Farm Mechanization & Conservation Agriculture for Sustainable Intensification

Review and Planning Meeting

17th to 20th of February 2016, Kibo Palace Hotel, Arusha, Tanzania

List of acronyms

2WT:	Two-wheel tractor
ACIAR:	Australian Centre for International Agricultural Research
AIFSC:	Australian International Food Security Centre
CA:	Conservation agriculture
CARMATEC:	Centre for Agricultural Mechanization and Rural Technology
CGIAR:	Consultative Group on International Agricultural Research
CIMMYT:	International Maize & Wheat Improvement Center
CSU:	Charles Sturt University
FACASI:	Farm Mechanization and Conservation Agriculture for Sustainable Intensification
FAO:	Food and Agricultural Organization of the United Nations
IFPRI:	International Food Policy Research Institute
KARI:	Kenya Agricultural Research Institute
KENDAT:	Kenya Network for Dissemination of Agricultural Technologies
M&E:	Monitoring and Evaluation
SARI:	Selian Agricultural Research Institute
SIMLESA:	Sustainable intensification of maize-legume cropping systems for food security in eastern and southern Africa
SRA:	Small Research and development Activity
SSA:	Sub-Saharan Africa

1. Background of the project

1.1. History of the project until this workshop

20th of December 2011:	First discussions between ACIAR and CIMMYT on the possibility to develop a project proposal looking at mechanizing CA in SIMLESA.
4th of January 2012:	*Selection of Frédéric Baudron as the focal point to develop a concept note on small mechanization and conservation agriculture in Eastern and Southern Africa.*
15th of January 2012:	*First draft of a concept note titled "Mechanization to Leverage sustainable Intensification in Sub Saharan Africa (MELISA)".*
19th of February 2012:	*Submission of a "Small Research and development Activity" (SRA) proposal to ACIAR to finance a research design workshop for the finalization of a Phase 1 proposal (pre-proposal) to be submitted to ACIAR.*
5th of March 2012:	*SRA titled "Research Design for MELISA" granted by ACIAR*
10th to 13th of April 2012:	*Research design workshop in Addis Ababa, Ethiopia.*
14th of June 2012:	*Submission of a Phase 1 proposal (pre-proposal) titled "Mechanization to Leverage sustainable Intensification in Sub Saharan Africa (MELISA)" to ACIAR.*
20th of June 2012:	*Reception of the comments from the In-House Review and invitation to submit a Phase 2 proposal (full proposal).*
6th of November 2012:	*Submission of a Phase 2 proposal renamed "Farm Mechanization & Conservation Agriculture for Sustainable Intensification".*
7th of December 2012:	*Reception of the comments from a first external reviewer on the Phase 2 proposal.*
12th of December 2012:	*Reception of the comments from a second external reviewer on the Phase 2 proposal.*
17th of December 2012:	*Submission of a revised Phase 2 (second version).*

20th of December 2012:	*Small group meeting at ACIAR discussing the Phase 2 proposal and requesting for adjustments.*
29th of January 2013:	*Submission of a revised Phase 2 (third version).*
28th of February 2013:	*Submission of the final version of the Phase 2 proposal (fourth version) following ACIAR comments on the previous one.*
18th of March 2013:	*Project accepted by ACIAR, letter of agreement signed by ACIAR and sent to CIMMYT.*
25th of March 2013:	*Letter of agreement signed by CIMMYT.*
25th to 30th of March 2013:	*Planning event for Kenya and Tanzania in Arusha, Tanzania.*
3rd to 8th of February 2014:	*Planning event for Ethiopia and Zimbabwe in Harare, Zimbabwe.*
11th to 14th of March 2014:	*Review of first year implementation and Planning for the 2nd Year of the FACASI Project (Kenya and Tanzania), 11th to 14th March, 2014*
9th to 14th of February 2015:	*Review of the first two years of implementation and planning for the 3rd year of the FACASI Project (Ethiopia, Kenya, Tanzania, Zimbabwe), and mid-term review, 9th to 14th of February 2015.*

1.2. The project in brief

Rationale

The need for sustainable intensification in sub-Saharan Africa (SSA) is widely recognized. Although a lot of emphasis is being placed in current Research for Development work on increasing the efficiency with which land, water and nutrients are being used, farm power appears to be a 'forgotten resource'. However, farm power in SSA countries is declining due to the collapse of most tractor hire schemes, the decline in number of draught animals and the decline in human labour (e.g. stemming from rural-urban migration and pandemics). A consequence of low farm mechanization is high labour drudgery, which affects women disproportionally (in, e.g. weeding, threshing, shelling and transport by head-loading). Undoubtedly, sustainable intensification in SSA will require an improvement of the farm power balance through increased power supply - via improved access to mechanization -

and/or reduced power demand via energy saving technologies such as conservation agriculture (CA).

Objectives

The overall goal of the project is to improve access to mechanization, reduce labour drudgery, and minimize biomass trade-offs in Eastern and Southern Africa, through accelerated delivery and adoption of 2WT-based technologies by smallholders.

The project has four principal objectives:

- To evaluate and demonstrate 2WT-based technologies to support CA systems, using expertise and implements from Africa, South Asia and Australia.
- To test site-specific commercial systems to deliver 2WT-based mechanization.
- To identify improvements in national institutions and policies for wide adoption of 2WT-based mechanization.
- To improve capacity and create awareness of 2WT-based technologies in the sub-region, and share knowledge and information with other regions.

Methods

The proposed project will be implemented in Ethiopia, Kenya, Tanzania and Zimbabwe. A range of methodologies will be employed by the project in these sites, including: (1) on-station and participatory on-farm evaluation of 2WT-based technologies; (2) business model development; (3) institution and policy analysis; (4) establishment of a permanent knowledge platform; and (5) establishment of an international mentoring platform aiming at building research capacity in the NARS by funding mentoring and training visits from countries such as Australia and India, and exchange visits between Africa and Australia/South Asia. A common M&E system including gender disaggregated data will be developed.

Partnerships

The project will operate in eight sites (two per country) half of them selected as a subset of existing ACIAR-funded project sites (SIMLESA and ZimCLIFS), the other half representing sites where NARS have conducted long-term CA and/or mechanization work. The project will be implemented mainly via national agricultural research centres (or national NGOs) and regional networks in each participating country. There will be strong links with CGIAR, Australian and Asian partners who will provide specific training on agricultural engineering, as well as mentoring, capacity building, and academic support. CIMMYT will coordinate the project implementation through its Ethiopia office.

Output and Impact

A large body of knowledge will be generated and strong linkages amongst stakeholders (including private sector actors involved in business models) will be established. Thus, at the end of the project, we anticipate that ~360 rural service providers would have emerged, ~9,900 farms would benefit from 2WT-based CA, and ~25,200 farms would benefit from 2WT-based transport, threshing and/or shelling. With service providers expected to double their income, smallholders adopting 2WT-based CA expected to increase their income by 50% and smallholders adopting 2WT-based transport, threshing and shelling, expected to increase their income by 20%, such an adoption pathway would translate into an approximate cumulative economic value of US$ 19 million at the end of the project.

The full program is in Annex 1

2. Day 1: introduction, learnings

2.1. Participants' introduction

See list in Annex 2

2.2. Welcome remarks (Dr January Mafuru)

- Drudgery affects productivity
- Large machines are too costly
- Agriculture is no longer attractive to the youth, and the youth is migrating to urban areas
- Role of the youth along the value chain, not only in production
- FACASI makes a contribution not only at the farm level, but also at higher level
- SARI feels FACASI is researching on an area that needs to be emphasized more, and expanded to other areas

2.3. Official opening (Dr Hussein Mansoor)

- We are back in Arusha where the project was launched, 3 years ago
- The majority of food production in Tanzania comes from small-scale farmers
- This type of agriculture depends on the hand hoe
- This project aims at improving rural livelihood through small mechanization
- Land preparation, sowing, and post-harvest operations are the most tedious ones
- The fact that the project works on agribusiness and policy is commendable. This is very important for sustainability
- The Government of Ethiopia is supporting public-private partnership, which appears to be at the core of the project
- Importance of the involvement/representation of innovation platforms, financial institutions, farmers' groups, etc.
- Reviewing the project achievements since its inception is of key importance to project members, but also smallholders and actors along the value chain
- Mainstreaming FACASI products is of high importance for the government of Tanzania. The Government fully support small mechanization and has imported thousands of 2WTs.

Figure 1: left - Dr January Mafuru (left) and Dr Hussein Mansoor (right) addressing the participants

2.4. AIFSRC/ACIAR remarks

- ACIAR in Africa only works in Eastern and Southern Africa
- Small Research Activity (between 100 and 200 kAus$) may lead to larger grants
- Project should have an Australian partner, and an international partner. They are the ones to approach ACIAR in Canberra.
- Other things ACIAR does include, for example
  - A biosecurity training (involving 10 countries in ESA, which will form a community of practice): big impact for money
  - Demand-led plant-breeding (partnership between Syngenta, Crawfurd fund and ACIAR)
  - Australia-Canada partnership: CultiAF. Ending in 2016. Perhaps a second phase. CultiAF includes supporting projects; focusing on communicating science and expanding business opportunities.
- ACIAR is moving to Sharepoint systems
- ACIAR is in a phase of annual report and strategy
- Emphasis on project linkages mid 2016 (mentioned in proposal but not always happening, lots of redundancies. A meeting is planned to bring all the PLs from African project to discuss this.
- 2nd phases with like-minded donors (as the ACIAR funding for Africa were cut by 70% in 2015)
- ACIAR investments should sit in policy priorities
- 2014-18 strategic plan: new technologies, new knowledge, greater capability, better decision-making
- AIFSRC merged into ACIAR but communication policy doesn't change. But from now on, all ew projects will be ACIAR projects
- ACIAR funding to SSA will remain at 15%... but the overall budget is not known

Question: the AIFSRC had a very short life. What was the rationale to close it?
Answer: the center had a very good review. The reason to close it was about confusion between AIFSRC and ACIAR

Question: What king of project will be considered for SRA?
Answer: It will have to be research project. ACIAR mandate is about innovation. There has to be a RQ, a hypothesis.

Question: regarding the demand-led breeding, given the current stresses (diseases, etc), isn't current breeding answering demand

Answer: There has been situation where new breeds are just sitting in station and have not been adopted by farmers. Are they looking at taste, cookability, etc? The point of view of Syngenta is: is it a seed that will sell? Is there farmer deman? Etc. Some crops (e.g., cassava) are also not considered by the private sector.

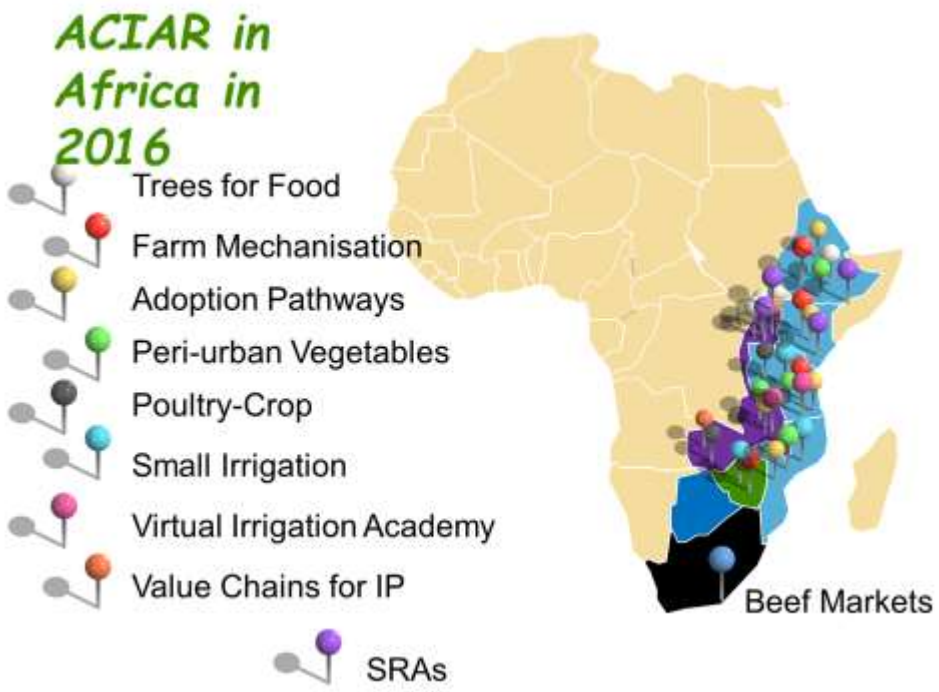

Figure 2: ACIAR projects in Eastern and Southern Africa in 2016

2.5. Where are we after 3 years? (Frédéric Baudron)

- We now have a well-developed 'FACASI rationale' that we have been presenting in a number of fora
- We have a 'proof of concept' for appropriate mechanization in SSA that we need to publish (Why small mechanization? What machine for what context? How to deliver small mechanization in different context? Which policy environment is suitable to the spread of small mechanization?)
- The Ethiopia wheat-case and the Zimbabwe maize-case are also interesting business cases
- We also need to publish our less tangible results in terms of lessons learnt: what worked and what didn't (in terms of technologies, business models, approach, partnership, project design, etc).
- We should rethink the niche where some mechanization fits
- We should also think of our approach (step-wise) and the importance of the third step: demand-creation
- Many donors are co-funding FACAI, proving that the concept in sound (if an idea is good, somebody should be prepared to pay for it): Africa RISING, GIZ, SFSA, etc.

- What new things could we do in a 'second phase', funded by ACIAR and/or like-minded donors? Research on small mech 'at scale' (D4R). There are still engineering issues (e.g., adaptation of machines to African conditions). New innovations in agronomy (e.g., water management, diversification, N fertilization, ridge tillage) may be generated by the introduction of small mech.
- The AUD/USD exchange rate is putting pressure on the project, and CIMMYT HQ is advising to close earlier
- But the rate of expenditure of several partners is low. It should be understood that there will be no no-cost extension. In addition, CIMMYT will not be in a position to prefinance any partner activity (this has created a lot of difficulties for CIMMYT)
- Let us be analytical during these few days

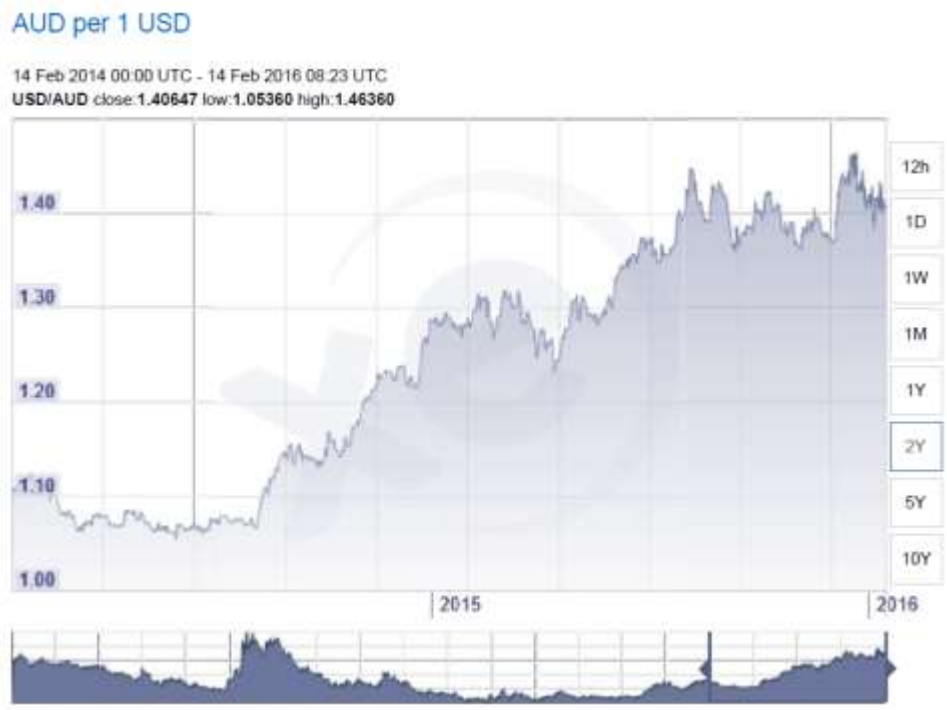

Figure 3 – AUD/USD exchange rate in the past 2 years.

Question: your presentation didn't cover well the issue of scaling out, which is essential
Answer: our strategy for scaling out is dissemination through communication (led by ACT – I hope that we can lay the foundations for 5 publications during this RPM: why? What? How? Which? And lessons learnt).

2.6. Learnings from Tanzania (John Sariah)

- Limitations with objective 1:
    - Limitation to maize and legume. What about other crops e.g., paddy rice?
    - Focus on CA. But most farmers tend to plough still, and these seeders work well in ploughed fields.

    - Focus on 2WTs. What about other small engine-operated machine such as tomato seed extractor, forage chopper, etc.
- Good linkages with importers, manufacturers, and financial institutions
- Contract services in Arumeru, and service provider model in Arumeru and Mbulu
- Lease business model (signed deal between rural service providers and local importers) difficult because of lack of trust between importers and service providers and because of monitoring costs
- Need for policy improvements: (1) include spare parts in the tax exemption, (2) loans targeting the youth groups, (3) empower local manufacturers, and (4) establish financial institutions to specifically support mechanization.
- Field demonstrations re key to create demand (10 farmers purchase a 2WT after one single field day)
- Good linkages with other ACIAR investments: SIMLESA (small mech expanded in Karatu) and VINESA

Figure 4 – (a) and (b) Field demonstration in collaboration with the dealer FARM EQUIP; (c) 2 individual purchasing 2WT as a result of the field demonstration, and (d) a new service provider and his newly acquired 2WT.

Figure 5 – 2WT-based trailer/thresher/forage cutter ready for dispatch in SIMLESA sites.

Q: Were you able to calibrate the planters the required level? If yes why is there a plant more than the calibrated amount?
A: Yes the planters were calibrated but the difference arises due to the fact that the situation on the farm turned out to be different from the calibration. Moreover, the soil type and moisture also had also and influence.

2.7. Learnings from Kenya (Pascal Kaumbutho)

- Challenges
    - FACASI assumed a relatively theoretical industrial, technical and operational ground
    - Difficulty of investigating best bet machinery… whilst promoting business models
    - Weak 2WT support and utilization scene
    - Weak linkages with SIMLESA
    - Tension research vs. development
    - Farmers not used to project promoting business instead of giving handouts
    - Low budget for equipment
    - Difficulties to demonstrate the multipurpose use of tractors (because of competition for time between research activities to demonstrate 2WT-based CA and development activities to demonstrate the multipurpose use of tractors).
- What worked?
    - Mechanization was put back on the agenda and at the center of the mandate of KENDAT
    - Best-bets identified
    - Attraction of additional support (e.g., USAID KFIE, potato platform)
    - Strong consortium of partners, gathered around Hubs
- Way forward for FACASI Kenya:
    - Have one Mechanization Hire Hub in each of Laikipia/Meru
    - Equipment in Bungoma was passed to service providers
    - Locals are helping build ownership through KFIE support to mapping, recruitment, business design

- Local hirers / service providers and their ready market are integrated
- User microfinance scheme

- Building a successful business model
  - Hub launch and services
  - Understand local mechanization needs
  - Build a business case for each service
  - Build business cluster (IP) among identified stakeholders
  - Train service providers beyond but with mechanization as entry point
  - Avail range of power and equipment for hire at a hub with room for other agribusiness services
  - Organize exposure, information exchange, value-addition etc. and links to markets

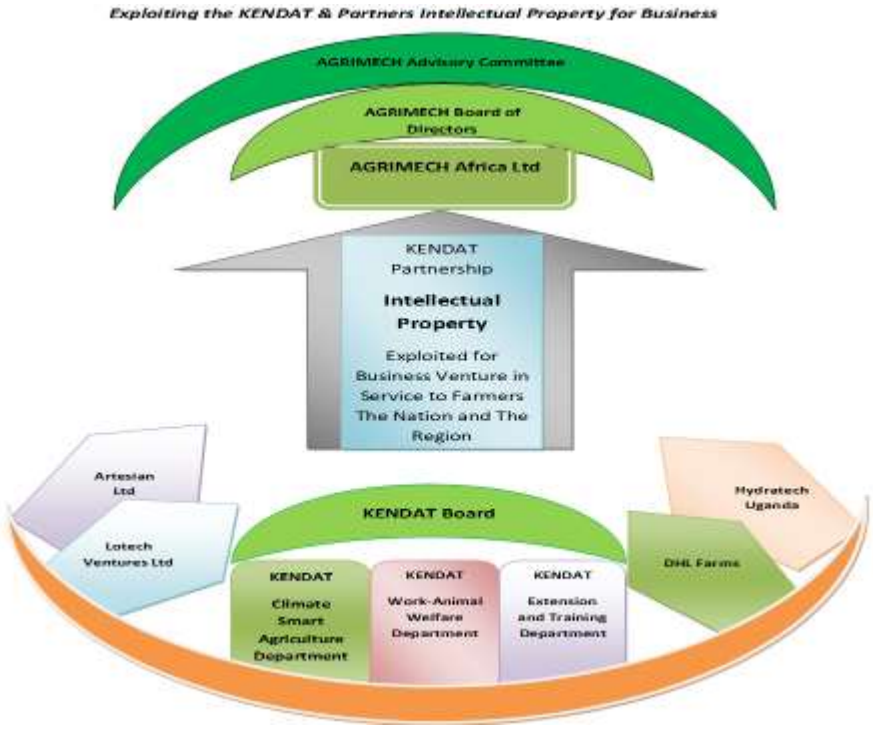

Figure 6 – KENDAT's Hub business model.

Q: What are the most popular mechanization services?
A: Seeding (wheat and maize) and boom spraying

Q: What are the incentives for the actors operating the HUB?
A: The main incentive is to get all information and services in one place e.g., technical advice, agricultural implements and inputs, market linkage support and financial support (loan).

Q: Why is the adoption of CA so low after all these efforts?
A: One main reason is the lack of equipment to warrant adoption at large scale.

Q: Can we get best bet specifications for Kenyan conditions at the end of the project?
A: Yes and No. Yes because there is a development in that respect e.g., the development of the hybrid planter. No because FACASI is a project designed to evaluate. Moreover the variables to consider as several and specifications will have to differ from place to place.

2.8. Learnings from Ethiopia (Girma Moges)

- Lessons learnt
    - Evaluation of 2WT technologies based on plant population, field capacity, yields and fuel consumption
    - Service providers engaged beyond project sites
    - Fitarelli planters (2 or 1 Row) not suitable for wheat
    - Different model of business model established
    - Linkages established – METEC to SP. Provided 70% loan with Gvt guarantee
    - Project duration limited
- Emerging issues
    - Reduction in drudgery not always clear (e.g., walking time behing a sigle row seeder)
    - Safety issues - training is critical
    - Selected test sites not suitable for 4WT
    - Socio-economics of the 2WT technologies didn't come out clearly.
    - Systems and management issues:
    - Single row seeder for wheat? When herbicides, what crops in the rotation?
- What didn't work
    - Delays in the procurement of equipment and in the establishment of effective partnerships.
    - Limited project budget for purchasing inputs and for capacity building of importers (concentrated on few importers, manufacturers and dealers)
    - Short project duration to properly commercialize 2WT and CA equipment
    - High expectations in terms of service provision (each SP is expected to provide direct seeding services to 20-30 smallholders and threshing/shelling and transport services to at least 70 smallholders.
    - No financial product adapted to the purchase of machinery
    - Delays from MTR to import/manufacture implements for demand creation
    - No personnel at project site to follow up day to day activities

Q: As one FACASI objective is to reduce drudgery and help women, why is the impact on women not reflected in the report? Why the issue of safety is also not raised?
A: With regraded to gender, the expectation during the life of the project is to establish awareness while the impact is to be realized in the long run. There will also be a qualitative evaluation at the end of the project to gage progress. Moreover there is an initiative being undertaken in collaboration with Wagengen University and a high level training is also to be provided to the gender experts of the countries.

Q: How do you explain the demand for 2WT in Assela, which has high levels of mechanization?

A: Fields in Assela are not accessible to 4WTs (no feeder roads) and fields are too small and fragmented for 4WT-based mechanization.

2.9. Learnings from Zimbabwe (Raymond Nazare)

- The CIMMYT umbrella and connections facilitated equipment sourcing
- On station plots (small) cannot generate information that feeds into costing of business models e.g. travelling distances, farmer field shapes, fuel consumption rates and work rates
- Field days are a marketing platform to get a buy in from farmers and potential service providers
- Messages should address both hardware and conservation agriculture aspects
- Be prepared to answer equipment sourcing/skills training questions at field days
- The project had to go back and replant 4 of the field demonstration sites due to the erratic rains and poor soil moisture else farmers would have attributed the poor germination to the hardware (training need for SP's on moisture issues?)
- In 2 years, the number of retailers increased from 3 to 9.
- The best performing equipment may be the most expensive and end up contributing to a loss making operation.
- The lowest cost equipment may have good field performance but fail to overcome drudgery issues with the operator having to walk 11km minimum to plant a hectare of maize or 22km to plant a soya bean crop.
- The equipment with best performance in planting maize may be the least versatile (Morrison)
- A strategy that combines manufacturing training and creating strong linkages with external suppliers of low cost well performing critical components of implements will speed up local R&D.
- Actual planting time turned out to be a third of that estimated with obvious implications on service provider planting incomes
- If farmers fail to access the 2wt planting service within 3 days after a rainfall event exceeding 20mm they adopt traditional systems based on manual or animal draft options.
- Given the current erratic rainfall patterns, farmers are not prepared to plant more than 3 days after a significant rainfall event (>20mm)
- The Facasi concept is a system. A system is only as strong as its weakest link. Generating demand amongst farmers is the current weakest part of the supply chain in Zimbabwe

Q: What is the guideline for SPs about?
A: In the past we have been too restrictive to the SPs in terms of the choice of implements. With the guideline the SPs are left to make their own decisions.

Q: what is your experience with respect to mentoring the SPs: is there a need for a permanent person in place to mentor?
A: The SPs require regular follow up. However the support should be in a technical aspect not in the operational and managerial as the SPs need to be left to make their own decision

Q: As FACASI operates in the same area as ZimCLIF, how extensive has been the collaboration between the two projects?

A: The collaboration was rather informal. There is talks now to formalize linkages, under the leadership of Liz Ogutu.

Comment: When talk of drudgery one should be site specific
Walking 11 km with hard work behind a walking tractor is not simple.

Q: Are there SPs who have emerged outside of the project area?
A: Not aware of anyone yet but there has been a demand raised to buy the machines after demonstrations have been made. It should also be noted that exposure alone would not bring about demand which needs time.

Q: What is the benefits of collective action in terms of formation of SPs in group?
A: Economies of scale for the members of the group

Q: What is the best bet planter you would recommend?
A: A machine with high capacity, able to plant large areas and shift between maize and soybean planting

Q: What is your exit strategy for the sustainability of the SPs?
A: Capacity building and letting institution come on board and take the responsibility of follow up and support, and also letting manufacturers provide technical support.

2.10. Synthesis of the learnings (David Kahan & Frédéric Baudron)

The following points were mentioned, which can be grouped in 3 categories:

- Technical issues
    - CA vs. post-harvest and transport
    - 2WT vs. 4WT niches
    - Cost vs. drudgery/durability
- Issues of processes
    - Brokering by national coordinating institution
    - Capacity building (technical issues, management issues, safety)
    - Demand creation and its challenges (e.g. sub-leasing by SARI)
    - Gender (access to service, gender division of labour, control over resources, intra-household decision making, values and assumption)
    - Economic analyses
- Possible phase 2
    - National scaling out projects (where a proof of concept exists) but regional umbrella project (exchange of expertise, equipment, etc)
    - Guarantee fund for credit to service providers

3. Day 2: Comparative analyses

3.1. In what policy environment is appropriate mechanization likely to spread?

The outcome of the country specific group exercise on selected policy related questions is found in Table 1 below.

Table 1 - outcome of the country specific group exercise on selected policy related questions

Question s	Ethiopia	Tanzania	Zimbabwe	Kenya
1. List at most three successfully and widely spread agricultural mechanization technology in TAN/KEN/ETH/ZIM.	• Tractors • Improved plows • Shellers • Pumps • Donkey cart • Combine harvesters	• Land preparation (ploughing) PT, 4WT, OX ploughing • Post-harvest processing • Transportation – Trailers	• Animal draft power (Ploughing) • Tractor power • Maize milling • Transportation –Scotch Cart	• Animal feed chopper • Animal draft power • Mobile phone
2. What policy or institutional arrangement(s) supported the spread of the specific agricultural mechanization?	• No policy/ strategy specific to mechanization agricultural • Agricultural mechanization strategy • Government research and extension system • Existence of dealers	• Tax exemption for agro machineries • Private sector involvement in mechanization • Establishment of Agri-financial window support	• Highly developed extension system • Establishment of standing Committee on Agricultural mechanization (SCAM) • Local manufacturing capacity • High demand and capacity	• Duty free importation • GOK extension services • GOK training institutions
3. Any attempt(s) made by the government in spreading agricultural mechanization, but didn't work?	• Treadle pump • BBM • seeders • Supplying agricultural mechanization technology through government channels	• Communal machinery ownership (during villagization) leading to undefined ownership	• National mechanization program 2007-2008 • National agricultural mechanization policy framework 1995-2020 • Public sector tractor hire schemes	• Agricultural mechanization services • Free distribution of agricultural mechanization to groups
4. Why not? What was the missing supporting element contributed to the failure?	• No institutional arrangement in MoA • Extension system does not support mechanization technology, technical backup • No financial system • Top down approach	• Low private sector involvement • After sale service (spare parts, fuel and lubricants)	• Lack of business culture in government • High inflationary environment • Sustainability not integral part of planning process • Imported technologies were week • No service system put in place	• GOK procedures • Poor management • No support systems • No private sector involvement
5. If you have got the chance to talk to a policy influencing Government body in TAN/ETH/KEN/ZIM	• Mechanization strategy • Financial policy (access to credit) • Standardization and certification	• Removal of tax on spare parts • market assurance for agricultural produce •	• Mandate local institutions/private sector to have robust R&D to adopt imported technologies for accelerated adoption and accessibility	• Local manufacturing sectors support • Financing

what are the key two policy related options you propose for a wider spread of smallholder mechanization?	• Incentive mechanisms (tax exemption, subsidy) • Regulatory and support • Policy that supports private sector		• Development of clear mechanization arrangement • Licensing/regulatory duty free spare parts	
6. Do you think that agricultural mechanization has got the necessary attention by policy makers in SSA?	• No	• Yes	• Yes	• No
• If 'No' to Q6, what is (are) the issue (s) you might think that policy makers and development experts know but researchers do not?	• Labor displacement			• Misplaced priorities and no focus on agriculture • Policy makers lack awareness or have limited knowledge of potential of agriculture mechanization sector • Because ways of making money are not as obvious for policy makers.

3.2. How to deliver appropriate mechanization to the largest number of smallholders?

Table 2: Assessment of business models and Management arrangement per country

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
Business models				
1. List the business models being developed in your country	• Group owner/ individual operator model • Individual owner/ operator model – local market, part time SP (farmer to farmer) • Individual owner/ operator model – wider market, full time SP	• Group owner/Operator model (Parachichi group Arumeru) • Group owner/Individual (Amani group Mbulu district) • Individual owner/Operator model-wider market, full time service providers (Mbulu and Arumeru) • Contract farming (Arumeru and Babati) • Dealer-led vertically integrated model (FE and Kishen) • Manufacturer-led vertically integrated model (Elmi)	• Group/owner operator model • Individual/owner operator model • Dealer led collaborative model • Contract farming – corporate owner/operator model	• Group owner/ operator • Individual owner/ operator model – local market, part time SP (farmer to farmer) • Hub • Dealer-led vertically integrated model • Manufacturer-led collaborative model
2. What business models are likely to be **most suitable** in your country contexts and why? (agro-ecology, farming system, market access, enabling environment)	• Group owner/ individual operator model • Individual owner/ operator model – local market, part time SP (farmer to farmer) • Individual owner/ operator model – wider market, full time SP *Cash crop, good income, Feeder road, irrigation, transportation*	• Group owner/Operator model (Parachichi group Arumeru) • Group owner/Individual (Amani group Mbulu district) • Individual owner/Operator model-wider market, full time service providers (Mbulu and Arumeru) • Contract farming (Arumeru and Babati) • Dealer-led vertically integrated model (FE and Kishen) Manufacturer-led vertically integrated model (Elmi)	Group/owner operator model Individual/owner operator model Dealer led collaborative model Contract farming –corporate owner/operator model Dealer led vertically integrated model - FARMSHOP	• Group owner/ operator • Individual owner/ operator model – local market, part time SP (farmer to farmer) • Hub • Dealer-led vertically integrated model • Manufacturer-led collaborative model
3. What are the **weaknesses/ strengths** of the BM?	Weaknesses : Conflict, poor maintenance & service, poor motivation & income /affordability,	<u>Group</u> ***Strengths*** Easy to mobilize fund	<u>Group Owner/operator model: Runene</u> ***Weaknesses***	<u>Group owner/ operator</u> *Strengths* • Social capital • Ready clientele / market

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
(include organization and management)	Strengths: Cost sharing, risk avertion, KS/ Commitment, easy to manage, Motivated. •	-Effectiveness in influencing policy makers. -Able to meet market demand -Market accessibility -Ability to reach more customers ***weaknesses*** Weak group management -Weak business management skills -Weak conflict management <u>Individual</u> *Strengths* -Flexibility in decision making. -High level commitment in business ***Weaknesses*** -Difficult to mobilize without collateral -Challenges in business succession. -Weak business management skills Inability to meet the quantity demanded <u>Contract farming</u> ***Strengths*** -Access to inputs and output markets. -Easy to mobilize fund -Private sector involvement ***Weaknesses*** Lack flexibility because contractual arrangements -Difficult for farmers to meet contract requirements e.g. quality issues	e.g Morefood programme: lack of business culture, political interference, Weak governance issues, ownership!, decision making is slow (esp start up stage), Lack of clear business plans, Poor selection of group (political orientation / dam) Bureaucracy ***Strengths*** Spread the cost amongst members, guaranteed demand from group members, shared risk Guaranteed funding for those in schemes <u>Individual owner operator model – Makonde</u> ***Weaknesses*** High risk since they do not have guaranteed demand ***Strengths*** Increased commitment, speedy decision making, <u>Dealer led vertically integrated – Farmshop</u> ***Weaknesses*** Value of equipment will be higher than market value, *Strengths*	• Collateral / Security for finance ***Weaknesses*** • Slow decision making / disagreements • Conflict resolution issues • Ownership challenges <u>Individual owner/ operator model – local market, part time SP (farmer to farmer)</u> ***Strengths*** • Quick decision making • Ready to take risks • More business focused • Trusted SP ***Weaknesses*** • Harder to access finance • Limited capacity to operate • Takes to develop clientele <u>Hub</u> ***Strengths*** • One stop for services • Crop Value chain support • Training base • Platform for Supply side actors • Quality assurance of Services / Products

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
			Agrodealer doesn't have to pay for equipment upfront, more after service support, Sp will be mentored, One stop shop for the agrodealer-income basegrows, facilities and systems of operations are in place, captive market, <u>Contract farming :</u> ***Strengths*** Assured market for the SP and for the farmer, market for services guaranteed, farmers do not have to pay for services upfront, Capacity utilization of equipment is guaranteed, improve yields for farmers hence ensuring profitability to both parties and ensure farmers continue with the enterprise, better management. *Weaknesses* Input prices higher than the market price for the farmer	• Employment creation • Info / Comms dissemination • Independent private led Service provision ***Weaknesses*** • High capital investment • Heavy management requirement • Heavy infrastructure requirements <u>Dealer-led vertically integrated model</u> ***Strengths*** • Strong support infrastructure • Direct feedback mechanism from farmers • Provide linkages to relevant stakeholders ***Weaknesses*** • Restricts farmers to few manufacturer • Single sourcing risks • Reluctance to try new tech • Can be easily undermined • Could exploit famers

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
				• Working capital constraints <u>Manufacturer-led collaborative model</u> ***Strengths*** • Strong support infrastructure • Direct feedback mechanism from farmers • Provide linkages to relevant stakeholders ***Weaknesses*** • High dependence on big orgs for purchases • Single sourcing risks • Working capital constraints Actions • Develop good linkages with relevant players • Connect to other models Produce products for the Hub
4. What can be done **to strengthen** the business model (including the process)?	• Financial support, Technical support (Training on technical and business skill), Enabling environment	*Group:* -Capacity building; BMS *Individual* - Capacity building; BMS ; establish service providers association *Contract:* Flexibility in contractual arrangements. Training farmers in contract formulations	*Group model:* Shared business plan, training, rehabilitation of irrigation infrastructure, Facilitate market linkages, Capacity building (technical,operational, management) *Individual owner operator:* Skills development (technical,	*Group model* • Capacity building • Group dynamics • Governance structures *Individual owner/ operator* • Capacity building • Strong marketing • Quality service • Pug into networks

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
			mgt, operational), bundling of services *Dealer, vertically integrated* : Building capacity of Farmshop and agrodealer *Contract farming :* Building capacity	*Hub* • Recruitment of stakeholders • Market the concept • Strong management and governance structure • Develop good linkages with relevant players • Connect to other models
5. What are the **lessons learned**?	• Lack of awareness • Weak after sale service • No support actors(credit, training) • Individual interest without policy favor • Affordability • Reliability (Quality)	On-farm demonstrations is the key to capture or create awareness on farm services available Group and contract models are the ways to help more farmers to access farm mechanization technologies and services easily	***Group model:*** Lack of ownership on community property, Encourage membership (commodity associations/farmers association for information sharing access to knowledge, in/output market access) Without external intervention the groups can perform better/ or can break apart ***Individual operator:*** Fast decision making, Increased commitment	• Need for capacity building • Need to structured financing both for SPs. SME and Farmers • Stop free distribution of machinery without understanding farmers requirements • Stop free provision of services and this kills the market • Support required to create the market to gain critical mass
Management arrangements				
1. What are the **management arrangements** that you made with the SPs for the receipt and repayment of	Arrangement with Manufacturer and NGO like IDE	**1.Cash Purchase.** **2. Sub-lease to individuals** -70 percent is for SP and 30 percent for Owner.	<u>Group model :</u> Leasing equipment for a 1 year period to raise money to buy equipment before we take back the equipment to give to another group.	• Payment terms agreed. Full payment within 3 year **Challenges** • Identification beneficiaries

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
machinery and equipment? How **effective** has the system been? What have been the challenges?	Just starting but It was lengthy process	-It has been effective in term of model performance, but payback is still a challenge **Ways of adoption and scaling of 2WT and accessories:** Through establishment of 2WT models (individual and groups) and through on-field demonstration of 2WT and its accessories.	**<u>Group model :</u>** Objective was to create awareness and demand- it worked, increased business as every group member will be looking for business. Challenges: group dynamics – governance issues, Lack of a bank account <u>Individual owner operator</u>: SP paid a commitment fee to access project equipment for one season whilst raising money to buy own equipment at the end of the season. Effective as it got rid of the SPs who were not serious and the committed ones continued What have been the challenges? Willingness does not translate to capability *Dealer led, vertically integrated model :* Not yet. The plan is for a rent to buy model, where the dealer(Farmshop) buys equipment and lease it to the	• Getting bay-in to the concept • Embedded culture of handout

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
			agrodealer, for a one stop shop. Challenges : Not yet. Finding equipment which is compatible with the four wheel tractor, currently have limited attachments. Contract farming : Not yet. A system which captures the inputsand services to every farmer hence in the marketing season Challenges : not yet implemented	
2. What **system** have you introduced to **manage and monitor** field operations?	- Data logger introduced and trained for field operation and follow up , - Frequent field visit	**Management and monitoring systems:** Field visitation, mobile phone and through government staff at district councils(District officers and extension workers).	Group : Record keeping and monitoring of records, extension staff to mentor the group Individual : Record keeping and analysis, involvement of extension staff and mentoring them to offer support Vertically integrated dealer model: Farmshop has installed GPS units on the tractors to monitor the business done.	• Identification beneficiaries • Getting bay-in to the concept • Embedded culture of handout
3. What more can be done to better	- Recording mechanism like bookkeeping - Documentation	**For better management and monitoring;** engagement of district extension system.	Group : Strengthen existing support systems and have minimal interference	• Farm mapping and tracking system

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
manage and monitor them?	- Intensive training on operation and maintenance - Stocking fast moving parts - Establish strong supply chain near to the service provider		Individual : Bundling of services, Capacity building Vertically integrated model : Record keeping system	
4. What have been the ways to encourage adoption/ scaling up			Group: Awareness creation e.g field days, shows, service provision using equipment to interested people etc, involvement of private sector in the R&D of 2WT etc, Adaption of equipment to suit local environment Individual: Demonstrations at schools, field days etc, agricultural shows Vertically integrated dealer model: Using the existing agrodealer network, Awareness creation through demonstrations and finance Contract farming: Using the existing agrodealer network, Awareness creation through demonstrations and finance	• Farmers Field days, demos • Shows and exhibitions •

Table 3 - Site characteristics for 2WT based mechanization and ranking

Rank 1 = low 5 = high

Criteria	**Ethiopia**		**Tanzania**		**Zimbabwe**		**Kenya**	
Location	Hawassa/Dorebafena	Assela	Arumeru	Mbulu	Runene	Makonde Kasoko	Bungoma	Laikipia
Awareness of CA	3		3 Adoption is still low because of land scarcity.		5 CA have long been implemented in the country	5	3	4 Impact of promotions. Influence of large in Laikipia
Road infrastructure	3		3 Are passable to access markets outside their areas		3	3	3	2 Improvements expected in the near future
Policy	1		4 Most of 2WT models provided through government initiatives		4 Regulations which hinder implementation of policy e.g licensing	4	1	1 Lack of political goodwill, high turnover of policy champions; Incoherent implementation strategies
Link to output market			4 Location access to irrigation scheme		2	2, 4 (dealer)	1	1
Cash crops as part of farming system	3		5 Access to irrigation schemes, Market accessibility		2	2, 3 (dealer)	1	3 Laikipia
Access to finance: *Working capital*	1		2		1		1	3

Criteria	Ethiopia		Tanzania		Zimbabwe		Kenya	
Investment capital	1		Lack of agricultural loan packages to farmers(low awareness) -Lack of collateral among farmers 2 Lack of agricultural loan packages to farmers(low awareness); Lack of collateral among farmers **Note:** Most of them use equity capital for working and investment capital		1	2, 5 (dealer) Agrodealer supplies money for fuel 2, 5 Farmshop got funding to promote this		Low awareness and fear of credit Bungoma
Existence of small fragmented households	5		1 Population density is high		5	5, 4	4	3
Fuel:								
Availability	3		5 Closest to Arusha town (More than 15 filling stations)		3	3, 3	5	5
Cost of fuel	3		3 Abundant supply		2	3, 4	3	3
Affordability	3		4 Price relative low(> 1 dollar) per litre		2	4	3	4
Population density	5		4 Small land size			1, 4	4	2

Criteria	Ethiopia		Tanzania		Zimbabwe		Kenya	
Labour constraint (high cost labour)	4		5 Urbanization(rural-urban migration)		1	2, 3	4	4
Availability of draft oxen	3		4 Cultural owned		3	4, 4	1	2 Scarcity of grazing land
Availability of other hire services	2		4 Demand is high		3	3, 3	2	2

Table 4- Cost-benefit analysis: suitability of 2WT based mechanization technologies

4-A. Technological packages per country

Questions	Ethiopia	Tanzania	Zimbabwe	Kenya
Cost-benefit analyses				
1. What technological packages are likely to be suitable and for what cropping system? 'Best fits'	• Threshing/Shelling, Transport, Pumping, Planting	• 2WT- Sheller, trailer, seeders (Gongli Africa, single, and double row Fitarelli) in Maize and legume cropping system.	Makonde : No till planters, transport, spraying, shellers	• Fitarelli, Shellers, Trailer, Sprayers – under maize cropping systems
2. Where are the niches for 2WTs?	• Area with fragmented land, feeder road, Inaccessible to 4WTs plus area dominated by hand tool technology, irrigation potential, animal draught based transport	Rural farm entrepreneurs- because return from farm enterprises.	Runene – transport, Gamanya – planting, shelling	• Small holdings owing to low affordability • Where oxen services are operating
3. What is the 'entry point' for 2WT mechanization?	• Transportation	Shelling and transportation	Depends on the time of the year. Transport business	• Transport, Shelling and Spraying

4-B. Ranking of suitability of 2WT based technologies by country and site

Ethiopia, Assela Site

Rank 1 = low, 5 = high

Criteria	Details	Ripper/ seeder	Sheller/ thresher	Trailer/ transport	Explanation
Location					
Technical factors	*Soils*	5	1	4	Soil texture & structure
	Rainfall	5	3	3	
	Topography	3	1	4	
	Stumps and rocks	4	1	3	
Costs	*Tractor*	5	4	3	
	Accessories				
	Operational expenses	5	4	3	
	Spare parts	4	3	2	Parts are not in country
	Repairs and maintenance	3	4	2	Cleaning, Calibrate
Profitability	*for farmer*	1	1	1	Own operation
	for SP	1	4	4	
	for other support services- workshops etc.	1	4	4	
Existing demand	*How many customers/ ha./ tons/ km. radius?*				
Potential demand	*How many customers/ ha./tons/ km. radius?*	20 customer	1,100 ton	24 KM	
Availability of spare parts	*Spare parts*	1	3	4	
	Mechanics and workshops	2	4	4	
SP skills	*Operational*	1	3	3	
	Entrepreneurial	1	1	1	Very low
	Management	1	1	1	Very low
Effectiveness of distribution channels		1	1	1	
Satisfaction of customers with services offered		1	3	4	

Tanzania

Rank 1 = low, 5 = high

1 easy 5 difficult

Criteria	Details	Ripper/ seeder	Sheller/ thresher	Trailer/ transport	Explanation
Location					
Technical factors	*Soils*	3		3	Clay loam
	Rainfall	4		4	
	Topography	3		2	
	Stumps and rocks	5		4	
Costs	*Tractor*	5			
	Accessories	4			Depends on accessories
	Operational expenses	3			
	Spare parts	4			Depends on brand
	Repairs and maintenance	3			
Profitability	*for farmer*	3	4	4	
	for SP	3	5	5	
	for other support services- workshops etc.		4	4	4= higher
Link to output markets	*Partner with market buyer*	1	5	5	5= high
Existing demand	*How many customers/ ha./ tons/ km. radius?*	1	5	5	
Potential demand	*How many customers/ ha./ tons/ km. radius?*	2	5	5	
Availability of spare parts	*Spare parts*	4	5	5	
	Mechanics and workshops	4	4	5	
SP skills	*Operational*	4	4	5	
	Entrepreneurial	2	3	4	
	Management	1	2	3	
Satisfaction of customers with services offered		4	5	5	

Zimbabwe

Runene site:

Criteria	Details	Ripper/seeder	Shelling/threshing	Trailer transport	Explanation
Technical factors	Soils	4	1	1	The soils are rocky
	Rainfall	4	1	1	
	Topography	1	1	1	
	Stumps and rocks	4	1	1	"
Cost	Tractor	3			
	Accessories	2	2	2	
	Operation expenses	2	1	1	
	Spare parts	3	1	2	
	Repairs and maintenance	2	2	2	
Profitability	For farmer	3	2	2	
	For Sp	3	2	2	
Existing demand	How many customers/ha/tons/km/radius	50	60	200	
Potential demand	How many customers/ha/tons/km/radius	150	100	500	
Availability of spare parts	Spare parts				
SP skills	Operational	2	2	2	
	Entreprenurial	4	4	4	
	Management	3	3	3	

Individual /operator model / Kasoko site

Criteria	Details	Ripper/seeder	Shelling/threshing	Trailer transport	Explanation
Technical factors	Soils	2	1	2	The soils are rocky
	Rainfall	2	1	2	
	Topography	1	1	1	
	Stumps and rocks	1	1	1	"
Cost	Tractor	3			
	Accessories	2	2	2	
	Operation expenses	2	1	1	
	Spare parts	3	1	2	

	Repairs and maintenance	2	2	2	
Profitability	For farmer	3	2	2	
	For Sp	3	2	2	
	For other support services				
Links to output markets	Partner with market buyer				
Existing demand	How many customers/ha/tons/km/radius	50	60	200	
Potential demand	How many customers/ha/tons/km/radius	150	100	500	
Availability of spare parts	Spare parts				
SP skills	Operational	2	2	2	
	Entreprenurial	4	4	4	
	Management	3	3	3	

Kenya

Criteria	Details	Ripper/seeder	Shelling/threshing	Trailer transport	Explanation
Technical factors	Soils	B – 2 L - 3	N/A	B – 2 L - 4	
	Rainfall	B – 4 L - 4	N/A	B – 3 L - 4	
	Topography	B – 2 L – 2	N/A	B – 3 L - 3	
	Stumps and rocks	B – 2 L – 3	N/A	B – 2 L – 3	
Cost	Tractor	B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	
	Accessories	B – 4 L – 4	B – 2 L – 2	B – 3 L – 3	
	Operation expenses	B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	
	Spare parts	B – 4 L – 4	B – 2 L – 2	B – 2 L – 2	
	Repairs and maintenance	B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	
Profitability	For farmer	B – 4 L – 4	B – 4 L – 4	B – 4 L – 4	
	For Sp	B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	
	For other SP workshops	B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	Catchment area wide.
Links to output markets	*Partner with market buyer*	B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	
Existing demand	How many customers/ha/tons/km/radius	B – 4 L – 4	B – 2 L – 2	B – 2 L – 2	
Potential demand	How many customers/ha/tons/km/radius	B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	
Availability of spare parts	Spare parts	B – 4 L – 4	B – 2 L – 2	B – 2 L – 2	

	Mechanics and workshops	B – 4 L – 4	B – 2 L – 2	B – 2 L – 2	
SP skills	Operational	B – 4 L – 4	B – 2 L – 2	B – 2 L – 2	
	Entreprenurial	B – 4 L – 4	B – 2 L – 2	B – 2 L – 2	
	Management	B – 4 L – 4	B – 2 L – 2	B – 2 L – 2	
Strength of partnerships		B – 4 L – 4	B – 4 L – 4	B – 4 L – 4	
Effectiveness of distribution channels		B – 4 L – 4	B – 4 L – 4	B – 4 L – 4	
Satisfaction of customers with services offered		B – 2 L – 2	B – 2 L – 2	B – 2 L – 2	

Findings and Lessons Learned from Business Model Analyses

Findings

Although hire services, particularly for tractors, can be successfully provided through private or cooperative ownership, policies and other support systems need to be in place to support hiring or leasing services. Since the role of hiring and rental markets for privately owned and operated tractors is likely to increase in the future, it is important to understand factors affecting the development and sustainability of rental markets for machinery.

The findings from the project to date suggest that business models located in higher potential areas with higher value cash crops as part of the farming system and more developed access to markets through more formalized value chain linkages, create a conducive environment for private sector led development (Kenya, Zimbabwe and parts of Tanzania). Dealers and manufacturers are more likely to drive the chain given the incentive system. The more consistent revenue flow also provides the incentive for independent owner operated custom hire services to flourish. The potential exists for stronger backward linkages to other supply chain actors – mechanics, dealers, spare parts stockists. A prerequisite for value chain development in this situation is the conduciveness of the enabling environment – physical transportation links, availability of finance and policy level incentives – to promote entrepreneurship. These attributes are best reflected through the contract farming model where mechanization is viewed as part of a package of commercial services whilst providing farmers with an assured market outlet for sales of raw materials.

A contrasting situation can be found in the more remote areas where markets are weak (such as Ethiopia, parts of Tanzania). These locations are often characterized by more vulnerable smallholders with a lower value cropping systems that comprise staples. This is particularly relevant for potential clients neglected because of gender, ethnicity and other social barriers. Where smallholders (male and female) cannot afford to purchase the machinery directly owing to lack of access to finance, group ownership of mechanization technologies are more likely to be found. The organization of these farmers into groups, associations, clusters or networks provide opportunities for sharing the costs of the capital equipment, generating economies of scale and reducing transaction costs. When they adopt gender-sensitive practices, collective action can also increase women's empowerment, voice and representation in decision-making whilst enhancing access to markets and services. However, the performance of these groups will depend very likely on internal management arrangements and the management incentive system. Collective ownership and management of common assets is generally seen to be ineffective unless management systems are followed that encourage private sector involvement in the custom hiring.

Enabling environmental factors that impact on the development of the market for 2WTs and their accessories are illustrated in the figure above. The figure suggests that Ethiopia is located at the low market development part of the continuum owing to the low demand for 2WTs and accessories, weak

private sector involvement, weak infrastructure and market access, low level of entrepreneurship capacity, limited access to finance for mechanization and intrusive public sector interference. Given these conditions the farmer group, cooperative and service provider group business models are more commonly found in the field, although scattered with some individual service providers.

In contrast, the Zimbabwe and Kenya, represent cases where the enabling environment for private sector entrepreneurship is strong although in both situations the demand for 2WT mechanization and accompanying operations is nascent. A distinction, however can be drawn. Kenya possesses good road infrastructure, strong market access, and a favourable financial environment albeit with a need for new products to support mechanization. Whilst, this largely conducive environment exists there is still limited awareness and demand for 2WTs although the long term trend of land fragmentation may suggest a potential that could be taken up. The business models found in Kenya are most commonly individual service providers – part time SPs and entrepreneurs – as well as the corporate model of the multi-purpose hub that has been designed to provide both goods (spare parts, equipment) and services (hiring services, extension and training).

The Zimbabwe context is similar as far as the potential for entrepreneurship and the available infrastructure, but currently there is much greater awareness and demand for 2WT based mechanization. This is reflected in the predominance of contract farming opportunities and dealer/ manufacturer led collaborative models linking up to individual service providers in the project areas.

Tanzania represents a country case that transcends a wide range of business models and this can be explained by regional and district differentiations in terms of market access, road infrastructure and an entrepreneurship culture. In this situation a range of business models can be found with collective action located in areas where smallholders may be more vulnerable to situations where the supply chain is more developed and private sector importers, dealers and manufacturers are more actively engaged. The main reason for this dynamic towards high market development, is that awareness of the potential for 2WTs exists largely a result of government efforts over the last decade or two with over 6000 units (2014) operating in the country. However, the challenge is to enhance the demand for the conservation based technologies – seeder/ ripper – and threshing/ shelling equipment.

The table below summarizes some of the advantages and disadvantages of the different mechanization hiring schemes discussed above.

Service provision scheme	**Advantages**	**Disadvantages**
Private sector led hiring services	• No long-term capital investment in the machine. The expenses of custom hiring can come from working capital. • Machinery costs are known from the outset • Can release capital and labour for other tasks • Flexibility in matching machinery to farm requirements • Hiring schemes could provide machinery support services • No need to sell machines and implements if production	• Availability could be a problem if there are no service providers in the area. If a machine isn't available at the right time there are likely to be timeliness bottlenecks • Restrictions in the number of hours of use or area could limit the use of the machine. • High cash outlay and a need for sufficient working capital • Possible shortage of competent operators and available machine nearby. • Farmers hiring the machinery will not have complete control over the quality of the operation

	practices change and they are no longer needed. • Farmers pay only for the number of hectares ploughed, sown or harvested, which may could vary from season to season.	• Rental charges may be high with high profit margins and the need to cover the average repair costs. • Owing to poor feeder road systems the market for hiring services may be reduced
Group owned and managed hiring scheme	• No capital outlay for individual farmers • Only requires working capital to cover hiring charges • Less dependence on hired labour • Better use of equipment over a larger area	• Performance depends on organizational management • Could lead to conflicts between members • Machine availability and a potential lowering of maintenance standards • Loss of independence • Need for management agreement (who does what, when)
Contract farming	• Corporate ownership could ensure more effective management of the scheme – providing mechanization services and procuring raw materials from smallholders • Corporation could provide machinery support services • Mechanization support enables companies to ensure regularity and quality of raw materials without taking on the risks associated with acquiring additional land • Especially relevant for high-value, labour-intensive crops – promoting efficiency in the provision of inputs and mechanization services. • Enables farmers to gain access to bundles of technologies – mechanization, credit, seeds extension etc. • Procuring inputs through the company may generate economies of scale that may be passed on to farmers. • The contract farming scheme can help smallholders gain access to more lucrative but remote markets for high-value crops	• Success depends on the specifics of the deal that outgrower farmers reach with corporate management. This in turn depends on negotiating power. Where contract farming accounts for a large share of the farmers' income, or where the company is the only purchaser, monopsony undermines local negotiating power • Contract farming may be difficult to enforce depending on the crop and this could undermine the sustainability of the mechanization scheme. Farmers may be tempted to sell produce on the open market if market prices rise above contract prices • From the company's perspective, supply risks may remain, particularly linked to insufficient or inconsistent quality and quantity of produce or default by contract growers. • Transaction costs related to support services may be high, particularly when large numbers of farmers are involved. • Where the company advances credit for mechanization services and inputs and deducts payments from purchase prices, growers may risk becoming locked into debt. • Poorly defined delivery schedules or quality standards may result in a breakdown of trust. Companies may

	• Smallholders may also develop management skills in commercial agriculture	set delivery schedules so as to influence purchase prices. Similarly there is also a risk of late payments. • Services and inputs provided by the company may be of poor quality.

There are some generalized findings that apply to all models which need to be recognized.

- The purchase of 2WTs was found to be unprofitable particularly for smallholder farmers and rural entrepreneurs located in maize based farming systems owing to the heavy capital investments involved. Hiring services for farmers both individually or in groups is a more feasible option. Custom hire services transform machine work into divisible inputs which small-scale farmers can find affordable.
- Service providers, who provide a bundle of technologies for multi-farm use and improved economic utilization are more likely to increase their profitability. This was seen to allow expensive equipment to be in productive use for a greater part of the year, reducing the unit cost of custom work.
- Business models for mechanization need to be broadened to consider the need for closer integration between input and output markets. The link between the two markets is critical to generate the revenue flow required to afford either buying or renting farm machinery.
- Gender neutral practices and approaches in developing business models do not necessarily lead to gender equitable results. Investment schemes and policy frameworks need to recognize and address the potential for women to be engaged in business as service providers or other types of rural enterprises. More attention needs to be given to the role of women and opportunities at upstream levels of the value chain beyond the farm family household. A gender sensitive policy environment to support entrepreneurship among women and youth is essential for achieving gender equitable outcomes.

Lessons learned

- The findings from the case study analysis to date show under what conditions and in what contexts a particular model is likely to be found, depending on the location, the farming system, access to markets and infrastructure and an enabling environment conducive to private sector development.
- In short, business models need to recognize the local context and develop in a way that is compatible with the background characteristics.
- There appear to be no clear prescription as to what model works best as the performance of the models depends on operational and management skills, entrepreneurial commitment and the management procedures introduced. Each model has the potential to be effective if the owners and managers are flexible and able to respond through management adaptations to the challenges they face.
- Intermediaries as brokers and facilitators are crucial in facilitating supply chain linkages between the different business models. This is particularly prevalent amongst vulnerable farmers situated in localities with weak market access.

4. Day 3: Field visit

4.1. Visit of EFTA Equipment loans (financial institution)

- EFTA offers up to Tsh 150m financing for equipment
- No collateral required
- A portfolio of trusted suppliers
- Many types of businesses are eligible
- Branches in Arusha, Mbeya, Mwanza, Moshi and Bukoba

Figure 7 – Visit of EFTA.

4.2. Visit of Farm Equip (dealer)

- Collaborates with FACASI- Tanzania in exhibitions & demos
- Diverse range of products
- Network of dealers
- Dealer has to have 50% financing capital
- Offers after-sale-services
- Nationwide reach – 4 outlets

Figure 8 – Visit of Farm Equip.

4.3. Visit of Dorgo Entreprises (Manufacturer)

- Technology from CAMETEC is locally produced by local manufacturer
- Equip is sub leased to service provider
- 70% income realized remains with SP
- 30% remitted back to SARI
- SP provides service to farmers
- Most common service is shelling and transport

Figure 9 – Visit of Dorgo Entreprises.

4.4. Visit of Maweni Community Based Best Practice Hub

- Equipment acquired under a leasing arrangement, 70:30
- Service provision cash basis – serving three villages
- SP period of seven months (Feb – November)
- Services provided – transport and shelling
- No planting services offered
- No CA practiced- hard pan, soil type etc.
- Have proper recordings of the service offered to clients

Figure 10 – Visit of Maweni Community Based Best Practice Hub

5. Day 4: Comparative analyses, way forward

5.1. Why investing in appropriate mechanization? (Frédéric Baudron)

Answering the question: is farm power a major limiting factor in most farming systems in ESA? Using the baseline data.

Understanding interlinkages between men's tasks and women's tasks using Fuzzy Cognitive Mapping

Additional work to understand the impact of mechanization from a systems perspective: statistical typologies, efficiency frontier and ecological network analysis

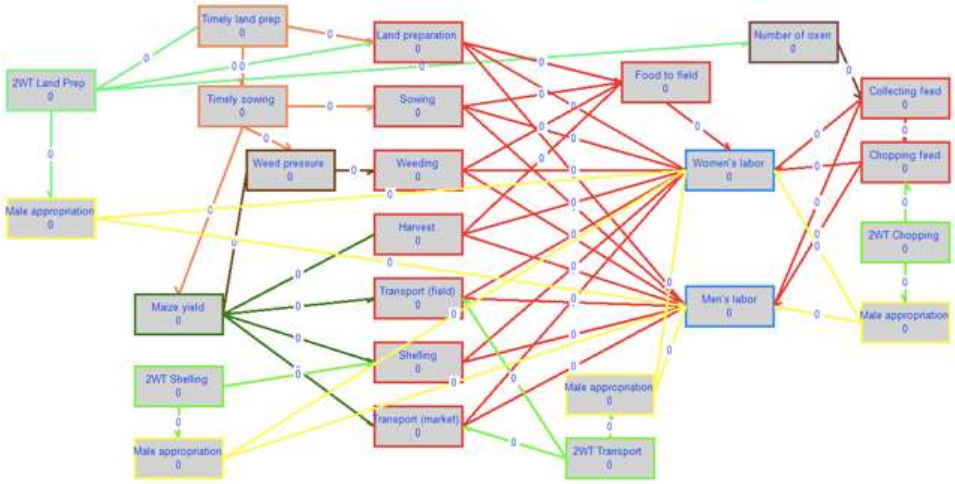

Figure 11 – Fuzzy Cognitive Map to test the impact of mechanization on male and female labor and interrelations between the two.

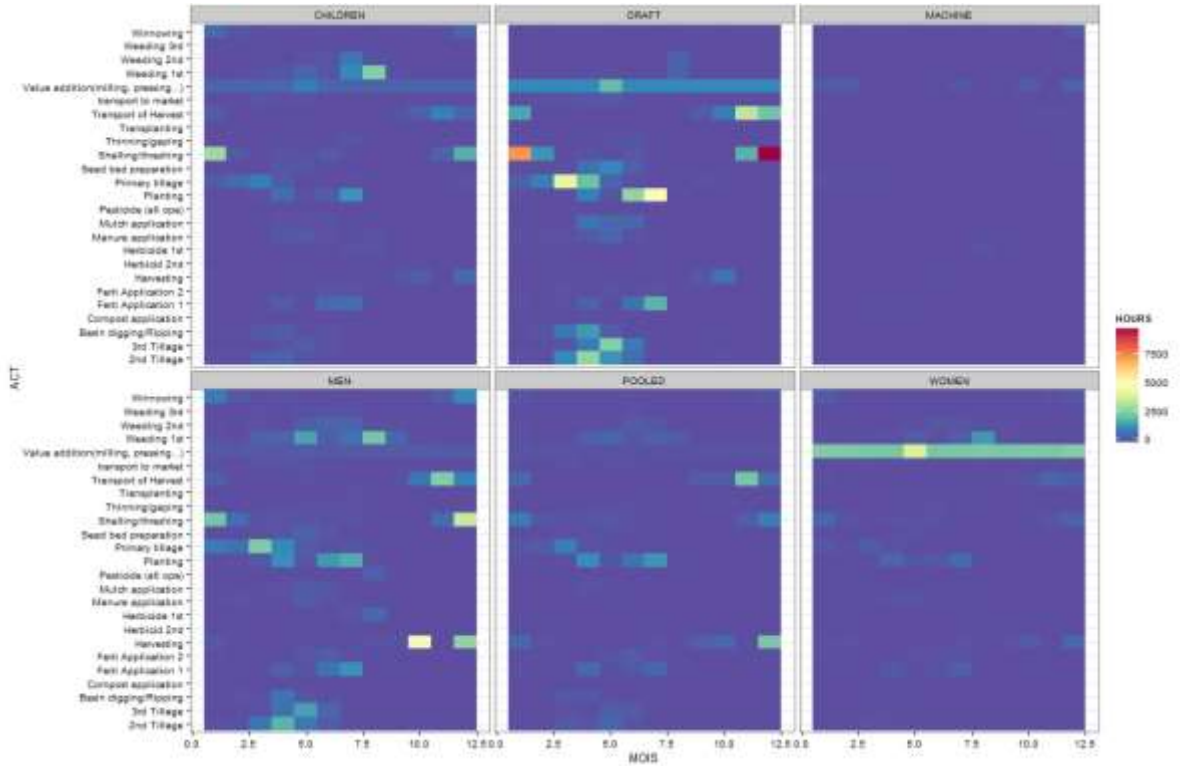

Figure 12 – Hit map displaying major peaks for different sources of labor and draft power

5.2. What technologies are the most appropriate in different circumstances? (John Blackwell)

With the combined experience of the Objective 1 country leaders, using data gathered from the on station and on farm trials we evaluated each machine tested for 24 attributes. Each attribute was scored for 1 (poor) to 5 (best). This analysis was presented as a first step realizing that the attributes themselves need weighting. This weighting has been completed for the **best bet for Maize, the 2 Row Fitarelli**, we are awaiting the weighting for the **best bet for Wheat, the 2 BFG**, which is being compiled by the Ethiopian team.

As an example of the evaluation and the attributes scored, the analysis for the 2 row Fitarelli, by the Kenyan (K), Tanzanian (T) and Zimbabwe (Z) teams, is shown below:

Two row Fitarelli

Cost	Work Rate hrs/ha	Effort to operate	Fuel Consumption
High	Low	High	High
1KTZ	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5KTZ	5KTZ (WITH ZIM MOD)	5KTZ
LOW	High	Low	Low

Two row Fitarelli

Strength/ Breakages	Ease of adjustment	Maintenance	Ease of turning /loading
Weak	difficult	High requirement	Difficult
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5KTZ	5KTZ	5KTZ	5KTZ
Strong	Easy	Low requirement	Easy

Two row Fitarelli

Blockages/ ground engaging	Blockages seed and fert	Constant depth of seeding	Ease of calibration
Many/bad	Many/bad	Bad	Diff
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4KTZ	4
5KTZ	5KTZ	5	5KTZ
Few/good	Few/good	Good	Easy

Two row Fitarelli

Stubble load	Weed load/green	Stones	Ease of transport
Low	Low	Few	Difficult
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4KTZ	4
5KTZ	5Ktz	5	5KTZ
High	High	Many	Easy

Two row Fitarelli

Establishment v/v calibration	Soil type	Soil moisture	Field condition
Poor	Few	Few	Few
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5KTZ	5KTZ	5KTZ	5KTZ
Good	Most	Most	Most

Fitarelli 2 Row

Hopper Size	Road Speed	Range of Seeds	Ease of changing row spacing
Small	Low	Few	Difficult
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5KTZ	5KTZ	5KTZ	5KTZ
Large	High	Many	Easy

For Maize planting

Total possible score : 120

Fiaterelli 2 Row:	114
Fiaterelli 1 Row:	112
VMP:	94
2BFG:	88
Gongli:	77.5
Morrison:	77
National Agro:	63

For wheat planting the 2BGF scored highest, hence the 2 row Fitarelli and the 2BGF have been submitted as the best bets to be used in the financial and business analysis.

5.3. Communicating our findings at country level in 2016

- Overview of FACASI Communication Products in 2015
    - Photostory/video clip
    - Media updates
    - FACASI website
    - Newletter
    - Kenya coutry video
    - Dashboard
- What is the hold-up to FACASI information and experience sharing within and across countries?
    - Within country: limited information flow within the organization and packaging the information to the targeted audience
    - Across countries: harmonized approach to disseminate information within the country and outside

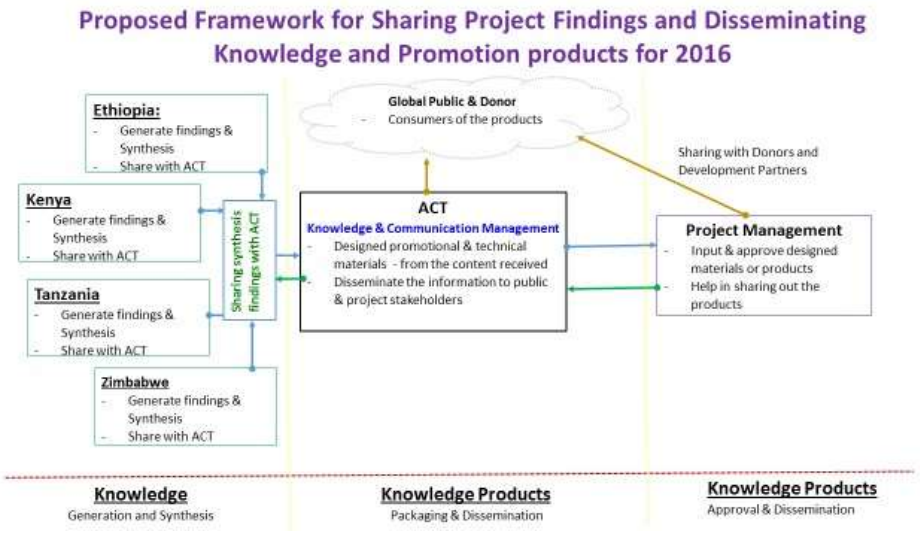

Figure 13 – A proposed framework for dissemination and knowledge sharing

5.4. Closing remarks (Project Steering Committee members)

- **R. Bell**
  - Not a steering committee per se, but rather an advisory group. Taking some key messages if any to ACIAR.
- **T. Koza**
  - Tremendous progress in all objectives
  - Delivering tech to farmers has to be completed and package in a format that leads to impact. Urging every country to come up with that product. Way to make this product sustainable.
  - Concern: issue of policy. New technology, few units. Build on the results and engage with policy. Bringing farmers in important. Technical results may not mean much to the farmers.
  - Positive move in engaging the private sector.
- **G. Mburathi**
  - Commend the project staff. Lots of progress in 1 year.
  - Scaling up and scaling out. Many achievements that needs to go beyond the project team. If not done during the remaining period, all the work would have been done in vain.
  - Communication – and role of ACT – needs to be dramatized during the remaining year.
  - Objective 2 is key.
  - Always include policy makers: they are the ones who will deliver your message to the state house.
  - Bring private sector in at country level. This is needed to have their co-investment.
- **Addissu**
  - Appreciation of the country teams and CIMMYT for their progress. Good management. Good commitment of people which should be continues and strengthened.
  - Good learning between the different countries. Knowledge should be shared to other countries. Big learning ground.

- More participation is needed from the private sector on technologies, for them to know clearly which technologies to import, promote, adapt, etc.
- Business model development: pioneer attempt. Useful ideas have emerge that can e tested and further elaborated.
- Good opportunity to learn from the BM experience, especially if this project could be expanded and continued.
- The flow of information between countries and between objectives should be improved. Documentation should also be improved.

- **G. Mrema**
  - Commend the team on the progress over the past 3 years, and especially the last year
  - Lots of push from the World Bank (the hoe must go) and from countries individually
  - We are trying to push 2 technologies: small mech and CA. But we should come up with simple messages.
  - For example timeliness. In Bungoma, every day delay in planting from the onset of the rain means a loss of 20 kg. Such simple messages are important to the policy makers.
- **R. Bell**
  - Looks like a new project. The project has grasps what this is all about now.
  - Congratulation to CIMMYT, countries and mentors.
  - Capacity building that won't leave.
  - Persuading ACIAR to come here and see what is happening, to understand the great return on investment. What additional capital could be needed.

Appendix 1: program

Day 0, 16th of February 2016: Arrival of participants

Day 1: 17th of February 2016: INTRODUCTION OF THE WORKSHOP, LEARNINGS

8h30 - 8h40	Welcoming remarks	Dr. January Mafuru
8h40 - 8h50	Official opening	Dr. Hussein Mansoor
8h50 - 9h10	AIFSRC/ACIAR remarks	Liz Ogutu
9h10 - 9h30	Participant introduction	All
9h30 - 10h00	Where are we after 3 years?	Frédéric Baudron
10h00 - 10h20	Presentation of the program of the week	Frédéric Baudron
10h20 - 10h40	Coffee break	
10h45 - 11h45	Learnings from Tanzania	John Sariah
11h45 - 12h45	Learnings from Kenya	Pascal Kaumbutho
12h45 - 14h00	Lunch	
14h00 - 15h00	Learnings from Ethiopia	Girma Moges
15h00 - 16h00	Learnings from Zimbabwe	Raymond Nazare
16h00 - 16h20	Coffee break	
16h20 - 17h30	Synthesis of the learnings	David Kahan and Frédéric Baudron

Day 2: 18th of February 2016: COMPARATIVE ANALYSES

8h30 - 8h50	Recap of previous day	ACT
8h50 - 10h20	In what policy environment is appropriate mechanization likely to spread?	Moti Jaleta
10h20 - 10h40	Coffee break	
10h40 - 12h45	How to deliver appropriate mechanization to the largest number of smallholders? Typology of business models.	David Kahan
12h45 - 14h00	Lunch	
14h00 - 15h30	How to deliver appropriate mechanization to the largest number of smallholders? Cost-benefit analysis	David Kahan
15h30 - 15h50	Coffee break	
15h50 - 17h30	Planning for 2016	

Day 3 - 19th of February 2016: FIELD VISIT

Day 4 - 20th of February 2016: COMPARATIVE ANALYSES, WAY FORWARD

8h30 - 8h50	Recap of previous day	ACT
8h50 - 10h20	Why investing in appropriate mechanization? (FGD, baseline, etc)	Frédéric Baudron
10h20 - 10h40	Coffee break	

10h40 - 12h45	What technologies are the most appropriate in different circumstances? (results from on-station and on-farm trials)	John Blackwell
12h45 - 14h00	Lunch	
14h00 - 15h30	Group work per comparative study (Why? What? How? Which?)	
15h30 - 15h50	Coffee break	
15h50 - 17h15	Communicating our findings at country level in 2016	Saidi Mkomwa
17h15 - 17h30	Closing remarks	

22nd to 24th of February: M&E and communication workshop (subgroup only)

22nd to 26th of February: Gender training (subgroup only)

Appendix 2: list of participants

S.N.	Name	Organization	email
1	Elizabeth Ogutu	ACIAR/AIFSRC	Elizabeth.Ogutu@aciar.gov.au
2	George Mburathi	Consultant, PSC Kenya	gmburathi@gmail.com
3	Geoffrey Mrema	Soikoine University, PSC Tanzania	geoffmrema@yahoo.co.uk
4	Tirivangani Koza	Ministry of Agricultre, PSC Zimbabwe	tirikoza@gmail.com
5	Addisu Tadege	EATA	Addisu.tadege@ata.gov.et
6	Richard Bell	Murdoch University, PSC Australia	R.Bell@murdoch.edu.au
7	Saidi Mkomwa	ACT	Saidi.mkomwa@act-africa.org
8	Janet Achora	ACT	janet.achora@act-africa.org
9	John C Blackwell	Charles Sturt University	jblackwell@csu.edu.au
10	Frédéric Baudron	CIMMYT Ethiopia	f.baudron@cgiar.org
11	David Kahan	CIMMYT Ethiopia	d.kahan@cgiar.org
12	Elias Berta	CIMMYT Ethiopia	e.berta@cgiar.org
13	Moti Jaleta	CIMMYT Ethiopia	M.Jaleta@cgiar.org
14	Mulatu, Esayas	CIMMYT Ethiopia	E.Mulatu@cgiar.org
15	Girma Moges Ketsela	EIAR	ggiirrmmaa@yahoo.com
16	Bisrat Getnet Awoke	EIAR	bisrat.get@gmail.com
17	Freiw Kelemu Dagne	EIAR	friewkelemu@yahoo.com
18	Ibrahim Yasin	Private sector	Ibrahimy2641@gmail.com
19	Pascal Kaumbutho	KENDAT	pkaumbutho@kendat.org
20	Joseph Mutua	KENDAT	jmutua@kendat.org
21	Jackie Gitahi	KENDAT	jgitahi@kendat.org
22	Tom Agwa	KENDAT	tomagwa1969@gmail.com
23	David Osamba	Private sector-Kenya	Dosamba1@gmail.com
24	John Sariah	SARI	jsariah@yahoo.com
25	Godfrey Mwinama	CARMATEC	gmwinama@gmail.com
26	January Mafuru	SARI (Director)	januarymafuru@yahoo.com
27	Dr. Husein Masoor	Ministry (Director)	Hussein.mansoor@gmail.com
28	Muhamed Elmi	Manufacture (Private sector)	
29	Edith Laurence Kadege	SARI (Gender focal person)	
30	Titus Banesta	CIMMYT FACASI Tanzania	B.Titus@cgiar.org
31	Raymond Nazare	University of Zimbabwe	rnazare2003@yahoo.com
32	Special Musoni	University of Zimbabwe	smusoni3@gmail.com

33	Dorcas Matangi	CIMMYT- Zimbabwe	dorcasmatangi67@gmail.com
34	Sepo Marongwe	Gender - Zimbabwe	sepomubiana@gmail.com
35	Walter Chigwada	Private sector-Zimbabwe	wchigwada@zimplow.co.zw
36	Western Zimunya	Private sector- Zimbabwe	wzimunya@hastt.co.zw
37	Frank Mmbando	SARI	Fmmbando@gmail.com
38	Mutat Waldane	ACT	Waldane.mutai@act.africa.org

Appendix 3: Action Plans

Ethiopia

Kenya

Activities	Tasks ('sub activities')	Responsibility	Others involved	Start	Deadline	Remark
1.2.3. Researcher-managed field evaluation of most-promising 2WT-based technologies						
	Development of model farm as demo site for community to participate, visit and learn	*J Mutua*	*Henry Rukunga, Stanley Muriuki, David Njoroge, Anthony Karimi and Student interns*	*3/15/2015*	*4/15/2016*	*No more best-bet analysis experiment will take place. Efforts will go towards hub model farm demos and farmer participation as they hire 2WT planter and other services.*
	Development of shool farm demo-farm	*P Kaumbutho*	*J Mutua, Henry Rukunga, Anthony Karimi*	*4/1/2016*	*3/31/2017*	*This is motivated by Feed the Future support plans. They will make good back-up to FACASI. Children need to participate and experience a new way of powering farming.*
	Data collation	*J Mutua*	*Anthony Karimi*	*4/1/2016*	*3/31/2017*	*Continuous process*
1.3.4. Participatory evaluation and adaptation of best bet 2WT-based technologies						
	Continuous monitoring, modification or adjustments, research and reporting of performance of best-bet equipment under hub-services programme	*J Mutua*	*Henry Rukunga, Stanley Muriuki, David Njoroge, Anthony Karimi and Student interns*	*3/1/2016*	*3/31/2017*	*MOU was signed with University of Nairobi. Student backed research will continue, monitoring and reporting machinery and hub performance.*
	Data collation	*J Mutua*	*Anthony Karimi*	*4/1/2016*	*3/31/2017*	*Continuous process*

Activities	Tasks ('sub activities')	Responsibility	Others involved	Start	Deadline	Remark
1.3.3. Training of innovation platform members on basic calibration, operations and maintenance of tractors and ancillary equipment **--> service providers**						
	Training No.1 of 5 Hub-connected 2WT operators in Laikipia	*J Mutua*	*Henry Rukunga, Stanley Muriuki*	*2/1/2016*	*9/30/2016*	*Continuous process*
	Training No.2 of 2WT operators in Bungoma	*J Mutua*	*Tom Agwa*	*4/1/2016*	*5/1/2016*	*Within April*
	Handover of 2WTs and acillary equipment to Service Providers	*J Mutua*	*Tom Agwa, Pascal Kaumbutho, Legal Expert*	*4/15/2016*	*4/30/2016*	*Continuous follow-up post-handover*
2.3.1. Lobbying for greater market integration of local importers and manufacturers, workshops/mechanics and rural service providers						
	Stakeholders Policy Workshop	*J Mutua*	*Tom Agwa*	*2/1/2015*	*3/31/2016*	*A good collection of private sector persons featured in our Policy meeting of Feb 15, 2016*
	Hub launch event and business Cluster enhancement	*P Kaumbutho*	*J Mutua, Emma Nganga, Henry Rukunga, David Njoroge*	*4/1/2016*	*5/31/2016*	*Hub launch will be a big event with all manner of stakeholders from all levels and exhibitors section*
2.3.2. Training of local importers/manufacturers/dealers in 2WT-based CA (including machinery operation, machinery maintenance, rotational requirements, agronomy, mulch conservation, fertilizer management, weed control)						
	Hub launch event and business Cluster enhancement	*P Kaumbutho*	*J Mutua, Emma Nganga, Henry Rukunga, David Njoroge, David Osamba*	*4/1/2016*	*5/31/2016*	*Hub launch will be a big event with all manner of stakeholders from all levels and exhibitors section*

Activities	Tasks ('sub activities')	Responsibility	Others involved	Start	Deadline	Remark
	Follow-ups with suppliers to enhance working relations with hub platform	*P Kaumbutho*	*J Mutua, Emma Nganga, Henry Rukunga, David Njoroge, David Osamba*	*4/1/2016*	*5/31/2017*	*Continuous process*
2.3.3. Training of local importers/manufacturers/dealers for them to become trainers of rural service providers in business and financial management and marketing						
	Hub launch and business Cluster enhancement	*P Kaumbutho*	*J Mutua, Emma Nganga, Henry Rukunga, David Njoroge, David Osamba*	*4/1/2016*	*5/31/2016*	*Hub launch will be a big event with all manner of stakeholders from all levels and exhibitors section*
	Follow-ups with suppliers to enhance working relationswith hub platform	*P Kaumbutho*	*J Mutua, Emma Nganga, Henry Rukunga, David Njoroge, David Osamba*	*4/1/2016*	*5/31/2016*	*The hub is already generating all manner of stakeholder interactions, including importers and sellers, farmers and their groups.*
2.3.4. Backstop training of rural service providers in 2WT-based CA and business and financial management and marketing by the importers/manufacturers/dealers and workshop owners/mechanics **--> service providers**						
	Training No.1 of 5 Hub-connected 2WT operators in Laikipia	*J Mutua*	*Henry Rukunga, Stanley Muriuki*	*2/22/2016*	*2/28/2016*	*Training is scheduled after shortlisting 5 form 20 operators interviewed earlier.*
	Training No.2 of 2WT operators in Bungoma	*J Mutua*	*Tom Agwa*	*4/1/2016*	*4/30/2016*	*Within April 2016 with rotocols work by a lawyer finalised.*
	Handover of 2WTs and acillary equipment to Service Providers	*J Mutua*	*Tom Agwa, Pascal Kaumbutho, Legal Expert*	*4/1/2016*	*5/30/2017*	*Continuous follow-up post-handover and reporting progress.*

Activities	Tasks ('sub activities')	Responsibility	Others involved	Start	Deadline	Remark
2.3.5. Development of appropriate financial products targeting (1) rural service providers, and (2) farmers seeking 2WT-based services						
	Hand in Hand training of Cluster farmers in Table Banking	*John Ndungu of Hand in Hand*	*Thomas Alai, Pascal Kaumbutho, Emma Nganga*	*3/1/2016*	*4/30/2017*	*First training happened in January (27-01-2016).*
	Farmer Cluster advancement to self-managed microfinance establishment	*John Ndungu of Hand in Hand*	*Thomas Alai, Pascal Kaumbutho, Emma Nganga*	*3/1/2016*	*4/30/2017*	*Four Clusters were identified and trained. A report is available and follow-up training took place on 3rd March 2017*
	Growth of micro-fianance scheme	*John Ndungu of Hand in Hand*	*Thomas Alai, Pascal Kaumbutho, Emma Nganga*	*3/1/2016*	*4/30/2017*	*By end April 2016 a working and growing farmer managed microfinance supported by KFIE will be operational.*
2.3.6. Development of promotional materials (1) targeting service providers to support and raise awareness on importers//dealers, and (2) targeting farmers to support service providers **--> demand creation**						
	Flyers for hub operation services with data on performance and comparative advantages	*Jackie Gitahi*	*David Njoroge, Anthony Karimi, Pascal Kaumbutho; Joseph Mutua*	*3/1/2016*	*4/30/2016*	*KFIE will chip in here as promotional material funds for FACASI were exhausted*
	Record keeping books for Hub Service provision	*Joseph Mutua*	*David Njoroge, Henry Rukunga, Henry Mwaniki , Stanley Muriuki*	*3/3/2016*	*3/11/2017*	*Hub operations have started and all work and money accounting processes and documents are under development.*
	Hub launch and beyond: promotional and advertising materials	*Jackie Gitahi*	*Joseph Mutua, David Njoroge, Henry Rukunga, Henry Mwaniki , Stanley Muriuki*	*3/3/2016*	*5/1/2017*	*Hub operations have started and all work and money accounting processes and documents are under development.*
2.3.7. Quarterly IP meetings on 2WT-based market systems **--> service provider**						

Activities	Tasks ('sub activities')	Responsibility	Others involved	Start	Deadline	Remark
	Bungoma Service Provider performance follow-ups	*Tom Agwa*	*Joseph Mutua, Pascal kaumbutho*	*3/3/2016*	*5/1/2017*	*Continuous process*
	Laikipia Hub cluster stakeholders business performance review meetings	*Joseph Mutua*	*Joseph Mutua, Pascal kaumbutho*	*3/3/2016*	*5/1/2017*	*Continuous process*
2.4.1. Actor-specific financial analysis (local importers, manufacturers, dealers, financial organization, mechanics and workshops)						
	Hub Buisness Cluster stakeholders business performance review	*Pascal Kaumbutho*	*J Mutua; Emma Nganga*	*1-Apr-16*	*30th April 2016*	*Finacial anlaysis will be conducted at Stakeholders Cluster formation meeting during the lanunch of the Hub*
2.4.2. Adoption and impact survey, disaggregated by gender						
	Finalised and reported by KIT team re: Liz Mukewa, KENDAT has a copy of the report.	*Diana Onyango*	*Liz Mukewa, Liz Waithanji and Pascal Kaumbutho*	*March 1 2015*	*March 31st 2016*	*Diana onyango will backstop gender work going forward.*
	Support to KENDAT gender desk ensuring gender profiling happens at all levels.	*Diana Onyango*	*Liz Mukewa, Liz Waithanji and Pascal Kaumbutho*	*March 1 2016*	*March 31st 2017*	*CIMMYT will hopefully have a second status review study, centrally organized like the KIT study.*
3.2.2. Evaluation of alternative policy options for a wider delivery of 2WT-based mechanization to smallholder farmers - particular to resource poor and women farmers						
	FACASI Gender representation on an ongoing basis	*Tom Agwa*	*Pascal Kaumbutho; Joseph Mutua*	*15-Feb-16*	*29-Feb-2015*	*Highly successful stakeholders meeting was held and a report prepared by Feb 29, 2016*
	FACASI Gender representation at Policy Advancement Stakeholders meetings (see Roadmap spelt by Government in 1st FACASI Policy Workshop)	*Diana Onyango*	*Liz Mukewa, Liz Waithanji and Pascal Kaumbutho*	*15-Feb-16*	*29-Feb-2015*	*Highly successful stakeholders meeting was held with a report of gender issues of farm power presented. A report was prepared.*
3.2.3. National policy workshops to discuss evidence-based recommendations						

Activities	Tasks ('sub activities')	Responsibility	Others involved	Start	Deadline	Remark
	National FACASI-run Policy Workshop	*Tom Agwa*	*Pascal Kaumbutho; Joseph Mutua*	*15-Feb-16*	*29-Feb-2015*	*Highly successful stakeholders meeting was held and a report prepared by Feb 29, 2016*
	National FACASI-run Policy Advancement, Stakeholders participation (see Roadmap spelt by Government in 1st FACASI Policy Workshop)	*Tom Agwa*	*Pascal Kaumbuth0; Joseph Mutua*	*29-Feb-16*	*31-Mar-17*	*Governement mechaization policy process is ongoing, and FACASI policy desk will keep contibuting to this, representing small mechanization for smallholders.*
4.2.5. Twice yearly farmer field days conducted in each site						
	Bungoma Field-Day with SIMLESA stakeholders present	*Tom Agwa*	*Joseph Mutua; George Ayaga; Josiah Gitari*	*10th February, 2016*	*11th February, 2016*	*A sucessful FACASI/SIMLESA field day was held on 10th February, 2016.*
	Follow-up Fieldday in Bungoma	*Tom Agwa*	*Joseph Mutua; George Ayaga; Josiah Gitari*	*8/1/2016*	*8/30/2016*	*A follow-up FACASI/SIMLESA field day will be conducted to gauge and report progress.*
	Seasonal Fieldday in Laikipia	*Joseph Mutua*	*David Njoroge, Mwiti Rukunga and Stanley Muriuki*	*11/1/2016*	*11/30/2016*	*To be held when crop is ripe and demo-farm vibrant with mechanization and CA crop impacts visible.*

Tanzania

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
1.2.3. Researcher-managed field evaluation of most-promising 2WT-based technologies (on farm)						
	Trial material aquisition (Input purchases ; Fertilizer, seeds, herbicides, etc)	*J. Sariah*	*SARI technicians*	*15/2/2016*	*15/3/2016*	
	Calibration of the seeders and run test before sowing	*Gedfrey Mwinama*	*CARMATEC) and SARI technicians*	*15/2/2016*	*15/3/2016*	
	Training of local maching operators (operate and maintanancy)	*Gedfrey Mwinama*	*CARMATEC) and SARI technicians*	*1/3/2016*	*15/3/2016*	
	Trial sowing	*Gedfrey Mwinama*	*CARMATEC) and SARI technicians*	*15/3/2016*	*30/3/2016*	
	Data taking (plant population after germination, soil moisture at sowing, planting depth, seed and fertilizer rate, fuel consumption and time)	*Gedfrey Mwinama*	*CARMATEC) and SARI technicians*	*15/3/2016*	*25/3/2016*	
	Trial management (Weeding, pest control)	J. Sariah	SARI and CARMATEC Technicians	*20/3/2016*	*30/6/2016*	
	Soil analysis (soil type, topography and texture, % mulch cover)	J. Sariah	SOIL LAB SARI Technician	*15/3/2016*	*15/3/2016*	
	Harvesting	J. Sariah	SARI and CARMATEC Technicians	*30/6/2016*	*30/6/2016*	
	Data analysis (agronomi including grain yields, soils and weather)	J. Sariah	Gedfrey M	*15/7/2016*	*15/8/2016*	
	Publicity/Dissemination of technology through (leaf lets, brochures, radio,TV channel and newspapers)	Dissemination unit SARI	Publication unit SARI, J.Sariah, Godfrey	*20/9/2016*		
1.2.3.1 Onstation evaluation of the availlable direct seeders						

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
	Trial material aquisition (Input purchases ; Fertilizer, seeds, herbicides, etc)	J. Sariah	SARI technicians	*15/2/2016*	*15/3/2016*	
	Planters callibration	Godfrey	SARI, CARMATC technicians	*15/2/2016*	*15/3/2016*	
	Sowing of trials (As many cycle as possible under irrigation) harvest the plants just after germination at 15 cm tall)	Gedfrey Mwinama	SARI, CARMATC technicians	*1/3/2016*	*15/3/2016*	
	Data taking (plant population after germination, soil moisture at sowing, planting depth, seed and fertilizer rate, fuel consumption and time)	Gedfrey Mwinama	SARI, CARMATC technicians	*15/3/2016*	*30/3/2016*	
1.3.4. Participatory evaluation and adaptation of best bet 2WT-based technologies						
1.3.4. 1 Participatory evaluation of the best bet technology	Farmers, local manufacture, service provider and importers evaluation of the seeders during seeding and after germination	Edith/Ben	j.sariah	*30/6/2016*	*30/6/2016*	
	Social economic data analysis.(stakeholders criteria for selection, like or deslike features, best machine of farmers choice, gender disagregated data)	Edith/Ben	J. Sariah, Ben	*15/7/2016*	*15/8/2016*	
	Feed back to the farmers and other stake holdes (IP members)	Edith/Ben	j. sariah, Godfrey	*20/9/2016*		
1.3.4.2 Adaptation of best bet 2WT-based technologies						
	Working on possible/ needed modifications on National India seeders for adaptation	*Godfrey*	*CARMETEC technician*	*1/4/2016*	*30/5/2016*	
	Testing of the modification functionality at factory/station (CARMATEC)	*Godfrey*	*CARMETEC technician*	*1/5/2016*	*30/5/2016*	

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
	Feed back to manufacturer for any necessary action	*Godfrey*	*j.sariah*	*30/5/2016*		
2.2.3. Ex ante business study to assess the potential impact of new/upgraded business models (considering the size of the market, profit along the market chain, etc.)						
	To conduct surveys to 2WT models in Arumeru,Mbulu Babati and Karatu to Update the Economic analysis report:	Benesta,	Dr.Sariah	1/4/2016	30/5/2016	
	Collect 2WT models- performance data from service providers	Benesta	Dr.Sariah	1/4/2016	30/5/2016	
2.2.4. Focus group discussions to 'demonstrate incentive' (cost-benefit analysis, net present value, breakeven point) to each group of market actor (including financial institution)						
	Feedback meeting with stakeholders to create awareness on profitability together with field demonstrations.	Benesta	Dr.Sariah	1/6/2016	30/7/2016	
2.2.5. Annual multi-stakeholder roundtable in each IP to evaluate and refine (if need be) the new/upgraded business models						
2.3.1. Lobbying for greater market integration of local importers and manufacturers, workshops/mechanics and rural service providers						
	Trying to get a supply chain developed - lobbying dealers and financial service providers	Benesta	Dr.Sariah	20/3/2016	30/5/2016	
	Identify potential deals which could be made following the previous agreement with Farm equip on leasing 2WT equipments and joint on-farm demonstrations	Benesta	Dr.Sariah	20/3/2016	30/5/2016	

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
2.3.2. Training of local importers/manufacturers/dealers in 2WT-based CA (including machinery operation, machinery maintenance, rotational requirements, agronomy, mulch conservation, fertilizer management, weed control)						
	To train 2WT operators in collaboration with the DCs on how to operate and maintain 2WT and accessories	Benesta, Godfrey	Dr.Sariah	30/4/2016	15/6/2016	
	Awareness raising of private sector on CA and 2WT mechanization.	Benesta, Godfrey	Dr.Sariah	15/05/2016	30/8/2016	
2.3.4. Backstop training of rural service providers in 2WT-based CA and business and financial management and marketing by the importers/manufacturers/dealers and workshop owners/mechanics						
	Mentoring support on business management skills to all business models including the new ones.	Benesta	Dr.Sariah	20/4/2016	12/1/2016	
	Collect 2WT models- peformance data from service providers	Benesta, Godfrey	Dr.Sariah	20/4/2016	30/9/2016	
2.3.5. Development of appropriate financial products targeting (1) rural service providers, and (2) farmers seeking 2WT-based services						
	Continue linking FIs (Micro) with mechanization packages to farmers and SPs	Benesta	Dr.Sariah	20/3/2016	30/08/2016	
2.3.6. Development of promotional materials (1) targeting service providers to support and raise awareness on importers//dealers, and (2) targeting farmers to support service providers						
	Distribution of promotional equipments to selected SPs in Arumeru,Babati,Mbulu and Karatu.	Benesta, Godfrey	Dr.Sariah	20/3/2016	15/4/2016	

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
	Train service providers on operations and machine management skills and engage any skilled person to continue to provide these skills to others (supported financially by the project)	Benesta, Godfrey	Dr.Sariah	24/3/2016	30/5/2016	
	Extensive regular demonstration of 2WT in field for ploughing/ ripping/ shelling/ transport /planting with Private sector.	Benesta, Godfrey	Dr.Sariah	1/4/2016	12/1/2016	
	Collect 2WT models-peformance data from service providers	Benesta	Dr.Sariah	1/4/2016	12/1/2016	
3.2.2 Evaluation of alternative policy options for wider delivery of 2WT-Based mechanization to smallholdres farmers particular to resource poor and women farmers.						
	Country level report prioritizing policy options for a wider adoption of mechanized CA	Moti Jaleta	Ben	30/8/2016	30/11/2016	
4.2.5. Twice yearly farmer field days conducted in each site	Conduction of field days in Mbulu and Arumeru during crop physiological maturity and during harvesting for shelling	J.Sariah	Godfrey, Edith, Msangi	15/05/2016	20/06/2016	
W. Advisory Group Meeting.						
	Advisory meeting to strategize outscaling of the best technology	J.Sariah, Godfrey, Edith	National PSC member, NGO's, Importers, IPS, local manufacturers and all other stakeholders.	20/08/2016	30/08/2016	

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Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
1.2.3. Researcher-managed field evaluation of most-promising 2WT-based technologies		S Musoni	R Nazare			this is an ongoing activity
1.3.4. Participatory evaluation and adaptation of best bet 2WT-based technologies		R Nazare	S Musoni, D matangi	Mar-16	Feb-17	this is an ongoing activity
1.3.3. Training of innovation platform members on basic calibration, operations and maintenance of tractors and ancillary equipment **--> service providers**		S Musoni	Mrs Gunda	Mar-16	Dec-16	
2.3.1. Lobbying for greater market integration of local importers and manufacturers, workshops/mechanics and rural service providers		R Nazare	D Matangi, S musoni	Mar-16	Feb-17	
2.3.2. Training of local importers/manufacturers/dealers in 2WT-based CA (including machinery operation, machinery maintenance, rotational requirements, agronomy, mulch conservation, fertilizer management, weed control)		Mrs Gunda	S Musoni			The activity has been on going. The new activities are more aligned to the additional funding from Syngenta Foundation which is upscaling 2wt CA activities.

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
2.3.3. Training of local importers/manufacturers/dealers for them to become trainers of rural service providers in business and financial management and marketing		D Matangi	Mrs Gunda	Apr-16	Dec-16	The training s most likely going to be offered at Hatcliffe
2.3.4. Backstop training of rural service providers in 2WT-based CA and business and financial management and marketing by the importers/manufacturers/dealers and workshop owners/mechanics **--> service providers**		D Matangi	Mrs Gunda	Mar-16	Dec-16	
2.3.5. Development of appropriate financial products targeting (1) rural service providers, and (2) farmers seeking 2WT-based services		D Matangi	R Nazare		Dec-16	This is an ongoing activity
2.3.6. Development of promotional materials (1) targeting service providers to support and raise awareness on importers//dealers, and (2) targeting farmers to support service providers **--> demand creation**		D matangi,	S Marongwe, W Mupangwa		Dec-16	This is an ongoing activity
	Purchase of equipment	R Nazare	S Musoni			This is an ongoing activity
	Identification of service providers	D matangi,				This is an ongoing activity

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
2.3.7. Quarterly IP meetings on 2WT-based market systems **--> service provider**		R Nazare	D Matangi, S Musoni	Mar-16	Dec-16	
2.4.1. Actor-specific financial analysis (local importers, manufacturers, dealers, financial organization, mechanics and workshops)		D Matangi	R Nazare	Apr-16	Dec-16	
2.4.2. Adoption and impact survey, disaggregated by gender		S Marongwe	R Nazare, D Matangi		Feb-17	
3.2.2. Evaluation of alternative policy options for a wider delivery of 2WT-based mechanization to smallholder farmers - particular to resource poor and women farmers		R Nazare	T Koza, S Marongwe	Mar-16	Apr-16	
3.2.3. National policy workshops to discuss evidence-based recommendations		R Nazare	T Koza, S Marongwe	May-16		We need to lobby key institutions first before calling for a national workshop

Activities	Tasks ('subactivities')	Responsability	Others involved	Start	Deadline	Remark
4.2.5. Twice yearly farmer field days conducted in each site		D Matangi	S Matangi, S Musoni	Mar-16	December 2016	the field days are starting with the current cropping season
W. Advisory Group Meetings (2 in 2015)		R Nazare	S Marongwe	Apr-16		
	June meeting (after annual report)		National PSC member			
	December meeting (after semi-annual report)		National PSC member			