from African countries with small contingents from Asia, America and Europe. There was a strong representation of the private sector in the form of farmers, and farmers' cooperatives, machinery manufacturers and their associations as well as global, regional and national development organizations.

The meeting was composed of presentations¹, discussions and working groups, so as to enable a common and agreed upon *way forward* for SAM in SSA.

¹ The format of these Proceedings closely follows the Meeting programme (see Annex 2). The original presentations and papers are all available at the Meeting portal (<http://www.africamechanize.act-africa.org>)

2. Summary of Day 1 Presentations and Discussions

2.1 Opening remarks

Opening remarks were made by several speakers: Jasper Nkanya, Ministry of Agriculture, Livestock and Fisheries, Kenya; Robert Allport, Assistant FAO Representative, Kenya; Sean de Cleene, AGRA.

The key points raised during this session were:

- Agriculture is a key pillar for national development agendas and are very important for the improvement of livelihoods and income generation in SSA.
- Reduction of poverty and food security depend on sustainable agricultural growth and therefore SAM plays a key role.
- Mechanization is needed to boost productivity and motivate youth (the average age of farmers in Kenya is 60 years).
- Kenya is working on a national mechanization policy to guide the sector in the process.
- Growth in the agricultural sector depends on innovation.
- While Mechanization plays a huge role in development along the entire food supply system, access to mechanization is a critical constraint. Therefore, innovations need to take place all along the food supply system.
- There are many innovations around us but access is the main challenge, which reminds us that there is a need to innovate within the finance packaging.
- Access to machines is a huge constraint and therefore innovations are needed to address this challenge. A 'non-siloed' approach is required for an innovative approach which avoids past mistakes.
- We need to ask ourselves how we innovate along the whole food supply system, from seeding to post-harvest. In particular, we need to ask how mechanization can contribute to this. How to finance this innovation, and create models to make mechanization sustainable economically?
- It is important therefore that we explore how to come up with a fully-fledged agenda to drive mechanization in SSA bearing in mind challenges including how to create consistent demand.
- A demand-led industry is needed for sustainability and appropriate financing will be critical to achieving this.

2.2 Sustainable Agriculture Mechanization: An Overview *by Josef Kienzle from FAO and Chakib Jenane from the World Bank*

(a) Chakib Jenane (World Bank)

- There is a rapid advancement in the design of agricultural machines that our fields could be tilled, sown, tended and harvested entirely by fleets of cooperating autonomous machines by land and air. This could allow machines working day and night.
- The current trends and evolutions taking place in SSA were:
 - A 5%+ annual increase in GDP;
 - Renewed political commitment to agriculture from NEPAD via CAADP;
 - Increased dynamism in the private sector with growing investments in the agri-food sector;
 - Abundant uncultivated land (202 million ha);
 - Over 60% of farm power is still provided by human muscle, mostly by women.
- Some of the guiding principles for building models of SAM include: (i) Avoid the mechanization mistakes of the 1960s and 1970s (ii) Adopt a value chain approach, and (iii) Ensure that the benefits of emerging models reach all SSA's diverse farming categories.
- A World Bank survey on the importance of the agricultural machinery market in SSA for suppliers worldwide provided the following results: (i) The future market for agricultural machinery in SSA over the next five years shows very strong potential for 49% of respondents, and (ii) Belief of a very strong potential market over the next 5-15 years rises to 74%.
- Improvement is needed in all areas for industry to engage and invest more. The sectors include: government; finance and market; industry, and; farmers and skills. Public-private partnerships (PPPs) will be very important for developing SAM in SSA. The key areas for PPP practices are: (i) Finance (access to credit, risk sharing) (ii) Education/ skills (technology centres and demonstration farms) (iii) Communication (exhibitions and knowledge sharing), and (iv)

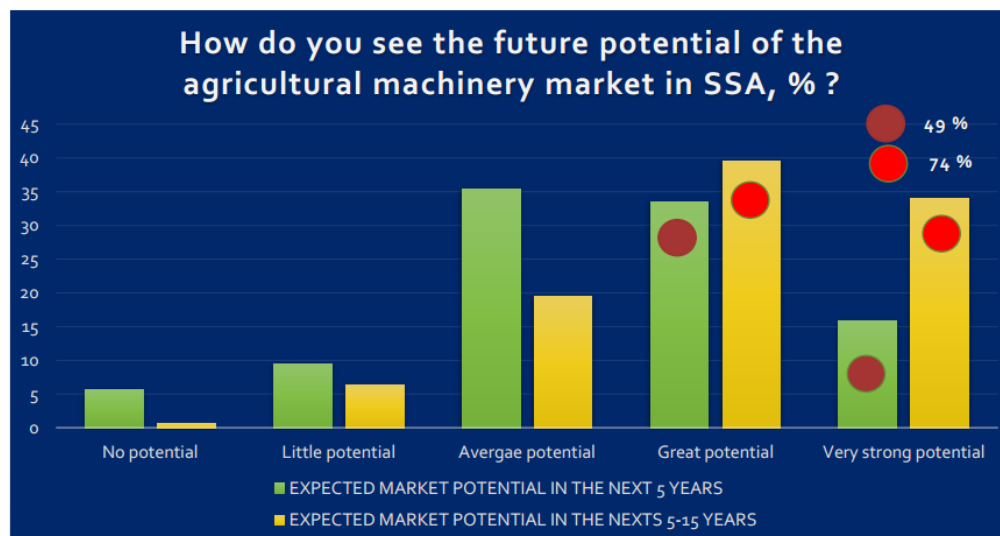


Figure 1. The perception of the companies on the future potential of agricultural machinery in SSA

Local manufacturing (clusters and assembly lines);

- Support is critical given the range of different challenges on the ground. Moreover, there is a need to capitalize on renewed impetus for growth and development through increased agricultural investments. A new approach is needed to: (i) Reinforce institutional support for agricultural mechanization and (ii) Promote greater inclusion of the private sector in public activities through PPPs;
- The Meeting needs to consider how to leverage World Bank support for SSA's agriculture sector considering the fact that the annual average Bank's support for agriculture and related sectors in SSA in the financial year 2013 – 2015 was USD 1509 million;
- New PPP business models that were suggested included: (i) Agricultural guarantee funds Support access to finance for mechanization (ii) Mechanization Demo farms (iii) Focus on farmers, and (iv) Field testing of machinery;

There are three takeaway points namely:

- (i) Agriculture transformation is key to sustaining SSA's drive to end poverty and boost shared prosperity by 2030.
- (ii) Sustainable mechanization can be a powerful force multiplier for securing SSA's agriculture future.
- (iii) Time is not on our side – our actions for the collective good must begin now!

(b) Josef Kienzle (FAO)

- Labour in SSA smallholder farms is provided mostly by women, children or the elderly who carry out the work (mainly with hand tools).
- At the same time degradation of soil, water and the effects of climate change are additional problems of concern for SSA. Soils in SSA are mostly

erodible sandy soils which are exposed to soil degradation and soil losses through surface erosion. In addition, many soils have low productivity while pulverization and compaction through excessive cultivation is adding to the problem.

- SAM needs to be considered in the sustainable intensification context, which means a productive agriculture that conserves and enhances natural resources; uses an ecosystem approach, and applies appropriate external inputs at the right time and in the right amount.
- There is a need for Climate resilient (smart) systems and conservation agriculture is a good example of a climate-smart agriculture practice.
- SAM involves the application of different forms of power sources in conjunction with appropriate equipment able to do useful work in agricultural production and along the agri-food value chain. Thus mechanization must meet farmers' needs efficiently and effectively and result in improved farm productivity and reduced drudgery, while contributing to the development and competitiveness of the food supply chain. To be sustainable, mechanization must take economic, social, environmental, cultural, and institutional issues into account.
- SAM can make farming more attractive for the rural youth and therefore contribute to job creation and prosperity in the rural areas of SSA. The key elements of a framework for sustainable agricultural mechanization are:
 - (i) Sustainable agricultural practices for smallholders
 - (ii) Specific models for smallholder upscaling
 - (iii) Economic, social and gender advantages of mechanization for smallholders
 - (iv) Institutional and organizational arrangements

- (v) Private sector development
- (vi) Integration of smallholders into agri-food value chains
- (vii) Field-based capacity development
- (viii) Regional Centres for SAM (CSAM)
- (ix) Integration of agricultural mechanization into pan-African policy frameworks
- (x) Increasing and strengthening South-South Cooperation
- (xi) SAM strategies
- The above points were discussed during the Meeting and specifically in the group sessions that focused on:
 - (a) new collaborative models in mechanization;
 - (b) modalities for a sustainable mechanization knowledge exchange platform; and
 - (c) the possibility of a Centre for Sustainable Agricultural Mechanization (CSAM) for selected regions in Africa.

2.3 Sustainable agricultural mechanization (SAM): sharing global lessons of experience

This session was divided into two parts, the first two presentations looked at experiences from Asia and the other five presentations focused on Africa.

2.3.1 Up-scaling sustainable mechanization in India: by Harminder Singh Sidhu, Borlaug Institute for South Asia (BISA), India

- The importance of sustainable agricultural mechanization was revisited taking into consideration declining farmers' income, labour shortages, degradation of Natural Resources (soil, water, & environment), climate change & and the need for sustainability of agriculture.
- Other key challenges include land holding, economic condition, seasonal use, size & shape of fields, terrain, machine v/s labour and mind-set (especially regarding CA).
- Challenges associated with agricultural mechanization in Africa include: (i) Africa is far behind on mechanization (ii) Africa agricultural development cannot move forward if key challenges are not met (iii) At the moment we are seeing an increase in the food demand associated with high demographic growth. This creates markets for food and therefore Africa need to seize this opportunity (iv) Most parts of Africa have two cropping systems (v) There is a need for labour saving technologies especially for women (vi) There is a need to improve the value chain integration (vii) Youth employment is another challenge and a key concern for Africa.

- BISA is investigating and disseminating methods of achieving sustainable mechanization and agricultural intensification. The main thrusts include: (i) Conservation agriculture (no/ minimum tillage, soil cover with residue, crop rotations). (ii) Laser land levelling which is necessary for taking up good agronomic, soil and crop management practices (iii) Straw management to eliminate burning (combine straw spreaders, surface mulch, Turbo Happy Seeder) (iv) Relay cropping (high-clearance tractors and seeders) (v) Sub-surface fertigation (avoids seasonal pipe removal).
- BISA's vision of the way forward include:
 - Travelling seminars;
 - Capacity building targeting farmers and operators and emphasizing on local adaptation with an understanding that there is no recipe for all;
 - Local adaptation and local after sales service;
 - Custom operators' network;
 - A scale-neutral business model and a win-win for all;
 - Giving wide publicity to successful technologies;
 - The BISA mission is seen as a service to protect the environment (including soil and water) and facilitate timely planting with greater net returns to the farmer.

2.3.2 The spread of smaller scale machinery in south Asia; observations: by Scott Justice, CIMMYT, Nepal; Stephen Biggs, SOAS, London; Enamul Haque, Murdoch University, Bangladesh

- This presentation was made by Mr Scott Justice and covered the following subthemes: (i) Why focus on small scale engines, equipment and markets (ii) Illustration of the rural capital goods (iii) Importance of the availability of markets (iv) Innovations in rural engineering (v) South-South cooperation and conclusion.
- It is important to focus on small scale engines and equipment and the associated service marketing, taking into consideration the following key points:
 - Equity issues (ease of access)
 - No need for land consolidation
 - Small scale operation is equally productive (compared with large scale)
 - Issues related to small scale operations are sometimes forgotten in global economics debates
- Rural capital goods including machinery, equipment, vehicles and tools used in the production of other goods were discussed. Examples of the technologies under discussion

include: two-wheel tractors (2WTs); diesel pump sets; small scale industry for manufacture, sales and service. It was noted that rural capital goods in Bangladesh and Nepal forms an important part of the efforts to develop agricultural mechanization.

- Figures were provided for units of relevant technologies in various countries, e.g. 0.5 million 2WTs in Bangladesh, 0.3 million in India and 12 000 in Nepal. The average life of Mini Tillers is 3 years but with a pay back in 1-2 years. Furthermore, many of these small machines operate in the same space, economic and social environment as larger equipment.
- Innovation in the field is important. For example, mini-tillers in Bangladesh which 'came out of nowhere' (following intense monsoon flooding removed a large part of the draught animal population) and pump engines can have multiple applications.
- South-South exchange is key, although there are problems associated with a lack of knowledge of what is available, capacity building and the false image that 'West is best'.
- The concluding remarks from this presentation was that there are no generalizations for agricultural and rural mechanization policies, which depend on: (i) Local natural resources; (ii) The local and international political contexts; (iii) Trade, industrial and energy policies; (iv) Agendas of donors, multi-national companies and government agencies.

Discussion: Discussions around these two papers included the observation that appropriate technologies need to be technically, financially, socially and environmentally sound. The critical problem of the lack of replacement parts for mechanization technology was brought to the fore with accounts of tractor cannibalism. It follows that capacity building is a crucial input, users must be able to manage new technology themselves. Ambassador Dinah Grace Akello (Uganda's Permanent Representative to FAO) raised the issues of the necessity of sharing available knowledge between countries and of the importance of appropriate technology for important, but neglected, crops such as millet. She was assured that existing technologies can readily be adapted to encompass them.

2.3.3 An overview of agricultural mechanization in SSA: by Geoffrey Mrema, Sokoine University of Agriculture, Morogoro, Tanzania

- Mechanization in Africa has been conceived only as farm power and noted that farm power increases agricultural productivity when it is applied in conjunction with other vital inputs.
- Advent of mechanized agriculture was assumed for developing countries during the 'independence decade' of the 1960s when many thought that mechanization would change from human power to tractors. However, in places like Asia tractors followed after centuries of using animal power. The use of animal power in Africa faced several

challenges the main one being the problem of tsetse fly in SSA which precluded draught animal power (DAP) over wide regions.

- Human muscles account for 50 to 85% of farm power in Africa.
- Tractor numbers in SSA increased from 23 000 to 47 000 between 1950 and 1960. The rise and fall of tractor numbers, and of government operated tractor hire services (THS) are graphically traced. Currently both 4WTs and 2WTs are appropriate for profitable THS.
- Detailed figures were given for the main regions of SSA on: the relative areas of cereals and root crops; average tractor hp; number of 4WTs in use; imports of 2 and 4WTs; tractor use intensity (units/1000ha) and; ploughing costs. For example, tractor use for land preparation is limited to 40 days per rainy season in any one location – leading to very high ploughing costs/ha.
- A historical perspective of Agriculture Mechanization was provided including: (i) Government hire services schemes (ii) Forgotten use of draught animal, and (iii) Graveyard of machinery. The key issues on the current status of agricultural mechanization in SSA include:
 - Importation of 4WT has increased since 2005 in many SSA countries. However, it is not clear whether this is replacing or adding on the 4WT numbers. There is a need for more accurate data on this;
 - Importation of 2WT accelerated since 2005. This is a new power source use of which is not yet well researched documented;
 - Concentration of both 4WT and 2WT in a few regions in most countries with the same trend observed for DAT. All these power sources are used primarily for tillage and transportation.
 - DAT still has severe limitations in many countries – tsetse flies; lack of animal husbandry tradition; increasing demand for livestock products; maintenance load during offseason for feed, herding etc;
 - Pan territorial & across country utilization of 4WT especially for tillage and also some harvesting equipment is increasing & will have a positive effect on sustainability of the business models for Tractor Hire Services [THS] and also harvesting equipment. However, as is the case with the importation of tractors, more data required;
 - Period when 4WT and 2WT can be used for land preparation at any one place is limited to less than 40 days per rainy season – severely restricting utilization rates. Need for off-farm utilization (in transportation etc.) is critical for business viability & sustainability.

- Agricultural mechanization needs to be viewed with a long-term perspective. Lessons from past mistakes must be taken into account and we should learn from the success stories of others. There is a need to learn from our past experience both successful and failed projects to avoid too much repetition of past mistakes. Agricultural mechanization is critical to the future of agricultural development and food security in SSA.

2.3.4 Feed Africa. Technology, infrastructure and mechanization for Africa's agricultural transformation: by Jonas Chianu and Mamadou Kane, African Development Bank (AfDB)

- Mechanization technology is imperative to transform Africa's agricultural sector:
 - Production can be increased;
 - Family labour can be reduced;
 - Mechanization impacts along the value chain from production to processing and storage.
 - Produces more income for farmers;
 - Produces food for growing urban populations;
 - It is critical for scaling out modern technologies for the new green revolution in Africa.
- Important requirements for successful mechanization include: (i) A systems approach along the value chain; (ii) Good rural infrastructure; (iii) Appropriate ownership arrangements; (iv) Private sector led; and (v) Labour saving and with the potential to increase earnings.
- The presentation drew participants' attention to the low productivity of agriculture in Africa; the predominance of hand labour in SSA; and the low intensity of tractor use. He further noted that despite the potential for mechanization to transform agriculture in SSA, there are challenges to that are worth mentioning including:
 - A disconnect between researchers and farmers;
 - Limited skills in manufacturing and operation;
 - Lack of finance;
 - Fragmented land holdings;
 - Increased food demand from population increase and urbanization.
- Feed Africa is one of AfDB's 'high 5' priorities (others are: electrification, industrialization, integration and improved quality of life). It focuses on integrated commodity chains and plans to achieve success with seven inter-connected enabling strategies. Key initiatives for promoting technologies, infrastructure and mechanization include:

- Technologies for African agricultural transformation (TAAT) including inputs from CGIAR and other international organizations;
- Mechanization availability through agricultural equipment hiring enterprises (AEHEs) and leasing arrangements;
- Post-harvest loss prevention and processing;
- Catalyse financing for agricultural infrastructure;
- Risk sharing and financing for increased agricultural finance;

- Recommendations and the way forward indicate:
 - Integration of mechanization in pan-African policy frameworks;
 - SAM strategies and a business model approach for meaningful smallholder up-scaling & adoption;
 - Good institutional arrangements for SAM for increased smallholder mechanization;
 - Private sector led and public sector enabled approach – for sustainability;
 - Regional centres of SAM excellence to promote agricultural mechanization;
 - Field-based capacity building (including better maintenance and service of agricultural equipment and implements);
 - All concerned (farmers, policy makers) must understand & contribute to efforts on mechanization, across the entire farming system, with a value chain perspective (FAO & UNIDO, 2008);
 - Global partnerships.

2.3.5 Sustainable mechanization development strategy options and the role of public-private and private-private partnerships: by Jean Moreira, Africa Rice Centre (AfricaRice), Ivory Coast

- AfricaRice is a member of the CGIAR consortium. Membership for AfricaRice comprises 26 countries in West, Central, East and North Africa.
- Mechanization is a priority area in their strategic plan and there is an Africa-wide mechanization task force to get appropriate technology into the hands of producers and processors. The main activities are: research, fabrication, out-scaling and training. AfricaRice collaborates with public-private partnerships to promote SAM with many technologies along the value chain from transplanter to weeders to threshers to parboilers. The 'ASI' light thresher is particularly suitable for operation by women who are offered agribusiness skills development advice through innovation platforms.

- AfricaRice has made many recommendations to promote SAM including:
 - Government – facilitate public-private collaboration; manufacturing partnerships; access to credit; local training centres;
 - International manufacturers – establish dealerships in Africa; build local capacity by upgrading techniques and supporting training;
 - Local manufacturers – locally adapted machines; good after-sales service; creation of partnerships to standardize);
 - National research and extension services – contribution to policy formulation; building local capacity; collaboration with manufacturers and local training; standards; business planning);
 - International R&D centres – contribute to enhanced public-private collaboration; improvement of local manufacturing; establish manufacturer networks; develop training curricula; facilitate South-South cooperation; assess government policies on SAM; advocate for SAM).
- Participants were reminded that women can play an important role in the development, introduction, utilization and out-scaling of SAM.
- Social transformation (entrepreneurship and the involvement of youth).
- CUMAs promote strong relationships within themselves and they react positively with other unions and cooperatives in the national and international institutional environment. The CUMA process is participatory, not passive. Under UN CUMA, sustainability becomes part of the system. Farmers are at the base, the unions work with school, banks and private sector, and a participatory approach is followed. Farmers understand that they need to join efforts in order to have access to the equipment.

A second presentation on UNCUMA was made by Mr Bagan Gontrand from the National University of Agriculture of Benin.

- The presentation focused on the role of UNCUMAs in maize crop production. Key issues related to a smooth operation of agricultural machinery such as maintenance, capacity building, extension, management of spares were explained as the main constraints which needs to be addressed on a regular basis.
- In conclusion, it was noted that these cooperatives constitute a mechanization strategy that is reliable based on an integrated participatory approach. A bottom- up, not top-down approach is used.

2.3.6 Promoting agricultural mechanization through cooperatives: CUMAs cases in Benin: *by Koffivi Nouwogou, UNCUMA, Benin*

- The Agricultural Equipment Cooperative (UNCUMA) is the agricultural service cooperative that was created by farmers for the aim of benefiting them. Under CUMA, the agricultural machinery such as tractors are jointly owned.
- UN CUMA is among the important approaches used in Benin to improve the living conditions of the farmers. However, the key challenges is integration of farmers and other key stakeholders such as the university, MoA, private sector, etc.
- Reasons for creating CUMAs (farm machinery cooperatives) include to: (i) facilitate access to agricultural mechanization (ii) overcome financing difficulties and (iii) increase the profitability of the investment. He further emphasized that CUMA is a collective investment, managed by farmers in independent groups in the same territory.
- Benin has 115 CUMAs serving 1250 farmers with 57 tractors and associated equipment. The result has been an increase in the cultivated area (by 350%) and better cultivation to produce leading to:
 - Increased income;
 - Better standard of living;

2.3.7 Mechanization from an industrial perspective: *by Rajam Padmanabhan, UNIDO*

- This was a web-based presentation which looked at a model of private sector engagement in industrial mechanization across the value chain. Human capacity development is a key activity by means of public-private development partnerships (PPDPs).
- UNIDO puts emphasis on the need to mechanize across the value chain. A PPDP approach for human capacity building (Learning and Knowledge Development Facility) is used.
- The examples given include:
 - Japan heavy equipment operator school (JHEOS) – Liberia (Komatsu);
 - Zambia industrial training academy (ZAMITA) – Zambia;
 - Heavy duty equipment and commercial vehicles academy (HDECoVA) – Ethiopia;
 - Académie engins lourds et véhicules commerciaux (AGEVEC) – Morocco;
 - In Liberia, Rubber and Palm companies had a challenge of skilled labour. UNIDO collaborated with the Government of Liberia and renovated a school which was used by KOMATSU to train the labour force and in the plant and machinery.

Discussion: This set of five papers with an African

SAM focus provoked a wide-ranging debate. Key points included:

- When debating mechanization needs, we need to take 'orphan' crops more into consideration and make sure that technologies are available for their production and processing. Orphan crops include millet, sorghum and teff. The World Bank explained that they support CGIAR centres (especially ICRISAT) with funding for research into these areas. The AfDB also affirmed that they put emphasis on orphan crops.
- Reference was made to the FAO/UNIDO meeting in Vienna in 2008 (FAO & UNIDO, 2008) at that it seems that nothing new was being discussed. This, perhaps, is a reflection on the fact that we are still in urgent need of action to solve problems that are now quite well known.
- It was pointed out that what small-scale farmers want are mechanization services and not necessarily ownership of machinery. It is also important to keep machinery in productive use for as long as possible throughout the year to enable machines to be fully and efficiently utilized. An example of this is hammer mills (which replace the mortar and pestle) which can attract year-round business. For sustainability it is also desirable to have local banks lending to local service providers.
- Africa faces challenges related to food insecurity, and it is still an important challenge at the moment. Therefore, sustainable agricultural mechanization has a critical role to play using the right agricultural mechanization system to sustainably intensifying the cropping systems.
- It is important to develop policies focusing on better approaches and strategies which are targeting and focusing on small- and large-scale farmers.
- It is important to give equal importance to postharvest mechanization as part of the agricultural mechanization effort to support agri-food value chain development.
- The aspect of energy should be addressed as we develop sustainable agricultural mechanization in Africa.
- Technical capacity is a requirement for the dissemination of the technologies. Only with proper technical knowledge, equipment will be operated, maintained properly and ensure profitability.
- There should be a regulatory framework that brings together the interests of all the stakeholders involved in the adoption of agricultural mechanization.

2.3.8 Key lessons learned

The key lesson learned during this session are summarized below:

- Mechanization is important for agricultural development in Africa, and it is necessary for moving forward the African agricultural agenda.
- The technical solutions available are many and independent of requirements. Examples in Asia with small-scale equipment and larger sizes have proven successful.
- There are several good examples that Africa can learn from Asia. However, every situation is different so there is a need to consider all key factors including the political and social environment to ensure returns.
- There are several approaches to promote mechanization in developing countries. However, they always require institutional support and intervention of the private sector.
- Africa is still lagging behind in terms of mechanization compared to the other continents, therefore joint and well-coordinated efforts involving the private, public and development partners to use mechanization to transform agricultural production in Africa are necessary.
- Technology can be adapted to the needs of farmers at a local/regional level, it is important to consider farmers' needs, market opportunities and the private sector's role to deliver the right equipment in the right environment.
- The lessons learned from the past efforts clearly show that the top down approach is not always successful. Furthermore, past efforts have not always taken into consideration models that benefit all stakeholders.
- There are several ongoing efforts addressing agricultural mechanization challenges at different levels in Africa. However, the collaboration among different players is lacking and therefore, there is a need to enhance collaboration by sharing approaches, experiences and results.

2.4 Sustainable Agricultural Mechanization: overview of public-private partnerships (PPPs)

2.4.1 Agricultural mechanization in Kenya: by Jasper Nkanya, Ministry of Agriculture, Livestock and Fisheries, Kenya

- The agriculture sector in Kenya contributes 26% of the country's GDP, 65% of total national exports, and 70% of the rural population depend on the sector for their livelihoods. In addition to being a major source of raw materials for industry it is a key driver to realization of Vision 2030.

- Agricultural mechanization contributes the following: (i) Increased labour and land productivity; (ii) Decreased production costs; (iii) Enhanced product quality; (iv) Removal of drudgery; (v) Involvement of youth to replace ageing farmers; (vi) Strengthened entrepreneurship; (vii) Soil and water conservation; (viii) Industrialization through cottage industry and value addition through agro-processing; (ix) Create employment and incomes.
- In Kenya, agricultural power sources are 50% human labour, 20% DAP and 30% motorized. The key players in agricultural mechanization include government institutions, manufacturers, dealers and distributors, service providers, farmers and research institutions. Twenty-four agricultural mechanization service (AMS) stations offer the following services: (i) Dam construction; (ii) Opening up new land to agriculture; (iii) Construction of farm access roads; and (iv) Soil conservation physical works.
- Ten agricultural technology development centres (ATDC) are based in distinct agro-ecological regions with the purpose of testing and integrating agricultural technologies, building human capacity and promoting appropriate technologies.
- The large number of challenges faced by mechanization initiatives includes: (i) Inadequate machinery; (ii) Inadequate staff (operators and mechanics); (iii) Inadequate mechanization extension; (iv) Inadequate access to mechanization technology; (v) Lack of credit and finance for farmers and contractors; (vi) Inadequate after sales service; (vii) Decreasing holding size; (viii) Inadequate resources/funding for stations; (ix) Aged farming citizens.
- The MoALF has recognized the need for action and has mobilized resources to strengthen existing institutions and introduce new ones (e.g. the Agricultural Mechanization Research Institute of KARLO).
- The way forward for Kenya will encompass: (i) Reformation of agricultural mechanization extension services; (ii) Developing a framework for PPPs for service delivery; (iii) Increasing access to affordable credit for machinery acquisition; (iv) Promotion of local manufacture and distribution; (v) Capacity building; (vi) Enhancing investment in agricultural mechanization; and (vii) Promoting and supporting youth involved in agriculture.

2.4.2 Sustainable agricultural mechanization; public-private partnerships: *by Ignacio Ruíz Abad, Ansemat and Agrievolution, Spain*

- Globally, in 2012, 97% of the agricultural capital stock were domestically raised out of which 77.3% was in private hands, whereas public expenditure and public R&D accounted for 17.4% and 2.3% respectively. On the other hand, foreign investment was 1.4% private (FDI) and 1.6% public (ODA).
- The European Agricultural Machinery Industry Association (CEMA) covers Europe, while Agrievolution now covers the world. They both gather

information for investing in agricultural machinery in developing countries from FAO, WB, UNCTAD and IFAD.

- The fundamental principles of R&D and finance in PPPs are the incorporation of regulatory good practices and enabling the business of agriculture. The principles of responsible agricultural investments are also reviewed. Regulatory good practices cover operational aspects, quality and safety and trade.
- Machinery inputs need to be cost efficient and be complementary to the three pillars of sustainability (social, economic and environmental).
- It is important that machinery is adapted to its purpose and this includes consideration of:
 - Ergonomics principles;
 - Safety requirements (and regulations);
 - Training in use, maintenance and repair;
 - Resource sharing;
 - Use in different environments (often requiring adaptation and adjustment).
- Adjustments (different machines) are needed for different: farm structures, crops, agricultural practices, resources, and soils. Different investors are likely to be needed for staple and cash crops. Awareness of the impact of mechanization on equity issues (e.g. employment, hunger eradication, cultural heritage) is important; as is environmental protection whilst increasing agricultural productivity) soil and water conservation, energy efficiency, waste minimization, etc.).

2.4.3 Sustainable agricultural mechanization: partnership models: *by Hans Balyamujura, AGRA*

- It is important to understand the type of farmers were are targeting. This is necessary since there is a broad spectrum of farmers in SSA ranging from smallholder farmers not linked into well-defined and right value chains to large scale commercial farmers.
- Demand creation is the key to out-scaling SAM in SSA. An example of this is the adoption of boda-boda motorcycles for transport in countries like Uganda. There has been a marked response to the demand and it is worth noting that most boda-boda operators are not the owners.
- It is necessary to categorize farmers into different tiers namely:
 - Tier 1: large commercial farmers;
 - Tier 2: medium-sized commercial farmers;
 - Tier 3: smallholders linked into well-defined and tight value chains;
 - Tier 4: smallholders with loose value chains.

- Investment can only be justified if there is business to be made. Different tiers have different ease of access to finance with those in the lower tiers having most difficulty in access. A good business model is needed. The example cited involves a farmer-led business for cashew nut tree spraying in Mozambique:
 - Equipment (motorized sprayer and protective clothing) bought from a dealer who is in partnership with the farmer organization (FO);
 - The FO trains the spray contractor who understands the needs of the value chain;
 - Farmers are contracted, standards set and managed by the FO;
 - All chemicals, maintenance and technical support supplied by the FO in partnership with dealers.

2.4.4 German machinery ring models: experiences and lessons learnt: by *Andreas Hastedt, Manager, Harburg machinery ring, Germany*

- Machinery rings in Germany are a response to a reduced labour force and inefficient machine use on individual small farms. There are approximately 230 local machinery rings (MRs) with 192 000 members. MRs are organized by the farmers themselves and constitute a modern centre of different services and good technical knowledge.
- Investments are made in common or by individuals and there is a value chain approach (e.g. planting, weeding, harvesting, loading, cleaning, transport of sugar beet).
- The MR has a board that comprises of farmers with an employed professional manager. There is a uniform price list, cashless payments and practical screening of new techniques. Some examples of MRs in value chains are: sugar beet; biogas for heat and power; cereals; potatoes, milk and; industrial and municipal services with agricultural equipment.
- The experience is that MRs are very successful. Farmers are the driving force but well-trained office staff are needed along with excellent management. Rules are clear and transparent, prices are reasonable. Farmers enjoy this means of working together to get modern mechanization at an affordable price.
- For MRs to work in Africa the following are some points to bear in mind: (i) Farmers must be convinced that it is a good idea; (ii) Farming must be a business; (iii) Education will be needed on what are the vital ingredients for MR success; (iv) A good regulatory framework is essential; (v) Good infrastructure is vital; (vi) There must be good access markets for all essential inputs and after-sales service; as well as for products; (vii) The financing system must be reliable; and (viii) An excellent MR

Manager is essential.

- There is good scope for PPPs in this area which should be explored further. A number of potential partners who could support formation of similar machine rings in Africa including: (i) Development and organizations; (ii) Governments; (iii) National Farmers unions or associations; (iv) Development partners such as EU, World Bank and others; (v) Agricultural machinery industry; (vi) national and international traders.

2.4.5 Private sector driven agricultural mechanization programme (PSDAMP) and GES application strategy of Nigeria: by *Innocent Ogirinye, PSDAMP Coordinator, Nigeria*

- Nigeria tested different models, correcting past mistakes before they arrived at the current PSDAMP model. It is important to bear in mind that agricultural mechanization is capital intensive and therefore there is a need to find ways of putting it in the hands of smallholder farmers.
- PSDAMP is a PPP arrangement involving the Ministry of Agriculture, financial institutions, agromachinery manufacturers and service providers. This PPP, initiated in 2012, sets up agricultural equipment hiring enterprises (AEHEs) where there is demand from farmers to hire or lease mechanized equipment for a variety of value chains.
- AEHEs are needed because:
 - Small and fragmented land holding sizes of SHFs;
 - Poor resource base of SHFs;
 - Inadequate skills;
 - Poor maintenance culture;
 - Corruption;
 - Lack of after sales technical support.
- AEHEs are created as safe housing and workshop centres to service a minimum of 1500 ha. A typical list of equipment (costing USD 60-123 000) for an AEHE is: (i) 3-5 units of tractors + basic implements; (ii) 5 power tillers; (iii) 2 mini-harvesters; (iv) 3 threshers; and (v) boom sprayer.
- Only equipment with a certificate from the National Centre for Agricultural Mechanization (NCAM) is eligible and all foreign equipment must have local technical back-up support. Funding for an AEHE is divided between the public and private sectors as follows:
 - Federal Ministry of Agriculture and Rural Development (FMARD) 35%
 - Bank of Agriculture 35%
 - Machinery vendor 10%
 - Service provider 20%

- AEHE funding (from a total project portfolio of USD35 million) is for four years at an interest rate of 7%. The AEHE is owned by service providers and can comprise cooperatives or other farmer groups, individual farmers or private investors. They are run by a 5-person team (leasing manager, accountant, field supervisor, mechanic and security guard).
- Capacity building is built in for technical and managerial staff. The investment is secured against risk by a variety of insurance schemes and machinery tracking. Service back-up is assured and periodic technical training programmes are given in collaboration with manufacturers.
- To date there are 140 AEHEs with 590 tractors and ancillary equipment. A total of 250 AEHEs is envisaged.
- The approaches used for the integration of CA mechanization services in an e-voucher system include: (i) The compilation of an integrated data base; (ii) The use of smart cards; (iii) Agricultural input catalogue; (iv) Electronic vouchers; and (v) Robust user and core data management and audit.
- Advantages and opportunities of the CAO mechanization e-voucher model include: (i) Enhanced due diligence in beneficiary identification; (ii) Robust record keeping and monitoring of redeeming process; (iii) A clear accountability and transparency; (iv) Flexible for various social protection program; (vi) Cost effectiveness.

2.4.6 Facilitating small scale farmers' access to conservation agriculture mechanization: by Mtendere Mphatso, CASU, Zambia

- Over 60% of Zambia's agricultural budget is spent on 2 major programs namely farmer's inputs subsidy program and strategies grain reserve. Therefore, not much is left for investment in other issues such as mechanization. However, despite this scenario, there is a government push towards promotion of mechanization in the country.
- Challenges with smallholder mechanization include: (i) Limitations in the technology available i.e. technology is available mainly on land preparation but not much on other activities such as planting, weeding and harvest; and postharvest handling; (ii) Limitations in the financing since financial institutions such as banks are not willing to invest in the low value DAP equipment which is not 'economic' for financing institutions; limitations in the availability of collaterals and high interest rates which is up to 43% for the loans to buy equipment such as tractors.
- CA mechanization is promoted by: (i) Harnessing the potential of existing service providers; (ii) Linking CA mechanization to on-going social protection programmes (e.g. by using e-vouchers); (iii) PPPs for financing and service provision; (iv) Bundling services (planting + weeding + harvesting).
- A detailed account of the introduction of e-vouchers into a Food Insecurity and Vulnerability Mapping System (FIVMS) for CA promotion in Zambia was provided. SHFs and service providers are registered in the data base. Machines are tracked in real time to ensure correct service provision. E-voucher redemption is via Google GPS. The clear accountability, flexibility and cost effectiveness mean that the system is viable for CA promotion.
- The key lessons captured during this session are listed below:
 - Several countries in Africa have developed their agricultural mechanization policies, however, the biggest challenge is to put the good plans into actions. Countries face challenges on the implementation, including how to effectively enable the private and public sector to work together in transforming agriculture through sustainable mechanization in their countries.
 - Manufacturers of agricultural machineries have an important role to play in supporting the development and promotion of agricultural mechanization in Africa. It is important that they understand the needs of sustainable agricultural mechanization along the value chain in Africa, including challenges associated with after sale services. Furthermore, all efforts should be considered under the umbrella of sustainability.
 - Efforts to promote agricultural mechanization in Africa need to ensure that different tiers of farmers, starting from small-scale to large-scale farmers, are taken into consideration and that the proposed solution correctly targets the intended audience.
 - Cooperatives have a role to play in promoting agricultural mechanization in Africa. However, transparency with clear rules and strategies including a clear roadmap are key to the success.
 - PPP arrangements could help to promote agricultural mechanization in Africa by ensuring that both private and public sectors address challenges that impede promotion of agricultural mechanization, such as the finance challenges. Furthermore, all partners must see a value and benefit in the collaboration for them to continue to participate.
 - ICT combined with other innovation approaches, such as the use of e-vouchers, could help to successfully promote sustainable mechanization among smallholder farmers while ensuring that the services are reaching the intended audience.

2.4.7 Key lessons learned

The key lessons captured during this session are listed below:

3. Summary of Day 2 Presentations and Discussions

3.1 Financing for Sustainable Agricultural Mechanization in sub-Saharan Africa

3.1.1 Food security in SSA; a fresh look on agricultural mechanization: *by Corinna Müller, DIE (German Development Institute)*

One of the main issues for mechanization is to translate the demand for mechanization into reality. Some of the main challenges found were:

- Farmers perceive mechanization as a risk to their livelihoods as it changes, for example, the common risk management strategies applied of mixed cropping systems on small-scale farms. Thus mechanization requires new risk management strategies to be defined at the small-scale level that may not be easy to define as many farmers do not know what outcomes on their farms, and to their livelihoods, mechanization will provide.
- Farmers and other actors in the agri-food value chain do not know how to turn their need for power (traction, transport, etc.) into effective demand for mechanization. There is a lack of business and financial literacy.
- There is a lack of credit as a consequence of lack of collateral on small-scale farms.
- Many financial institutions seemingly lack knowledge of the specifics of the agri-food sector and in particular of credit products and their risks related to mechanization.
- There is a lack of effective communication between stakeholders.

Effectively though there are a number of existing financial models that can support the financing of mechanization: savings, contract based securities, loan guarantee schemes, joint liability groups, leasing, matching grants and subsidies. Some real world examples can be found: myAgro in Mali and Senegal uses savings, CUMA in Benin uses cooperative purchases where farmers contribute financially based on farm size and buy equipment for joint use, Hello tractor in Nigeria provides services to smallholders via mobile communication technologies, while NWK agri- services in Zambia provides to be an intermediary between farmers and banks. The shared usage and ownership models can be a solution to some of the main obstacles to mechanization as financing becomes economically viable, purchase and maintenance can be done jointly, improved use of machinery through training and specialist operators can be provided and financial institutions are more enabled to reach small-scale farmers.

However in considering the financial perspective to mechanization, the effects of mechanization must also be considered, as it can potentially:

- Improve quality of life.
- Increase productivity of labour and land.
- Provide for income and employment.
- Have effects on women: they can include, for example, a reduction in hard manual labour.
- Have effects on social structures which can provide for a decrease in income inequality.
- Can potentially provide for positive agro-ecological effects.

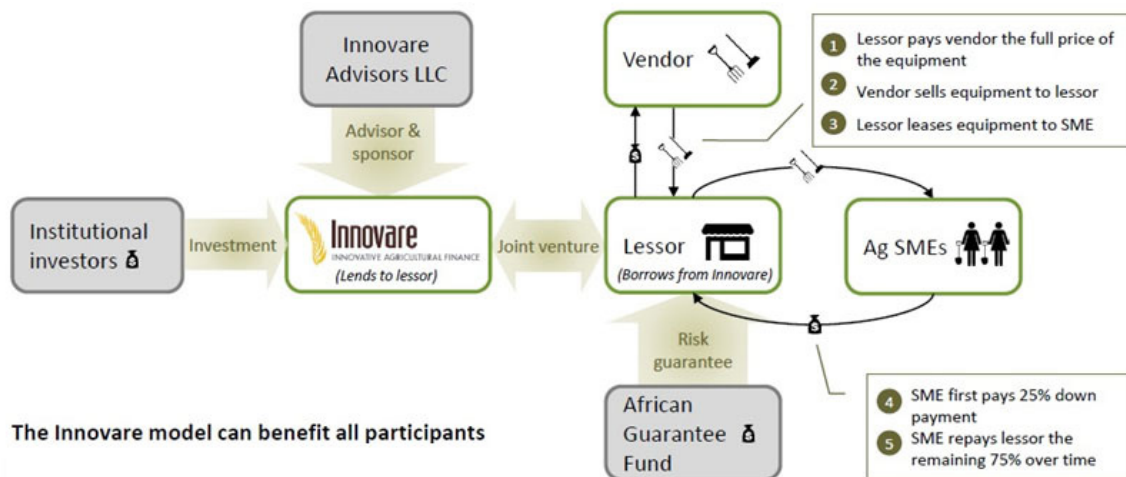
Overall and in summary the conclusions of this section were:

- Mechanization technology needs to be adapted to farm size and the local context, land, labour, soil, etc.;
- Only demand-driven and profitable mechanization is viable if it is based on sound business models and risk management strategies;
- Low intensity technologies (e.g. 2WTs and DAP) are feasible at farm level. Higher intensities require shared ownership;
- The financing needs of *all* actors need to be considered (not only farmers but service providers etc.);
- Mechanization is necessary and will lead to structural changes.

3.1.2 Innovare leasing facility: *by Mary J Porter, Innovare Advisors, USA*

The facility brings capital to Africa through a leasing strategy, partnering with local leasing companies and this in turn provides for financing production and processing of food and feed. The model provided for looking at financing mechanization in synthesis raises funds for mechanization from capital markets. It then forwards lending to local leasing companies who in turn lease farm machinery to farmers and service providers. The model is shown in the figure below.

Figure 2 How the leasing facility works



Source: Global Development Incubator

The main point is that the lessor borrows from Innovare. With the money borrowed the lessor pays the vendor the full price of the equipment who buys the equipment. The lessor then leases the equipment to the agricultural mechanization SME as shown in the Figure above. The lessor continues to own the asset until all payments have been made. The model is a “Virtuous Circle” as shown in the Figure above.

The principal benefits to the equipment purchaser (are):

- No collateral required.
- Reduced up-front payment. Instead of paying 100 percent of the equipment cost ‘Up Front’, only a 25 percent down payment is required, so that you can use the 75 percent balance for other purposes: i.e., working capital for the purchase of raw material inputs.
- Payments are stretched out over 36 months.
- Interest and fees are calculated on the financed amount only.
- Bank borrowing capacity is not affected.
- The application procedure is straightforward with a credit check.
- Interest rate and fees are competitive with bank loans, and
- Local support from an established East African leasing company, including facilitated import procedures.

3.1.3 L3 Consortium, John Riggan

The model considers as a first step for associating farmers with common characteristics and motivation as well as working with already constituted farmer organizations. If needed this can be followed by capacity building and development in terms of finance, business planning, etc., based on farmers requests. The identification of appropriate and sustainable business models is the next step in the process for what type of mechanization can occur with the farmer association. Only once this cycle had been completed is finance provided, preferably through leasing arrangements. However there are the farmers who make the request on the expertise and equipment required and only then does the consortium link them to the financiers through a lease agreement arrangement. A pilot is underway in collaboration with AGRA and its partners, to strengthen farmer’s organization in terms of post-harvest assessment, packaging, sorting etc.

3.1.4 African Development Bank, Jonas Chianu

There is an overall lack of financing to the agri-food industry in sub-Saharan Africa. In the *Feed Africa* programme, mechanization is seen as a key to raising food production in the continent and has the potential to convert it into a net exporter. Limited access to adequate financing is crippling agricultural development which is viewed as high cost and high risk by commercial lending institutions together with the perceived lack of capacity. Proposed improvements include the following:

- Risk sharing capacity (giving the bank guaranty if they loss they can be compensated);
- Increase loan scheme;
- Create finance facility;
- Scale out soft commodity and financing;

- Diaspora bonds to attract them in agriculture;
- Non-Bank SME finance;
- Lower lending rate for commercial banks.

3.1.5 Service provider, Stanley Muriuki, Kenya

He started his hire service in 1980 with oxen ploughs and would travel long distances to provide services.

In 2005 he received training through FAO and ACT and used animal drawn direct planters which planted 4 Acres per day with a net income of Kshs 4000 and was also provided with business training. He moved to conservation agriculture and reduced costs, and later with 2WT that made a big advantage due to time reduction, reducing costs compared to animals. Then to 4WD, which increased productivity. Currently, with KENDAT he established a service provision Hub which has two wheel and four wheel tractors and can now cultivate 10-17 acres in a day. In this context associating farmers to receive services as a group was seen as viable. To up scale his enterprise he used savings and offering more services.

He saw the way forward as being composed of the need for facilities for servicing, greater adaptation of services to differing farmers' needs and better access to funding for equipment.

3.1.6 Key lessons learned:

- There is a need to provide for more capital, and consequently finance for SSA;
- The overall financial infrastructure requires strengthening, and an emphasis on more active collaboration and partnerships among national institutions and linkages to regional institutions;
- There is a need for more formal private sector development for mechanization, not only in terms of hire services, but also in terms of dealerships, spare part providers, repair and maintenance enterprises, etc.;
- Financial considerations for mechanization need to be regarded in the wider social and cultural context, and the beneficial effects mechanization can bring to livelihoods, for example;
- Financing models need to be considered on a case-by-case basis within local contexts for mechanization;
- The sustainability of mechanization to defined local areas needs to be in unison with the related financing models that are needed for investment in equipment and its appropriate functioning;
- Current models to finance mechanization have proven their case, but within defined and particular contexts;
- Hire services and farm association models for financing seemingly have a wider usage spread and the related financing models seem easier to apply;

- Only demand-driven and profitable mechanization is viable when it is based on sound business models and risk management strategies;
- Low intensity technologies (e.g. 2WTs and DAP) are feasible at farm level. Higher intensities require shared ownership;
- The financing needs of *all* actors need to be considered (not only farmers but service providers etc.).

3.2 Strategic planning and forming new models for action and impact

3.2.1 Group 1: New collaborative models of PPPs

This theme was probably one of the main discussions carried during the Consultative Meeting. Developing business models that involve private and public partners for the benefit of sustainable accessing and utilizing mechanization services including for smallholders is today's main challenge in bringing mechanization forward in the context of African circumstances.

The key points addressed during this discussion were:

- Government policies with regard to rural infrastructure, public sector bias towards mechanization (as opposed to private sector actors) and lack of financial support schemes in rural areas (where mechanization is needed the most).
- Private sector investments and initiatives in rural mechanization and related support systems.
- The role of producer associations and cooperatives and how they are organized.
- Private sector suppliers provision of after sales services and technical assistance (repair services) in remote areas.
- Special and more flexible finance schemes especially for women and youth that want to engage in mechanization services.

In summary two overall concepts were discussed in view of the challenge to deal with small and medium size farmers. The first approach is rather a top down approach, the local institutions (under the lead of the Ministry of Agriculture), develop a detailed national agricultural policy and which includes profound food security objectives. It should be detailed enough to allow the private sector to come forward with the most suitable sustainable and efficient mechanization services to reach the objectives set out by the local institutions. FAO, WorldBank, UNIDO, NGOs and others can contribute to facilitate collaboration between the local public sector institutions and the private partners.

The Nigeria private sector driven agricultural mechanization programme (PSDAMP) that is presented in Session 3 above is probably a good example of such a concept. According to the Nigerian presenter, it is important to bear in mind that agricultural mechanization is capital intensive and

therefore there is a need to find ways of putting it in the hands of smallholder farmers. He noted that PSDAMP is a PPP arrangement involving the Ministry of Agriculture, financial institutions, agro-machinery manufacturers and service providers. This PPP, initiated in 2012, sets up agricultural equipment hiring enterprises (AEHEs) where there is demand from farmers to hire or lease mechanized equipment for a variety of value chains. AEHEs are needed because:

- Small and fragmented land holding sizes of SHFs.
- Poor resource base of SHFs.
- Inadequate skills.
- Poor maintenance culture.
- Corruption.
- Lack of after sales technical support.

AEHEs are created as safe housing and workshop centres to service a minimum of 1500 ha. A typical list of equipment (costing USD60-123 000) for an AEHE is: (i) 3-5 units of tractors + basic implements; (ii) 5 power tillers; (iii) 2 mini-harvesters; (iv) 3 threshers; and (v) boom sprayer. To date there are 140 AEHEs with 590 tractors and ancillary equipment. A total of 250 AEHEs is envisaged. For more details please see Session 3 above.

The **bottom up approach** is where the local representatives of the small and medium size farmers, i.e. ACT or producer groups, and the providers of agricultural machinery (CEMA or other local private sector suppliers) work together. The farmers associations should provide the specific needs of the local farmers in terms of average size of farms, commodities produced, local food staff markets, diets, agricultural preferences and behaviours, etc. In order to allow the private sector partner (agricultural machinery) to define suitable and sustainable mechanization options that could contribute to the gradual and slow process of developing a first step of mechanization (utilization of small machinery and equipment) in the small and medium size rural economy. In this process FAO, WorldBank, UNIDO, NGOs and others can again contribute to facilitate between the local public sector institutions and the private partners.

As concrete example a particular model from Kenya on cooperative rice farming scheme was elaborated. It was said to be most important for a farmer group to have common objective, e.g. profitable rice production. It should be made sure that all stakeholders along the value chain are involved (seeds, local infrastructure, finance, mechanization service providers, etc.). It is important for the group to formally register in order to achieve cooperative status and be eligible for possible financial support. Other key components are:

- Provide incentives for mechanization service providers
- Functioning machinery supply chains
- Re-enforcing institutional support

3.2.2 Group 2: Modalities and approaches for establishing a global sustainable mechanization knowledge exchange platform

Prior to tackling the question, the group brainstormed on some initial considerations to set the framework for the later discussion and these included:

- It is important to define what we mean by global. The group agreed that the platform should be global but with an African focus.
- There is a global need for comprehensive information on existing demand (especially for machinery suppliers). It was observed that the current platforms do not have this information.
- There are already several knowledge sharing platforms on line: e.g. CGIAR; FAO; WB; UNIDO; Club of Bologna, etc.
- For a new platform the target should be farmers and farmers' associations as a priority.
- The platform should offer technology as well as knowledge and include machinery that has the potential to be sustainable (i.e. it would not be a purely commercial website).

Following a long participatory discussions reflecting on the experience from Asia and other continents, the group agreed that the proposed platform should be an ICT-level site that manages information and can link to other ICTs serving the farming community (e.g. SMS, WhatsApp, YouTube, databases, etc.). It would also be a resource centre for statistics. Furthermore, the platform should be based at an existing institution in the African continent with the required capacity (this could be ACT). However manufacturers (both regional and global) should participate. The **objectives** and **outcome** of the project would be as follows:

Objectives: To share knowledge and experience and give visibility to SAM equipment and its use. Bridge the gap and forge a link between machinery users and manufacturers. To validate existing technologies, setting minimum requirements. The immediate action is to target farmers.

The **outcome** would be to a well demonstrated approach on how to adapt and/or develop technologies for SAM obtained from the knowledge exchange.

The platform would distinguish between short-term and long-term development. Product information should be presented from the users' (usually farmers but also support players such as extension officers) perspective. Participation would be encouraged and opinions on equipment shown. Surveys, statistics and reports can also be included.

The burning issue for the platform's content was seen by the Group to be technology transfer – matching farmers' needs to manufacturers' offers. There would also be a strong content on capacity building and market information. Longer-term issues to be included would be newly developed equipment, and finance options and models. A country focus would be appropriate for many themes.

As for the organization of the platform, it was agreed that it could be a collaboration between manufacturers'

associations and an agricultural development organization (e.g. ACT). The platform would need a kick-start from donors and thereafter should be self-sustaining with revenue from advertising and fees from machinery manufacturers wishing to place their products.

3.2.3. Group 3: Establishment of regional centres or networks for SAM in SSA

The concept of a network of centres of excellence rather than a single centre was proposed as the most viable option, based, as it is, on the successful experience of the Asian network (the original RNAME) set up by the UN system.

Taking into consideration the size of the African continent, the Group proposed that the Network should comprise of a central hub (with a secretariat) and regional centres covering West, Central, East and Southern Africa sub-regions. It would also need to have strong links to North Africa and other networks globally.

The **objectives** of the Network would be:

- Improving SHF access to appropriate SAM technologies to improve their livelihoods.
- Sharing information and knowledge.
- Data collection and dissemination.
- Training and capacity building.
- Provision of standards (using OECD, ISO and ANTAM codes where applicable).
- Testing and evaluation of technologies (although all technologies should be allowed to flourish or fail, there would be no imposition).
- Preparation of catalogues for successful stories (but **not** prototype development).

Complementary centres in SSA and globally. The group was informed that In West Africa there are already nine value chain centres of excellence and a tenth is being added (with WB funding) on agricultural mechanization. This has the potential to be a West African regional centre of the Network. There is also positive experience with the UN Centre for Sustainable Agricultural Mechanization (UN-CSAM) based in Beijing.

In SSA the regional centres can specialize on specific roles, such as machinery testing or capacity building. The Network itself will identify the best choices for regional centres of excellence. The identification should be undertaken in close collaboration with:

- Governments of the countries involved.
- Private sector, especially manufacturers of agricultural machinery.
- Farmers' associations seeking to improve access to SAM technology.
- SAM service provider associations.
- National and international institutions research centres, universities, UN organizations (FAO and UNIDO).

Funding is likely to emanate from a variety of sources. The private sector is only likely to be interested in joining *after* initial funding and institutional set-up. Once this has happened, private sector companies can be invited to become corporate members. Funding for the establishment of the Network could include the following:

- World Bank and UN agencies (UNIDO, UNDP, FAO).
- Foundations (e.g. the Bill and Melinda Gates Foundation).
- Development agencies (e.g. DFID, GIZ, USAID).
- Intergovernmental organizations (e.g. AfricaRice, IITA).
- Private sector.

The **next step** will be for a Concept Note to be prepared (possibly by the WB and FAO) to flesh out the idea with specific indications of how the concept can be elaborated and implemented.

3.2.4 Key lessons learned:

- Developing business models that involve private and public partners to enable access and utilization of sustainable mechanization services, for the benefit of smallholders, is one of the key challenges to transform agricultural production in the context of SSA.
- All stakeholders have a role in these PPP schemes – for example, the government develops policies, the public sector designs financial support schemes in rural areas (where mechanization is needed the most), the private sector invests in rural mechanization and related support systems, and producer associations and cooperatives are registered to represent farmers.
- There is a need for special and more flexible finance schemes, especially for women and youth who want to engage in mechanization services.
- There is a global need for comprehensive information on existing demand, especially for machinery suppliers, since current platforms do not have this information.
- For this new platform, the priority should also be to meet farmers and farmers' associations' demands.
- The knowledge platform should offer technology and include machinery that has the potential to be sustainable (i.e. it would not be a purely commercial website).
- It would be ideal if the proposed platform be an ICT-level site that manages information and can link to other ICTs serving the farming community (e.g. SMS, WhatsApp, YouTube, databases, etc.). It could also be a resource centre for statistics.
- A network of centres of excellence was proposed rather than a single centre as the most viable

option, based on the successful experience of the Asian network (the original RNAM) set up by the UN system. These regional centres can specialize on specific roles, such as machinery testing or capacity building.

- Stakeholders for identifying the best choices for regional centres of excellence include: Governments of the countries involved, Private sector (especially manufacturers of agricultural machinery), Farmers' associations seeking to improve access to SAM technology, SAM service provider associations, and national and international institutions research centres, universities, UN organizations (FAO and UNIDO).

3.3 Sustainable mechanization strategy for SSA

3.3.1 The process of developing a draft framework for SAMS for the transformation of agriculture in Africa: *sending the hand-hoe to the museum: by Geoffrey Mrema, Sokoine University of Agriculture, Tanzania*

Prof. Mrema, the lead consultant for the FAO project entitled "Promoting Agricultural Mechanization in Eastern Africa", made a brief presentation about the initiative and the process of developing a draft framework for SAMS for the transformation of Agriculture in Africa. His presentation covered three main areas namely: (i) The process of developing a framework for SAMS for SSA/Africa; (ii) Project coverage and consultations; and (iii) The next steps.

He noted that the process of developing a SAM strategy for Africa was initiated by the AUC in 2015. The AUC is particularly interested in seeing an end of the hand-hoe as a key tool for transforming agriculture in Africa, and its new strategy should be based on commercial, environmental and socio-economic sustainability. The presentation was essentially about the process being taken to arrive at a framework since the project's inception workshop held in June 2016 when a steering committee was formed for the purpose of formulation.

The steering committee reviewed past studies and lessons learnt and looked at developments in other parts of the world (Asia and Latin America) as well as undertaking a number of sub-regional and country studies in collaboration with AU Regional Economic Communities (RECs). Four African experts have been commissioned to conduct a rapid appraisal of the SAM situation and potential in Central, Eastern, Southern and Western Africa, together with a limited number of country studies (e.g. Rwanda and Uganda).

A draft framework, ready for discussion, is expected by January 2017 and the final draft will be discussed in March 2017. After which there will be a formal review by the AUC.

3.3.2 Agricultural mechanization policy issues: by Mataba Tapela, Botswana University of Agriculture and Natural Resources

Prof. Mataba started by emphasizing that smallholder farmers (SHF) are at the centre of interest for SAM, and are being impacted by: (i) Government's enabling environment; (ii) Financing institutions; (iii) Development partners and international organizations; and (iv) Equipment suppliers and manufacturers. Surrounding these are the issues of: (i) Value chain services; (ii) R&D; (iii) Marketing; and (iv) Infrastructure.

The remainder of the presentation examined the roles of the various stakeholders in a little more detail.

Regarding the role of farmers, it was noted that it includes:

- Primary producers.
- Processors/ value addition.
- Marketing.
- Create demand for services.

The role of the private sector:

- Machinery manufacturers and suppliers (distributors).
- Machinery services, repairs and maintenance.
- Providing training on use and care of equipment.
- Provide financing.

The role of development partners and international agencies:

- Advice on policy.
- Advocacy.
- Funding.

The role of government is to create an enabling environment through:

- Stimulation of demand for services.
- Policy and regulations.
- Quality assurance and safety.
- Legislation.
- Infrastructure development.
- Trade facilitation.
- Provision of date and usage information.
- Provision of incentives.

Policy related issues. There should be an integrated approach to Policy and Strategy development which should encompass, consider and incorporate the following points:

- Sustainable Development Goals.
- National development plans.
- Strategy for increasing production and food security.
- Environmental sustainability.
- Economic diversification.
- Employment creation.
- Women and youth employment.
- Land tenure and holding size.
- Trade relations.
- Citizen empowerment.
- Skills development.

3.3.3 Key lessons learned:

- This is one of the major initiatives aimed at promoting agricultural mechanization in Africa. The initiative is led by FAO while working closely with the AUC.
- The initiative is supported by the AUC high level management, including the former Chairperson, and therefore providing an excellent platform for spearheading agricultural mechanization in AUC member countries.
- At the moment, the roles of the key stakeholders in developing sustainable agricultural mechanization in Africa are well known, and the team involved in preparing the SAM has stipulated well the roles that need to be played by different parties.
- The process of developing the SAM framework is inclusive and the team involved in developing it has a long history of working on agricultural mechanization in the continent. Steps have been taken to ensure that key stakeholders from both the private and public sectors are involved.
- It is important that FAO strives to involve more stakeholders during the discussions that will follow as the framework is being finalized.

4. Conclusion and the way forward

4.1 Conclusion

Africa faces many challenges linked to food insecurity, and sustainable agricultural mechanization (SAM) has a critical role to play in providing a suitable agricultural mechanization structure for the sustainable intensification of cropping systems. Africa considerably lags other continents in terms of mechanization. Therefore, joint and well-coordinated efforts involving the private, public and development partners are needed to promote mechanization as a means to transform agricultural production in Africa.

It is important to develop policies based on better approaches and strategies which are focused on small-scale farmers, as well as large-scale farmers. The lessons learned from past efforts clearly show that a top down approach is not always successful. Past efforts have not always taken into consideration models that benefit all stakeholders. Although there are numerous approaches to promote mechanization in developing countries, they always require institutional support and private sector intervention.

There are several ongoing efforts addressing agricultural mechanization challenges at different levels in Africa. However, the collaboration among different players is lacking and therefore, there is a need to enhance collaboration by sharing approaches, experiences and results. A regulatory framework should bring together the interests of all the stakeholders involved in the adoption of agricultural mechanization. Several countries in Africa have developed their own agricultural mechanization policies. However, the biggest challenge is to put good plans into action. Countries face many challenges during the implementation, including how to effectively enable the private and public sector to work together in transforming agriculture in their countries through sustainable mechanization.

Developing business models that involve private and public partners to enable access and utilization of sustainable mechanization services, for the benefit of smallholders, is one of the key challenges to transform agricultural production in the context of SSA. Public-private partnership (PPP) arrangements can help promote agricultural mechanization in Africa by ensuring that both private and public sectors address challenges that impede promotion of agricultural mechanization, such as those posed by financial challenges. Furthermore, all partners must see a value and benefit in the collaboration to continue to participate. All stakeholders have a role in these PPP schemes – for example, the government develops policies, the public sector designs financial support schemes in rural areas (where mechanization is needed the most), the private sector invests in rural mechanization and related support systems, and producer associations and cooperatives are registered to represent farmers. Demand-driven mechanization is viable and profitable when based on sound business models and risk management strategies.

Manufacturers of agricultural machineries have an important role to play in supporting the development and promotion of agricultural mechanization in Africa. It is important that they understand the needs of SAM along the agri-

food value chain in Africa, including challenges associated with after sale services. Equal importance should be given to postharvest mechanization as part of the agricultural mechanization effort to support agri-food value chain development. Furthermore, there is a need for more formal private sector development of mechanization not only in terms of hire services, but also in terms of dealerships, spare part providers, repair and maintenance enterprises, etc. All this should occur in the context of ensuring economic, social and natural environment sustainability.

The technical solutions available are many and independent of existing requirements. In Asia, examples exist with small-scale equipment and larger sizes have proven successful. There are valuable examples from Asia's experience upon which Africa can build on. Every situation is different, so it is important to consider political, social, economic and cultural aspects and the natural environment to ensure returns. Technical capacity is a requirement for the dissemination of these technologies. Proper technical knowledge is key for the operation of equipment, its proper maintenance and for it to be profitable. Technology can be adapted to farmers' needs at a local/regional level, therefore, it is also important to be aware of these needs when identifying market opportunities and defining the private sector's role in delivering the right equipment in the right environment. Experience has shown that low intensity technologies (e.g. 2WTs and DAP) are feasible at farm level. On the other hand, higher intensities technologies may require shared ownership.

There is a need to provide for more capital and financing to SSA. The overall financial infrastructure needs to be strengthened, and emphasis should be placed on a more active collaboration, partnerships among national institutions and linkages to regional institutions. Financial matters concerning mechanization need to be considered in the wider social and cultural context, as well as the beneficial effects mechanization can have on improving livelihoods. Financing models need to be considered on a case by case basis within local contexts. The sustainability of mechanization within defined local areas should be aligned with the financing models for investment in equipment and its appropriate functioning. Current models to finance mechanization have proved successful within defined and in particular contexts. Hire services and farm association models for financing seemingly have a wider usage and the related financing models seem easier to apply. The financing needs of *all* actors have to be considered (not only farmers but also service providers etc.). Special and more flexible finance schemes should be established especially for women and youth who want to engage in mechanization services.

Efforts to promote SAM in Africa need to ensure that different types of farmers, starting from small scale to large scale farmers, are taken into consideration and that the proposed solution correctly targets the intended beneficiaries. Information and communication technology (ICT) combined with other innovative approaches, such as the use of e-vouchers, could help to successfully promote sustainable mechanization among smallholder farmers

while ensuring that the services are reaching intended beneficiaries. ICT platforms should prioritize the demands of farmers and farmers' associations. The platforms should offer information on technology and should include machinery alternatives that have potential to be sustainable (i.e. it is not a purely commercial website). It would be ideal if the proposed platform can also link to other ICTs serving the farming community (e.g. SMS, WhatsApp, YouTube, databases, etc.) and could be a resource centre for statistics.

In this same regard, a network of centres of excellence was also proposed – rather than a single centre – as the most viable option, based on the successful experience of the Asian network (the original RNAM) set up by the UN system. These regional centres can specialize on specific themes and have specific roles, such as machinery testing or capacity building. The stakeholders that should be included in identifying the best choices for regional centres of excellence include: Governments of the countries involved, Private sector (especially manufacturers of agricultural machinery), Farmers' associations seeking to improve access to SAM technology, SAM service provider associations, national and international research centres/institutions, universities, and UN organizations (FAO and UNIDO).

4.2 The way forward: by Joseph Mpagalile, FAO, Rome

The way forward was prepared based on the presentations, discussions and consultation that took place during the meeting, as well as the agreed points and actions to be taken. FAO will be working closely with the other institutions, which form the secretariat, to spearhead the implementation of the suggested action points.

There is consensus on the following points:

- SSA has an ageing population of farmers. SAM has a clear role to play in making agriculture more attractive to youth, who otherwise migrate to urban areas.
- Skills and capacity development are essential, and investment is needed from both the private *and* public sectors.
- SAM must be viable as a business. Demand aspects need to be addressed by ensuring that farmers have access to information in order to make informed choices.
- Technical service backup is vital and not always sufficiently well developed.
- Apply a value chain approach and not a focus solely on production.
- SAM needs to be accompanied by complementary services and inputs, especially finance.

The **way forward** includes a list of concrete actions to enable SAM systems to function correctly, they include:

- Development of the social sector (food security, improved nutrition, and assured livelihoods).
- Conservation of natural resources and the environment.
- Identification, delivery and application of new models for public-private and private-private partnerships at regional and global levels.
- Establishment of a SAM network with centres of excellence for Africa. For this a well-developed Concept Note is an urgent priority.
- Establishment of a knowledge platform for technology exchange at a pan-African level. This will also require, urgently, a well-developed Concept Note.
- Production of a concise SAM advocacy brief for policymakers and donors. This has been produced as a separate draft advocacy document.
- Elements to take into consideration, which came up during that discussion on the way forward: From the commercial farmer's perspective, the equipment is not so much an issue as its operation (for sustainability). The private sector (e.g. AGCO) wants to be part of the SAM and SAM strategy development process.
- Service providers have potential for job creation in the rural private sector. *Hello tractor* (Presentation 16) is a good example of how job opportunities for women and youth can be created.
- The Meeting provided ample material for the next steps, including drafting the Concept Notes and then proceeding to concrete action.

5. Closing plenary

5.1 Closing presentation by Josef Kienzle (FAO) and Jenan Chakib (WB)

Josef Kienzle in concluding, introduced the concept of the vicious cycle of hand-hoe technology which leads to low income and low savings for farmers, resulting in a low demand for mechanization and so perpetuating the low productivity cycle. Increasing the demand for mechanization can reverse this cycle and result in high productivity and high savings. The mechanization supply cycle is also transformed by higher demand leading to greater supply and lower costs.

SAM has at its heart the concept of sustainable intensification which means that FAO's Save and Grow paradigm (FAO, 2011), involving an ecosystems approach and natural resource conservation, should be adhered to.

Finally it was emphasized that improving mechanization from hand tools through DAP to engine power increases productivity and reduces drudgery. It applies along the value chain, from production through storage to processing and marketing.

Chakib Jenane underlined that agricultural mechanization in SSA is necessary and perfectly possible. Japan, he pointed out, does not produce steel but has no problem in leading the world with Toyota. The participants at this Meeting are not the usual talk-shop candidates including, as they do, manufacturing organizations (CEMA and UNACOMA) together with multinational producers such as AGCO and John Deere, international organizations, and high level experience from Africa. A potent mix with potential for real action.

In her closing remarks, **Ambassador Dinah Grace Akello** reminded participants that Africa is a continent of great potential that can feed the world. Unfortunately, children in the continent are still malnourished. Therefore, she urged all stakeholders to be involved in the process of transforming African agriculture using sustainable agricultural mechanization as one of the tools. She urged that all possible avenues should be explored including the South-South Cooperation for technology and knowledge sharing and transfer. She requested FAO to carry the flag while working closely with other members of the Secretariat and stakeholders at large.

5.2 Consultative meeting on mechanization; vignettes and reflections: by Sarwat Hussain, World Bank, Washington DC

This was a useful summary of the main themes discussed during the Meeting. The three planned outputs (new collaborative models; knowledge platform and an African Network for SAM) have been amply debated with a strong focus on the diverse needs of African smallholder farmers. The presentation then touches on wider issues including:

- Africa has 202 million hectares of uncultivated land (but it is highly vulnerable to land grabbing).
- Africa's food and beverage export markets are set to soar in the near future. Sustainable mechanization will facilitate the transformation.
- Climate-smart agriculture increases productivity, enhances resilience, and reduces emissions.

This presentation also summarized well the three areas where consensus has been reached as areas of work in the way forward:

And finally Ambassador Dinah Grace Akello brought the Meeting to a successful close by urging that firm action now be taken by the WB, FAO and UNIDO to convert our conclusions into concrete action. Africa needs SAM to feed itself into the future.

6. Field visits

Two field visits made by the participants to a large scale mechanised precision conservation agriculture wheat farm and a mechanization hub and small-scale entrepreneurial service provision. Both sites are located in Laikipia county. Brief reports are included as Appendix 4.

Appendix 1: Meeting concept note



Consultative Meeting on a Mechanization Strategy

New models for sustainable agricultural mechanization in sub-Saharan Africa

30th November – 3rd December 2016, Venue: Safari Park Hotel, Nairobi, Kenya

Background

The large potential for agricultural production has not been realized in sub-Saharan Africa (SSA). One of the key development paradigms for long-term increased agricultural production in SSA is sustainable agricultural mechanization. The benefits are multi-faceted ranging from reducing drudgery, improving the timeliness of agricultural production operations, increasing the efficiency of input use, to facilitating the implementation of the sustainable intensification of production systems, and making agriculture more resilient to increasingly extreme and unpredictable climatic events. Sustainable mechanization can also be applied to the development of improved post-harvest, processing and marketing activities, enabling more timely, and concise operations, with value added to primary products. This can foster the delivery of more nutritious foods and higher value products to final consumers. Moreover, sustainable mechanization has the capacity to contribute to entrepreneurial activities in rural and remote areas, with hire services that can provide much needed mechanization services to those involved in the agri-food sector. In addition, farm-based sustainable mechanization hire services can also contribute to wider development efforts, such as rural-urban transport of goods (and people), rural feeder road construction and maintenance, power for water pumping, provision and distribution of drinking water as well as the collection of bio-waste in rural, peri-urban and urban areas.

Sub-Saharan Africa (SSA) has a history of strong public sector leadership in agricultural mechanization development. Procurement, mechanization services and spare parts supply have mostly been in the realm of the public sector. Over the years, differences in the priorities, perspectives and approaches between the public and private sector towards the development of agricultural mechanization have led to the agricultural mechanization in SSA being largely led and run by the public sector with the private sector playing a minor role. In the long run, this approach was not sustainable as important stakeholders such as private sector agri-machinery suppliers, manufacturers and service providers were neglected.

Initiatives for applying sustainable mechanization to growing more food and other functions and activities designed to increase sustainability of the food system, requires new thinking and perspectives. There is a primary need to see mechanization in a wider and more holistic context. There are numerous cross-cutting and cross-sectorial factors that can contribute to well-functioning, inclusive and sustainable mechanization systems. These need to be ascertained, assessed and elaborated upon and the important experiences and lessons learnt need to be shared with wider audiences that can facilitate and enable a more holistic framework to support the design, formulation and implementation of targeted sustainable mechanization policies.

There is a secondary need to consider mechanization as an important component of private sector development, but with an acceptance that private sector initiatives and markets cannot do the 'job' alone. The public sector still has a role to play in ensuring that a conducive environment exists for the development of sustainable agricultural mechanization in SSA. For example, the public sector needs to play a key role when developing agricultural mechanization strategies that will guide implementation of the planned actions. Furthermore, this will foster new and innovative models of public-private partnerships (PPP) that include the numerous opportunities provided by the shared economy, (via ICT and social media platforms, for example), that could play a key role in the successful development of a regional framework for sustainable mechanization.

There is also the need to consider mechanization as a complex system, intricately tied to food and livelihoods systems and not only to agricultural production. Yet the overarching question, or model, to consider is how sustainable mechanization can have greater impact and positively contribute to the urgent need to align agricultural (production) systems in climate-smart ways that include adaptation and mitigation strategies. This new and PPP-based sustainable mechanization paradigm will contribute to more resilient production systems in order for sub-Saharan Africa to meet food needs and reduce heightened pressures on the natural resource base.

Purpose and objectives

The main purpose of the meeting is to provide a platform to discuss sustainable mechanization development strategy options and, specifically the role of public-private and private-private partnerships. This will be implemented via the exchange of knowledge, perspectives, experiences and lessons learnt in the past while identifying leveraging and entry points for sustainable development of agricultural mechanization in SSA.

The key objectives of the meeting are as follows:

- (i) Providing a platform for public and private sector actors to meet and exchange knowledge, and articulate commitments to improve agriculture mechanization in sub-Saharan Africa for:
 - a. Ascertaining the main needs and constraints for the dissemination and adoption of sustainable mechanization in sub-Saharan Africa
 - b. Defining potentials
 - c. Identifying key factors for developing sustainable agricultural mechanization
 - d. The delineation of holistic sustainable mechanization policy guidelines;
- (ii) Devising new collaborative models for Private-Public and Private-Private Partnerships in order to prepare the ground for potential investments and articulating opportunities, across a range of specific points of agriculture and food value chains, that can create jobs and improve livelihoods with support from the World Bank, FAO, AGRA and the industry and as part of this define:
 - a. Possible pilot/priority countries (5 – 7)
 - b. Funding (immediate funding needs, finance/co-finance options)
 - c. Governance issues
- (iii) Explore and consider the development of a global sustainable mechanization knowledge exchange platform (ICT level) to enable the continuation of consultations;
- (iv) Explore the possibility to establish a Regional Center for sustainable agricultural mechanization in Africa similar to existing centers in Asia (BISA², UN/CSAM³) which will help in the research, training and capacity building on technologies and practices related to mechanization along the agrifood value chain specifically for the region in line with the priorities of the existing and future policies.

Meeting Outputs and Deliverables

Outputs

1. The meeting will elaborate on the concept of sustainable mechanization as a development paradigm, the numerous challenges associated with sustainable mechanization and the delineation of policy guidelines, focused at regional and national level, but also and importantly including the local level. The meeting will articulate the needs for more holistic policy-making considering, among the many factors to be addressed, and in particular: south-south cooperation, public and private sector development, social sector development as well as natural environment and climate change themes.
2. The meeting will lead to the identification of viable and adaptable collaborative models among public, private, social and environmental sectors that are accessible, equitable functional and facilitative for all stakeholders in SSA.
3. The meeting will provide an opportunity for potential joint venture partnerships between domestic and international companies, and intra-partnerships among African based companies.

² Borlaug Institute for South Asia - <http://bisa.org>

³ UN Center for Sustainable Agricultural Mechanization for Asia and the Pacific - <http://www.un-csam.org/>

4. The meeting will also identify key factors that are necessary to enable sustainable mechanization systems to function appropriately and in an inclusive manner. A list of concrete actions will be developed and a clear strategy on how to move forward would be agreed upon.
5. The meeting will furthermore produce a list of potential focal areas in which sustainable mechanization can play a key role in natural environment conservation and usage as well as contribute to substantive climate change adaptation and mitigation strategies.
6. Sustainable mechanization action plan brief: The meeting will attempt to provide a commonly and jointly agreed upon sustainable mechanization action plan brief. Principally targeted at policy-makers and donors it will intend to provide a step-by-step suggested action plan for regional, national and local level development for sustainable mechanization within SSA.
7. Meeting Report: A concise report will be prepared to summarize the meeting. The report will summarize the presentations made during the sessions, focusing on the key lessons learnt and the way forward. The report will also include guidelines and recommendations made during the sessions which will contribute to the overall and intended outcomes of the meeting. Furthermore, the report will highlight collaborative activities which could be developed jointly by the World Bank, European Agricultural Machinery Association (CEMA) and FAO and other partners in SSA including AGRA, ACT and AfricaRice especially on collaborative models among public, private, social and environmental sectors, capacity building and the role of mechanization in climate change adaptation and mitigation strategies.

Participants

The main participants at this meeting will be delegates drawn from SSA countries, including policy-makers, academics, private sector, financial institutions, farmer organizations, and national development organizations (international and regional), and NGOs. Experts from outside the region, especially private companies, will also be invited. In order to enhance the sharing of knowledge, experiences and lessons learnt, focus will be given to inviting participants who are *actively involved* in ongoing initiatives to promote sustainable mechanization in SSA. However, in order to have meaningful discussions, the number of participants will be kept at a manageable level.

Meeting organization

The meeting is a result of a joint effort of a number of organizations, led by the World Bank, CEMA, FAO and AGRA and close collaboration with ACT and AfricaRice,. AGRA took the lead in logistical support and organization in Nairobi, Kenya and worked closely with the other partners based in Nairobi such as ACT and AfricaRice.

The meeting is designed to foster interaction, learning, and 'matchmaking' of concrete investment opportunities. With a view to achieving its objectives, the meeting is structured to include plenary context setting and wrap-up sessions with high level speakers from the public and private sectors, as well as parallel dialogue sessions around priority models more conducive to match-making.

Location and dates

The meeting will be held on the 30th November – 3rd December 2016, in Nairobi, Kenya at the Safari Park Hotel

Appendix 2: Meeting programme

Agenda

Wednesday, November 30

PM Participants arrival and Registration, meet-and-greet, informal dinner

Thursday, December 1

08:30 Participants arrival and Registration

09:00 Session 1: Opening Plenary

Chair: Gajendra Singh, Adjunct Professor, Indian Agricultural Research Institute (IARI)

Moderators: Peter Chisawillo (English) and Alioune Fall (French)

Welcoming Remarks: Robert Allport, Assistant FAO Representative

Remarks by Ambassador Dinah Grace Akello, Uganda Permanent Representative to UN/FAO

Remarks: Sean De Cleene, representing, President, Alliance for a Green Revolution in Africa (AGRA)

Opening Speech: Dr. Richard Lesiyampe, Principal Secretary, Ministry of Agriculture, Livestock and Fisheries, Kenya

09:40 Sustainable Agricultural Mechanization: An Overview

Josef Kienzle, Food and Agriculture Organization of the United Nations (FAO)

Chakib Jenane, World Bank Agriculture Global Practice

10:00 Coffee/Tea, Group Photo

10:15 Session 2: Sustainable Agricultural Mechanization (SAM): Sharing Global Lessons of Experience

Chair: Aifa Fatimata Niane Ndoye, (World Bank)

India: Harminder Singh, Borlaug Institute for South Asia

Bangladesh and Nepal: Scott Justice, CIMMYT and Enamul Haque, Murdoch University

Moderated Q&A

10:50 Sustainable Agricultural Mechanization: Focus Africa

Overview (past and ongoing efforts): Geoffrey Mrema, Sokoine University of Agriculture, Tanzania

Feed Africa and Mechanization Flagship: Jonas Chianu, the African Development Bank (AFDB)

Mechanization in Rice Farming: Jean Moreira, AfricaRice

Agricultural Machinery Cooperatives: Koffivi Nouwogou, UNCUMA, Benin

Mechanization from an Industrial Development Perspective: Stravos Papastavrou, UNIDO

12:00 Q&A, Toward a Synthesis of Experiences from Asia and Africa

12:30 Lunch

13:30 Session 3: Sustainable Agricultural Mechanization: Overview of Public-Private Partnerships (PPPs)

Chair: Marco Pezzini General Secretary (FederUnacoma, Italy)

Public sector perspective in Kenya: Eng. Jasper Nkanya

Ignacio Ruiz, Spanish Association of Agricultural Machinery Manufacturers (ANSEMAT) and Agrievolution delegate

PPP Models, Rwanda, Hans Balyamujura Rwanda, AGRA

German Machine Ring Models: A. Hastedt, Germany

PPPs in Nigeria: Innocent Originye, Nigeria

PPPs and Conservation Agriculture: Mtendere Mphatso, Zambia

Moderated Q&A

15:30 Coffee/Tea

16:00 Session 4: Sustainable Agricultural Mechanization: Forging the Next Generation of PPPs

Chair: Saidi Mkomwa, Executive Director, African Conservation Tillage Network (ACT)

Facilitated Match-making Platform for PPPs

Discussion, Q&A

17:30 Session ends

18:30 Reception (Safari Park Hotel)

Friday, December 2*Recap of Day 1 by Moderators***09:00 Session 5: Financing for Sustainable Agricultural Mechanization in Sub-Saharan Africa***Chairs: Abdoulaye Toure, World Bank (Lead Agriculture Economist) and Martin Hilmi, FAO, (Mechanization economist)***09:05** Opening Presentation: C. Muller (German Development Institute, DIE)**09:20** Panel Discussion Bringing Diverse Perspectives, Common Goal – Voices from Banks, Farmers, Public and Private Sectors, Civil Society, Academia

- John RIGGAN L3 Consortium

- Jonas Chianu, AFDB

- C. Muller, DIE

- Mary J Porter, Innovare Advisors

10:30 Coffee/Tea**10:45 Session 6: Strategic Planning and Forming New Models for Action and Impact***Chairs: Gichuki Muchiri (University of Nairobi) and Joseph Mpagalile (FAO)*

Formation of Strategic Working Groups, by theme (PPP, knowledge, regional centre)

- **Theme 1:** New collaborative models of Private-Public Partnerships (including finance for demand enhancing models for sustainable mechanization, etc.)
- **Theme 2:** Modalities, approaches for establishing a global sustainable mechanization knowledge exchange platform
- **Theme 3:** Suggestions/proposals for the establishment of a regional Centre for Sustainable Agricultural Mechanization in Africa (and how to fund it with private-public efforts?)

12:30 Lunch**13:30** Working Group Reports

Theme 1: New collaborative models

Theme 2: Sustainable mechanization knowledge exchange platform

Theme 3: Africa Regional Centre for Sustainable Mechanization (CSAM – Africa)

Moderated discussion, Q&A

15:30 Coffee/Tea**16:00 Session 7: Plenary, Sustainable Mechanization Strategy for Sub-Saharan Africa***Moderator: Peter Chisawillo and Alioune Fall*

- Elements of a Framework, Geoffrey Mrema (Sokoine University of Agriculture)
- Policy Formulation Working Groups, Mataba Tapela (University of Botswana)
- Charting the Way Forward, Joseph Mpagalile (FAO)

17:00 Closing Session

Concluding Remarks by Josef Kienzle (FAO) and Chakib Jenane (World Bank)

Vignettes from the Consultation: Sarwat Hussain, World Bank

17:30 Official Closing: Gabriel Rugalema, FAO Representative, Kenya**17:45** Session ends**Saturday, December 3****0730 - 1800****Session 8: Field Visits (Sign-Up Sheets available at Registration Desk)**

- Mechanization Hubs and Small-Scale Entrepreneurial Service provision
- Large scale mechanised precision Conservation Agriculture wheat farming
- Manufacturers and Equipment Suppliers: AGCO (Massey-Ferguson, John Deere)

Appendix 3: Meeting participants

First Name	Last Name	Country	Position
Boubacar	Adamou	Niger	Directeur du C/DARMA
Ahmed D.	Adekunle	Nigeria	Senior Technical Adviser To The Honourable Minister of Agriculture Mechanization, Nigeria
Emmanuel	Ajav	Nigeria	Dean Faculty of Technology
Dinah Grace	Akello	Italy	Ambassador/Head of Mission; current Chairperson Africa Regional Group, Rome
Tito	Arunga	Kenya	Head of Agribusiness Unit
Edward	Baars	Nigeria	International Institute of Tropical Agriculture (IITA)
Hans	Balyamujura	South Africa	CEO - Zed Group Limited
Sabdiyo D.	Bashuna	Kenya	didoecta.Int
Jit	Bhurji	Kenya	Chairman- Farm Engineering Industries Limited
Stephen	Biggs	United Kingdom	Research Associate- School of African and Oriental Studies (SOAS), University of London
Roger	Bird	United States	Founder, CEO
Gabriel	Boateng-Appiah	Ghana	MANAGER, ENGINEERING & INDUSTRIAL DESIGN CENTRE - GRATIS FOUNDATION
Robert	Bowen	Somalia	Head of Production Infrastructure for Agriculture- FAO-Somalia
Marcos	Brandalise	Kenya	Brazafic Ltd
Jason	Brantley	South Africa	Managing Director, sub-Saharan Africa- John Deere
Monica	Buyu	Kenya	Administration Officer- African Conservation Tillage Network (ACT)
Musa	C. Sang	Kenya	Engineer
Mamane	Chekarao	Niger	Ministère de l'Agriculture du Niger
Jonas N.	Chianu	Cote D'ivoire	Principal Agricultural Economist- African Development Bank
Walter N.	Chigwada	Zimbabwe	Mealie Brand (A Division of Zimplow Holdings Limited)
Peter	Chisawillo	United Republic of Tanzania	Director – Intermech Engineering Ltd
Sean De	Cleene	Kenya	AGRA
Alessio	Colussi	Kenya	Head of Crops and Agribusiness Sector- FAO Kenya
Peter	Craufurd	Kenya	Strategic Programme Leader- CIMMYT
Alan	Crossan	South Africa	Lonrho

First Name	Last Name	Country	Position
Rajshekhar	Dravid	India	Chief Operating Officer- EcoDev
Hamisi	Dulla	United Republic of Tanzania	Country Manager- CFU/ACT Tanzania
Alioune	Fall	Senegal	Director General - Institut Sénégalais de Recherches Agricoles (ISRA)
Alessandro	Gimona	Italy	Director -International Business Development- Agro Tractors
Ayub	Gitau	Kenya	Professor and Chairman
Bagan	Gontrand	Benin	Afrique de l'Ouest
Martha	Haile	United States	Head of Operations
Hussein	Haji	Somalia	Executive Director. Somali Agricultural Technical Group
Enamul	Haque	India	Murdoch University, Australia
Andreas	Hastedt	Germany	Manager Machinery Ring Harburg
Martin	Hilmi	Italy	Mechanization Economist - FAO
Sarwat	Hussain	United States	Head of Communications, Agriculture Global Practice- World Bank
Chakib	Jenane	United States	Sr. Agribusiness Specialist
Afeikhena	Jerome	Nigeria	Consultant
Richard	Jones	Kenya	Chief of Party, Scaling Seeds and Technologies Partnership (SSTP)
Scott	Justice	Nepal	Consultant- CIMMYT
Mamadou	Kane	Cote D'ivoire	African Development Bank - Senior Rural Infrastructures Engineer
Maina	Kariuki	Kenya	BrazAfric Ltd.
Pascal	Kaumbutho	Kenya	Chairman- Kenya Network for Dissemination of Agricultural Technologies (KENDAT)
Josef	Kienzle	Italy	Agricultural Engineer / Mechanization Team Leader-FAO
Hellen	Kirikiru	Kenya	BrazAgro Ltd
Jane	Kiringai	Kenya	World Bank
Philip	Kiriro	Kenya	Chairman- East Africa Farmers Federation (EAFF), Nairobi
Peter	Kuria	Kenya	Program Officer - African Conservation Tillage Network
Joern	Lemvik	Norway	Secretary General
Laoudan	Maimbe Nelede	Chad	Ministry of Production, Irrigation and Agricultural Equipment
Altine Mahamane	Mariama	Niger	Coordonnatrice Adjointe PPAAO/niger
Walendom	Mbeteamngar	Chad	Director Rural Equipment and Agricultural Mechanization- MoA/Chad
Erastus	Mbugua	Kenya	Consultant
Meaza	Melkamu	Kenya	Policy and Strategy Adviser - African Conservation Tillage Network

First Name	Last Name	Country	Position
Nomathemba	Mhlanga	Ethiopia	Agribusiness Economist-FAO
Valentine	Miheso	Kenya	AGRA
Saidi	Mkomwa	Kenya	Executive Secretary - African Conservation Tillage Network (ACT)
Mark	Moore	United Kingdom	AGCO Ltd.
Jean	Moreira	Senegal	Senior Researcher- Africa Rice
Joseph	Mpagalile	Italy	Agricultural Engineer/ Mechanization Team - FAO
Mtendere	Mphatso	Zambia	Project Coordinator – FAO CASU Project
Geoffrey	Mrema	United Republic of Tanzania	Sokoine University of Agriculture
Gichuki	Muchiri	Kenya	Senior Lecturer- University of Nairobi
Corinna	Mueller	Germany	German Development Institute, DIE
Christine	Mukami	Kenya	
Beatrice Nkatha	Munyi	Kenya	Tharaka North Service provider
Stanley	Muriuki	Kenya	Laikipia Farmers Association
Joseph	Mutua	Kenya	Program Manager and Team Leader
Joyce	Mwangi	Kenya	Assistant Manager- Projects - Toyota Tsusho East Africa Limited
Pierre Claver	Nahimana	Burundi	CEO COGERCO
Cyprien	Ndayegamiye	Burundi	Advisor to the Cabinet- Government
Miriam	Ndungwa	Kenya	Makueni County Farmer
Aifa Fatimata	Niane	Senegal	Sr. Agro-economist- World Bank
Koffivi	Nouwogou	Benin	Union Nationale des Coopératives d'Utilisation de Matériel Agricole du Bénin - Coordonnateur National
Gladys	Ogendi	Kenya	Business Development Executive
P	Nyemiki	Kenya	JKUAT
Innocent	Ogirinye	Nigeria	Project Coordinator / Technical Assistant to Mech. Team Leader
Barrack	Okoba	Kenya	FAO Country Office
Abdirahman	Osaman Abdi	Somalia	Director
David Ouma	Osamba	Kenya	Rice Cultivator supplier - Trader
Louisa	Parker	Zambia	Director External Affairs - AGCO
Marco	Pezzini	Italy	Secretary General European Affairs- Feder Unacoma
Maximilien	Pierotti	Morocco	Technical Coordinator - UNIDO
Mary Jane	Potter	United States	Partner and Chief Investment Office-Innovare Advisors
Padmanabhan	Rajam Venkatachalam	Zambia	Chief Technical Advisor
Subrata	Rana	India	Ceo & Managing Director
John	Riggan	United States	Innovare
Andriamady	Rondromalala	Madagascar	Chief of Service for Promotion of Agricultural Mechanization

First Name	Last Name	Country	Position
Gabriel	Rugalema	Kenya	FAO Representative
Ignacio	Ruiz	Spain	Chairman of Industry Issues Committee / Secretary General
Robert	Sabiiti	Italy	Uganda Embassy in Italy and Permanent Mission to FAO, IFAD and WFP - Alternate Permanent Representative
Adekunle Sheu	Salau	Nigeria	Economist
Santiago	Santos Valle	Italy	Consultant -FAO-AGP (HQ)
Chombe	Seyoum	Ethiopia	Gedeb Engineering plc
Chintan	Shinde	India	Jomo Kenyatta University of Agriculture and Technology (JKUAT)
Harmander Singh	Sidhu	India	CIMMYT-BISA
Brian	Sims	United Kingdom	FAO - Consultant
Gajendra	Singh	India	Adjunct Professor - Indian Agricultural Research Institute (IARI)
Samuel Adu	Somuah	Ghana	DEPUTY DIRECTOR - AGRICULTURAL ENGINEERING SERVICE DIRECTORATE-MOFA
Tobias	Strohbach		
Mataba	Tapela	Botswana	Acting Vice Chancellor- University of Botswana
Teklu	Tesfaye	Ethiopia	World Bank
Martina	Torma	Kenya	Communications
Abdoulaye	Toure	Cote D'ivoire	Lead Agric. Economist- World Bank
Almut	Van Casteren	Kenya	Managing Director
Jan Willem	Van Casteren	Kenya	Director Market Systems Development
Philip	Wanjohi	Kenya	Finance & Admin. Manager - African Conservation Tillage Network (ACT)
Mutai	Weldone	Kenya	Capacity Building Officer, KIM African Conservation Tillage Network (ACT)
Michael	Winklemaier	Tanzania	Director- AfricaRice
Rabe	Yahaya	Ethiopia	Integrated Mechanization Expert - CIMMYT
Abdifatah	Yussuf	Somalia	UNIDO
Padmanabhan,	Rajam	Zambia	UNIDO

Appendix 4: Field visits in Laikipia county

1. Lengatia Farm

Introduction

A field visit was arranged to Lengatia Farm in Laikipia County on 3rd December 2016. The farm is owned by the Sessions family. The main purpose of this visit was to facilitate enhanced and wider understanding of the mechanization system in SSA focusing on the key theme of the workshop. Lengatia farm is located in Naro Moru one of the counties in Kenya that is characterized by a predominantly semi-arid climate. Annual rainfall in this county ranges from 600 to 900 mm in areas close to mouth Kenya. Since the farm is on the leeward side, it tends to experience inadequate and unreliable rainfall. It is due to these facts that after many years of using conventional farming methods, the owner of the farm adopted conservation agricultural practices. Out of the total area currently under cultivation, the Session family owns 278.8 ha whereas 1 800 ha is rented from the Ol Pejeta Ranch. Owing to the large farm size, the rainfall within the farm ranges from 450 to 600 mm.

The visit

Participants were briefed about the ongoing field mechanization activities so as to learn first-hand the opportunities and challenges. Lengatia farm is one of the large scale farms in Kenya that have opted to use conservation agriculture (CA) in its crop production. Under CA, crop production at the farm is based on three pillars: (i) avoiding or minimizing mechanical soil disturbance (ii) enhancing and maintaining a permanent mulch cover with organic matter in the soil (iii) diversification of the crops through crop rotation. The conversion of the farm's operation to CA has led to great changes in crop production and improvement of the soil quality.

Some of the machines that participants were able to see and discuss their operations included disc plows, disc harrows and chisel ploughs, which are no longer in use. As for the CA equipment, participants were briefed about the operations involving direct seeders, precision planters, hay balers, combine harvesters, boom sprayers and small and large tractors.

Key observations from the visit were:

- Mr. Session provided a history of the farm covering how farming activities have evolved from conventional farming with heavy tillage equipment to the current CA farming practices.
- Mr. Session gave testimony on how converting to CA has enabled the farm to move from debt ridden to profit making year after year. This has enabled the farm to invest more into modern CAN equipment most of them are bought in cash rather than being obtained as a loan as it used to be the case in the past.
- Evidence of heavy investment on machinery (source of power) and CA implement was clear. Support from the bank in terms of loans was also reported.
- The other advantage of converting to CA was reported as being the improvement in the soil quality, which has been observed since converting to CA. As a result of the confirmation on the improvement of soil fertility, the use of inorganic fertilizer has been reduced yearly as the average rate is currently 25 – 35 kg/acre depending on the location. Furthermore, the improvement in the soil structure is attributed to the use of controlled traffic for farm maturity which has led to a reduction in soil compaction and increase in the soil structure.
- It is expected that the learning experience gained from the field visit and the interest that will be generated will help to further promote the role of mechanization in SSA.



Figure 2: Scenes from a visit at Lengatia farm



Figure 2: Scenes from a visit at Lengatia farm

2. Kendat-Agrimech mechanization hub

A group of about 20 workshop participants visited the agri-machinery hub run by an NGO known as Kendat under the commercial name of Agrimech, which is located in Mwireri in Laikipia County. This hub has been established with the support of the Australian Centre for International Agricultural Research, CIMMYT and the Kenya Innovation Engine of USAID. At the site, participants visited a field that had been recently tilled and seeded by Agrimech operators. The farmer in charge of the land together with the commercial manager, the Director and the operations manager of Agrimech explained to the participants the structure and nature of the services provided by the company.

At the time of the visit, the land was infested with weeds even though it was recently seeded with beans and bean plants were in the first stages of post emergence. The farmer expressed her satisfaction with the reduction in costs and time that the use of tractor for land preparation and seeding made compared with traditional use. Agrimech provides only the service of land preparation and seeding, but farmers are the ones to buy and select the weed management inputs.

Also, participants we were informed that in order to be competitive and reach more farmers, their services are being served under a subsidized price.

Agrimech provides land preparation, crop establishment, crop management (spraying and harrowing) and harvesting services in an ample area around Laikipia County. Their aim is to extend the use and acknowledgment of Conservation Agriculture practices, however, the visitors were told that they are flexible and do not enforce CA as a condition to provide the service. Only part of the farmers serviced, are following the three principles of CA.

A demonstration involving the following equipment was made during the visit: An animal drawn harrow which opens furrows to operate the animal drawn direct seeder; a disk plough and an adapted two row direct seeder both pulled by a four wheel tractor; two wheel tractors; a direct seeder and a sprayer. Later on, a brief interaction was made with farmers at the offices, where farmers explained their experiences and wishes regarding mechanization and Conservation Agriculture.



Figure 3: Mechanization activities at Kendat-Agrimech

Consultative Meeting on a Mechanization Strategy

New Models for Sustainable
Agricultural Mechanization
in sub-Saharan Africa



Partners

