Trans-SEC

Innovating pro-poor Strategies to safeguard Food Security using Technology and Knowledge Transfer

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Deliverable 2.3.1 **Approach, design and implementation of on-field Participatory Action Research of biophysical and other UPS**
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1 Background

Trans-SEC is a five years (2013/2017) research project with the title "Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer: A people-centred Approach". It is implemented in Morogoro and Dodoma regions, specifically in Changarawe and Ilakala villages in Kilosa district and in Ilolo and Idifu villages in Chamwino district with the aim to improve the food supply for the most-vulnerable poor rural population in Tanzania, while focussing on the entire food value chain (FVC). Trans-SEC is made up of members from research organizations and NGOs from Germany, Tanzania and CGIAR-centres, involving approximately 90 researchers/scientists and nongovernmental professionals from the 14 partner organizations. A participatory action research (PAR) process has been set up from the beginning as an integral part of most analytical steps of Trans-SEC.

In Trans-SEC the FVC stakeholders distinguished are:

a) "primary users" at grass-root level such as farmers (and pastoralists), processors, millers, stockiest, traders, middlemen, transporters, and consumers, and

b) interested organizations & institutions (key informants) such as policy makers, extension officers, service providers, NGOs, churches, …

This report elaborates how multi-stakeholders' engagement has been planned and structured, and how PAR is implemented by Trans-SEC partners.

2 Participatory Action Research (PAR) process elements and related activities

1. Mapping stakeholders across FVC: this identified all relevant key and grass-root level stakeholders and their functions along the FVCs on local, regional, and national scale. The exercise involved visits of stakeholders in their locations and enquired for information through FGD, interview or workshop. The various stakeholders consulted were categorized according to their activities on which eight categories of stakeholders were formed. These encompasses local producers, agro-dealers, processors/millers, buyers/traders/exporters, manufacturers, service providers, marketing, non-governmental organizations.
2. Inventorying FVC constraints & strategies: priority commodities and FVC constraints to rural farmers in all CSS were inventoried. These were achieved through the use of FGD, Interviews and complemented by information from the HH survey. Stakeholders involved were 15 -20 key informants and farmers from the CSS.
3. Identifying local food security criteria: food security criteria for assessing the impact of UPS were identified using existing literature. This involved discussing with stakeholders in each CSS to pinpoint food security criteria according to their understanding in their community. In the process local focus group and panel discussions were conducted. They were validated and adapted with/to the local stakeholders' perceptions of food security.
4. Identifying 3-5 UPS/FVC component: potential UPS of priority commodities among each FVC component enhancing on food security were screened, described in detail using fact sheets, and an inventory established for the CSS in the target regions, and beyond. This was done using jointly defined selection criteria. They were then jointly analysed in-depth among scientists with regards to their selection criteria, for instance, expected positive impact on food and livelihood security, knowledge and data availability of previous implementations, and practicability. Finally 3-5 UPS were selected by scientists for subsequent prioritisation by the CSS stakeholders.
5. Prioritising UPS in CSS for testing: 2-3 UPS per FVC component for final field implementation were prioritised and decisions made anticipatively by stakeholder groups in all four CSS. Scientists accepted few more UPS for implementation and to merge few UPS, attaining a feasible number of 6-7 most promising UPS per CSS and an overall number of 10 UPS selected.
6. UPS groups formation: 6-7 UPS farmer groups per CSS with member sizes ranging from 10 to 50 members were formed from a household panel survey sample of 150 HH per CSS. In the group formation process some individuals joined the group without prior knowledge of what really the UPS requires. This led to drop outs of some members and also shifting of members between UPS groups.

7. UPS implementation, testing, adaptation: the 10 UPS prioritised were implemented and tested in the CSS. This included different processes with recurrent feedback and adaptation activities between local stakeholders and scientists extending over several months up to one year. Some of the adaptation procedures required trials and error which consumed time and resources before being accepted by stakeholders involved. Example, the Pyrolyser (TLUD-reactor) faced various challenges (high temperature near it, size of the reactor) and to address them it took longer time.
8. Co-creation of potential future scenarios: future scenarios were developed with researchers of all components of the FVC, stakeholders from the CSS, and Tanzanian meteorologists. The challenge here is to prove if the future climate conditions alter the performance of the UPS. Therefore, the UPS specific conditions are proven with bio-physical simulation models for large climate datasets. The output of these simulations models provide new insights to possible futures of the UPS and will be communicated back to farmers and researchers with no meteorological background.
9. UPS monitoring & impact assessment: the implementation and testing of the UPS is monitored by using generic and specific parameters collected during both UPS groups focus group discussions and visits of all involved households. The monitoring is done in phases with weekly, monthly and in three months period. Once a year the UPS groups meet together to provide feedback to the scientists on the expected (ex-ante) and/or experienced (ex-post) UPS impact on food security..
10. UPS results dissemination, upscaling and outscaling: During the process of selecting, testing and assessing UPS, lessons learnt are prepared for dissemination and outreach. This is done via the research network (scientific papers, home page, movies) and stakeholder organizations through policy briefs and capacity-building workshops at the policy, extension and farmer school levels. Scaling out of UPS which have already shown scientific evidence has started through field days and farmers exchange visits within and in neighboring villages.

3 Stakeholder involvement among Trans-SEC partners

The Trans-SEC consortium consists of a) a central coordination (ZALF) and b) a Tanzanian sub-coordination (SUA) for operational management and synthesis (Figure 1). ZALF and SUA each coordinate their national partner cluster. ZALF and SUA do the overall planning for involving stakeholders at local, regional and national level. ARIs and MVIWATA are responsible for the local to regional stakeholder involvement, and TFC and ACT for the regional to national stakeholder involvement. German partners approach stakeholders through SUA, ARI, and together with the other Tanzanian partners. All Tanzanian partners feel responsible to disseminate Trans-SEC results, for instance, among farmer associations and schools as well as cooperative societies, public authorities and ministries.

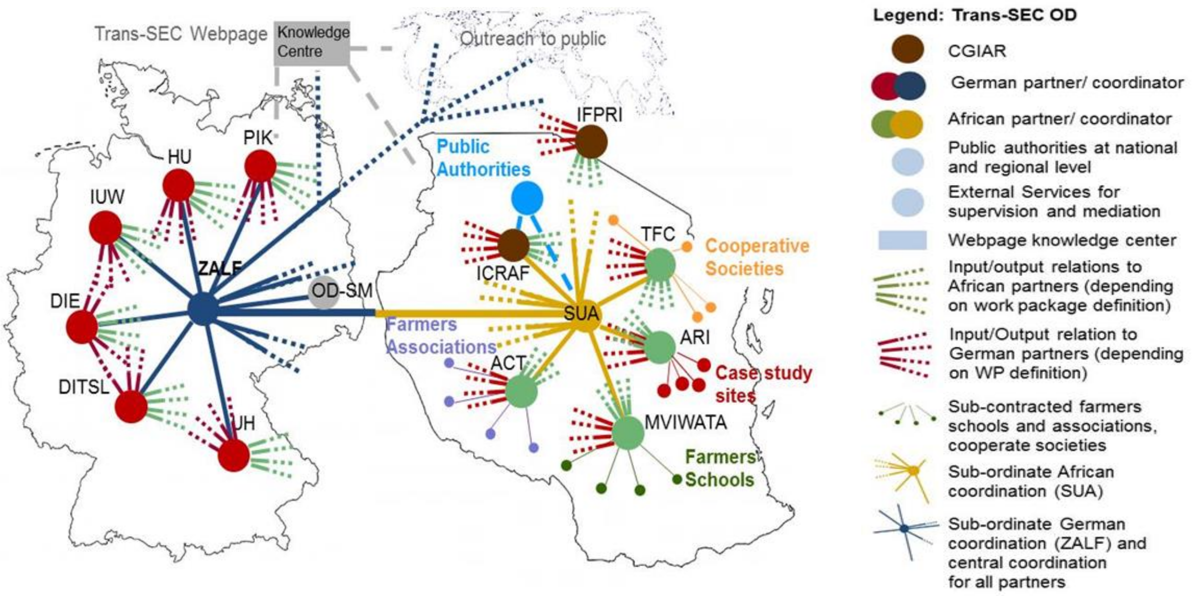


Figure 1: Mapping of the Trans-SEC partner organisations

4 Decision making on UPS for implementation in each CSS

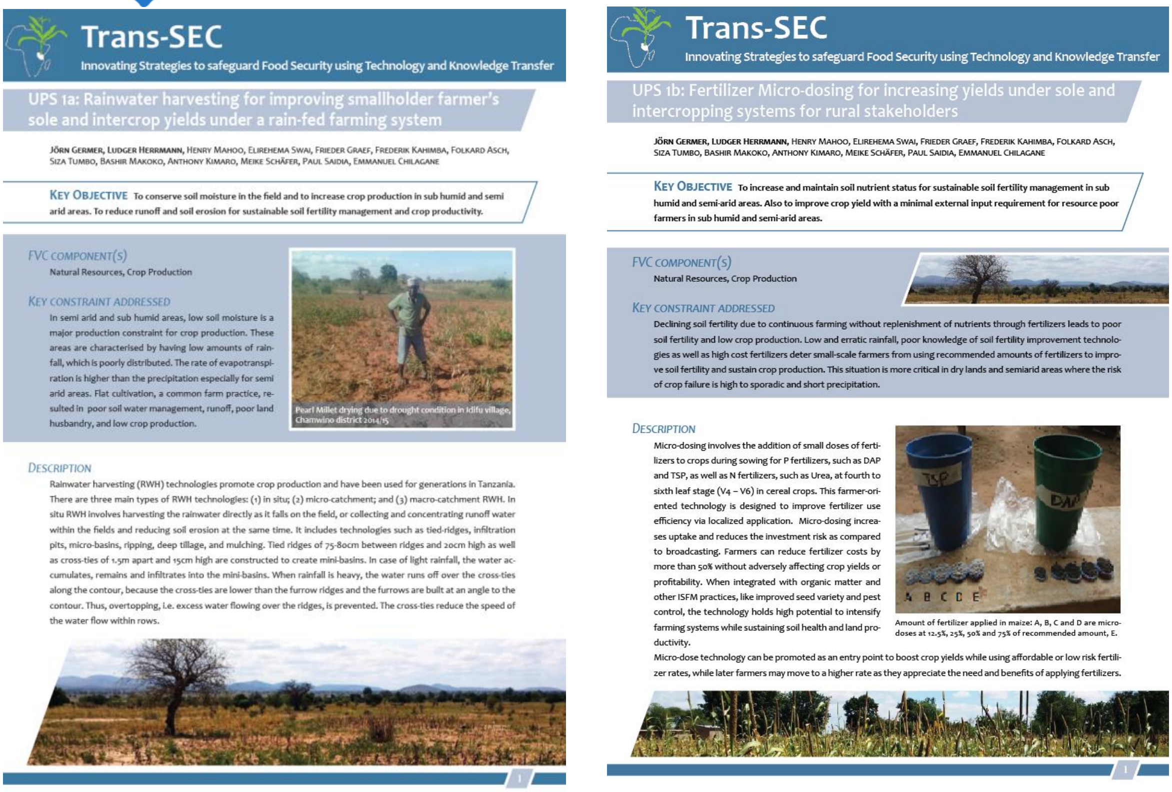
This task involved FGDs with local stakeholders in the CSS. The activity involved the presentation of all FVC upgrading strategies elaborated and defined by scientific experts (based on local constraints and requirements) to local stakeholders in all CSS to enable them to decide on UPS to be tested in each CSS during Trans-SEC lifetime. The decision making process included participatory impact assessments of the UPS. Altogether 10 UPS were selected (Table 1) This decision making was followed by a series of stakeholder workshops at CSS levels to share at larger scale (150 HH per CSS) the UPS prioritized for implementation. This was done in order to receive feedback and inputs for subsequent implementation.

5. UPS selected in the sub-humid and semi-arid regions

Table 1: Upgrading strategies across FVC components and their selection (✓) in different climate regions (Graef et al 2017)

FVC component and upgrading strategies	Description of upgrading strategy	Sub-humid region	Semi-arid region
Natural resource management/crop production			
1 Rainwater harvesting(RWH) andFertiliser micro-dosing	in-situ RWH using tied ridges in the sub-humid region and infiltration pits in the semi-arid region (Mahoo et al. 2012); microdose rates of 5-10 kg P/ha (1.2 g /hill as DAP) placed 4-8 cm close and lateral to the seeds, with higher rates in more humid climate (Bagayoko et al. 2011)	✓	✓
Post-harvest processing & biomass/energy supply			
2 Byproducts for bioenergy (pyrolisor)	low-cost (US$ 300) pyroliser (manufactured from 100-200 l oil barrel) producing charcoal from maize cobs and simultaneously used for cooking (Ikele and Ivoms 2014)	✓	

3 Improved processing	mobile maize shelling machines in sub-humid region and millet shelling machines in the semi-arid region, including participatory business plans for investment and pay-offs (Mejia 2003)	✓	✓
4 Improved wood supply	tree planting in various niches (farm boundaries, woodlots, natural regeneration in-field) using tree nurseries (Kimaro et al. 2007)		✓
5 Improved stoves	small scale stoves reducing energy consumption from loam for household use with one or two holes at US$ 3-5/stove, locally constructed by trainers training stakeholders (Kshirsagar et al. 2014)	✓	✓
Markets and income generation			
6Sunflower oil production	enhanced horizontal and vertical coordination of sunflower oil production, including investment in sunflower oil press (RLDC 2008)		✓
7 Optimised market oriented storage	storage using low cost IRRI airtight superbags (RohithaPrasantha et al. 2014) for a few months after harvest until grain market prices rise	✓	✓
8 Poultry-crop integration and marketing	poultry keeping, disease management, utilisation of crop by-products in raising poultry, utilisation of poultry manure (Mlozi et al. 2003) and selling on local or regional markets	✓	
9 Market information access system (m-IMAS)	mobile phone based online market for farmers marketing their produce at better prices and for buyers (Kadigi et al. 2013)	✓	
Consumption			
10 Household nutrition education& kitchen garden training	Increasing the awareness of nutrient-rich including indigenous foods, and making better use of these crops to improve nutritional status especially of under-five children (Roy et al. 2005); cultivating indigenous fruits and vegetables at the homestead for dietary diversification (Galhena et al. 2013)	✓	✓



Trans-SEC
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UPS 1a: Rainwater harvesting for improving smallholder farmer's sole and intercrop yields under a rain-fed farming system

Jörn Germer, Ludger Herrmann, Henry Mahoo, Elirehema Swai, Frieder Graef, Frederik Kahimba, Folkard Asch, Siza Tumbo, Bashir Makoko, Anthony Kimaro, Meike Schäfer, Paul Saidia, Emmanuel Chilagane

Key Objective To conserve soil moisture in the field and to increase crop production in sub humid and semi arid areas. To reduce runoff and soil erosion for sustainable soil fertility management and crop productivity.

FVC component(s)
Natural Resources, Crop Production

Key constraint addressed
In semi arid and sub humid areas, low soil moisture is a major production constraint for crop production. These areas are characterised by having low amounts of rainfall, which is poorly distributed. The rate of evapotranspiration is higher than the precipitation especially for semi arid areas. Flat cultivation, a common farm practice, resulted in poor soil water management, runoff, poor land husbandry, and low crop production.

Pearl Millet drying due to drought condition in Idifu village, Chamwino district 2014/15

Description
Rainwater harvesting (RWH) technologies promote crop production and have been used for generations in Tanzania. There are three main types of RWH technologies: (1) in situ; (2) micro-catchment; and (3) macro-catchment RWH. In situ RWH involves harvesting the rainwater directly as it falls on the field, or collecting and concentrating runoff water within the fields and reducing soil erosion at the same time. It includes technologies such as tied-ridges, infiltration pits, micro-basins, ripping, deep tillage, and mulching. Tied ridges of 75-80cm between ridges and 20cm high as well as cross-ties of 1.5m apart and 15cm high are constructed to create mini-basins. In case of light rainfall, the water accumulates, remains and infiltrates into the mini-basins. When rainfall is heavy, the water runs off over the cross-ties along the contour, because the cross-ties are lower than the furrow ridges and the furrows are built at an angle to the contour. Thus, overtopping, i.e. excess water flowing over the ridges, is prevented. The cross-ties reduce the speed of the water flow within rows.

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UPS 1b: Fertilizer Micro-dosing for increasing yields under sole and intercropping systems for rural stakeholders

Jörn Germer, Ludger Herrmann, Henry Mahoo, Elirehema Swai, Frieder Graef, Frederik Kahimba, Folkard Asch, Siza Tumbo, Bashir Makoko, Anthony Kimaro, Meike Schäfer, Paul Saidia, Emmanuel Chilagane

Key Objective To increase and maintain soil nutrient status for sustainable soil fertility management in sub humid and semi-arid areas. Also to improve crop yield with a minimal external input requirement for resource poor farmers in sub humid and semi-arid areas.

FVC component(s)
Natural Resources, Crop Production

Key constraint addressed
Declining soil fertility due to continuous farming without replenishment of nutrients through fertilizers leads to poor soil fertility and low crop production. Low and erratic rainfall, poor knowledge of soil fertility improvement technologies as well as high cost fertilizers deter small-scale farmers from using recommended amounts of fertilizers to improve soil fertility and sustain crop production. This situation is more critical in dry lands and semiarid areas where the risk of crop failure is high to sporadic and short precipitation.

Description
Micro-dosing involves the addition of small doses of fertilizers to crops during sowing for P fertilizers, such as DAP and TSP, as well as N fertilizers, such as Urea, at fourth to sixth leaf stage (V4 – V6) in cereal crops. This farmer-oriented technology is designed to improve fertilizer use efficiency via localized application. Micro-dosing increases uptake and reduces the investment risk as compared to broadcasting. Farmers can reduce fertilizer costs by more than 50% without adversely affecting crop yields or profitability. When integrated with organic matter and other ISFM practices, like improved seed variety and pest control, the technology holds high potential to intensify farming systems while sustaining soil health and land productivity.

Amount of fertilizer applied in maize: A, B, C and D are micro-doses at 12.5%, 25%, 50% and 75% of recommended amount, E.

Micro-dose technology can be promoted as an entry point to boost crop yields while using affordable or low risk fertilizer rates, while later farmers may move to a higher rate as they appreciate the need and benefits of applying fertilizers.

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Figure 2: Fact Sheet synopsis of UPS 1a Rainwater harvesting and UPS 1b Fertilizer Microdosing

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UPS 2: Pyrolysis for energy and biochar production in rural areas

Valerian Silayo, Yusto Yustas, Simon Munder, Götz Uckert, Joachim Müller, Nikson Elly, Anthony Kimaro, Mathew Mpanda, Harry Hoffmann

Key Objective To process crop wastes and by-products into useful energy and other products as means of adding value to the crop production subsector.

FVC component(s); key constraints and objectives addressed
The key constraints identified include inadequate management of waste processing and nutrient cycling, inadequate utilization of crop waste products (e.g. maize cobs) as a household energy source, low value accorded to some wastes and by-products, as well as haphazard disposal of such by-products leading to potential environmental pollution. Therefore, the main objective of this UPS is to process crop wastes and by-products into useful energy and other products as means of adding value to the crop production subsector.

Description
On-farm crop residues are not efficiently used: typically it is left to decompose or, sometimes, used by livestock in-situ. Crops residues are available in parallel with animal manure where crops and livestock production are integrated. The main crops grown in the project area include maize and sesame in the Kilosa district and millet, sorghum and sunflower in the Chamwino district. These crops, primarily processed at both household and peri-urban centres, generate by-products that could be utilized in various ways, including use for cooking. The same applies to secondary processing, where the resulting by-products have some limited use, but are often left unutilized, resulting in pollution through decomposition into uncontrolled emission of marsh gases and proliferation of disease causing agents, such as mosquitos and flies. Although such products could be just burned, there are other alternative decomposition methods useful to the society. Promoting use of these products will add value to the FVC, reduce use of fuelwood, and save the environment from being polluted by such waste. Residues from primary processing, especially from threshing and shelling, are usually high in highly lignified structural components and therefore suitable for thermo-chemical conversion. Among

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UPS 2: Improved maize sheller and millet thresher machines for reducing human labor in rural areas

Yusto Yustas, Sebastian Romuli, Nickson Elly, Charles Mgeni, Simon Munder, Bashiri Makoko Götz Uckert, Valerian Silayo, K. Mutabazi, Christopher Magomba, L. Mwinuka, and Joachim Mueller

Key Objective The main objective of the UPS is to improve the livelihood of farmers by introducing machinery that increases the efficiency of shelling maize and threshing millet at their location.

FVC component(s): Processing

Key constraints addressed
Some of the key constraints associated with post-harvest processing of agricultural products by smallholder farmers include low income; highly intensive human labor needs for shelling and threshing activities, as well as poor knowledge of better processing methods at the case study sites.

Description
Primary processing by smallholder farmers in Tanzania is still largely performed directly in the field or with technically insufficient devices. As maize shelling and millet threshing is performed in a labor-intensive way, the products are of poor quality and polluted with dust, animal waste and insects. Awareness of better and more efficient shelling and threshing methods is lacking at the case study sites.
Appropriate technologies to address the aforementioned challenges are available and have been focused on by numerous projects (Tefera et al., 2012). Both manufacturers and traders are present in Tanzania and are willing to sell the machinery to stakeholders in CSS. Regarding this fact, researchers from SUA and MVIWATA along with stakeholders carried out discussions about advantages, disadvantages and possible benefits of mechanizing both maize shelling and millet threshing. The stakeholders in question were farmers in the Kilosa district for maize shelling and those in the Chamwino district for millet threshing. Later, development of business models to help stakeholders purchase the machinery was completed by SUA researchers while MVIWATA were involved with the machine procurement process. These machines can be powered by engines or electrical motor. Since the electricity is a challenge in the CSS, the chosen machines were powered by diesel engines.

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UPS 4: Improved wood supply on-farm, education and tree planting: Wood supply and environmental sustainability in rural communities

Anthony A. Kimaro, Götz Uckert, Ogossy Gasaya, Johannes Hafner and Martha Swamila

Key Objective This UPS was designed to address the cooking energy and land degradation problems by integrating fast growing tree species to supply wood and improve soil fertility.

Key constraint addressed
Over 90% of rural households in Tanzania rely on biomass energy for heating and cooking. Native forests are limited and facing increased pressure as wood is extracted for fuelwood, construction materials, and other wood products. Consequently, there is an acute shortage of cooking energy in semiarid sites like Dodoma. To cope with this problem, farmers often uses crop residues and livestock manure as a source of cooking energy. However, this approach accelerates land degradation and nutrients depletion because it disrupts the nutrient cycling processes.

Description
This UPS focus on building the capacity of farmers to produce tree seedlings and plant trees that provide alternative sources of wood biomass for the supply of cooking energy (especially firewood), fodder, other wood products (e.g. poles), and for the provision of other environmental services (e.g. improving soil fertility, carbon sequestration, and soil erosion). One of the main challenges to tree planting is the availability of a sufficient number of high quality tree seedlings. In order to address this challenge during and after the Trans-SEC project phase out, community-based tree nurseries were established. This activity started by mobilizing farmers into groups (*Mazengo* and *Jamhuri*) to facilitate training. These groups have a total of 31 members, with women forming 74% of the group. Training was conducted for three days per group and covered the following topics: site selection, seed source, selection and collection, potting mixture and pot filling, nursery management, as well as silvicultural treatments of seeds and seedlings at the nursery. Group members were also trained on tree planting techniques. After training, farmers participated in nursery establishment activities, including pot filling and seeding. Tree seedlings were planted in various niches in the fields, including farm boundaries, within the farm where suitable species like *Gliricidia sepium* are intercropped with crops, and in highly degraded sites not suitable for crop production, such as woodlots or pure stands. ARI Hombolo and ICRAF staff conducted regular monitoring of trees in the nursery and farmers fields to get feedback from farmers on progress and challenges encountered as well as to assess the survival and growth of the seedlings. Data collected was used to calculate preliminary estimates of biomass yields to demonstrate the extent to which agroforestry technologies may meet household cooking energy demand, improve crop production, and reduce land degradation.

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UPS 5: Using Improved Firewood Cooking Stoves and its Implica tions for rural livelihoods in Tanzania

Götz Uckert, Anthony Kimaro, Ocossy Gasaya Sererya, Methusela Obedy, Zacharia Maseta

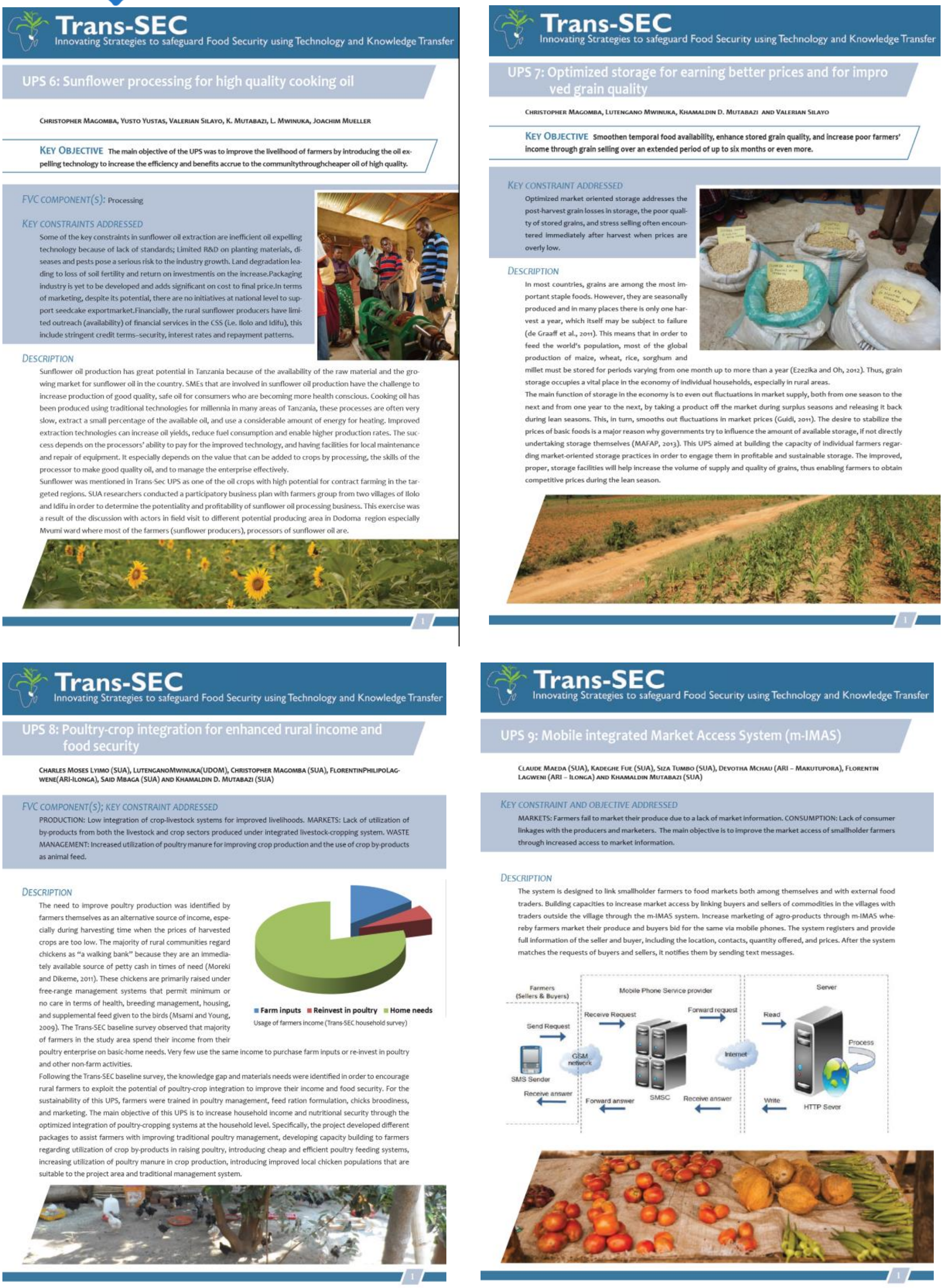
Key Objective The objectives of establishing this technology is to reduce the demand for fuelwood, improve the economy of rural citizens, and ensure environmental sustainability.

FVC component(s); key constraints addressed
This UPS focuses on the natural resources and energy supply. The key constraints addressed are forest degradation and deforestation to supply wood fuel, high reliance on wood fuel (fuel wood & charcoal) as the main source of energy.

Description
The Improved Cooking Stoves (ICS) improves the utilization methods of fuel-wood aiming at achieving higher cooking efficiency, improved health via reduced smoke, and time savings for women. Different types have been explored in field trials. An ICS was chosen as most advantageous for rural areas. The ICS were manufactured by experienced trainers within the village. Materials used (clay, iron and bricks) as well as the design and functionality are still being improved and adapted, thus "improving the improved stoves."

Construction training: Three to 8 individuals from each sub-villages were trained on how to construct stoves, prepare firewood (storage and drying), and how to provide the service of stove construction to other households. The training of trainer concept was established to share, disseminate, and sustain knowledge among the village households. In Tanzania, like many other sub-Saharan countries, communities use traditional cooking stoves for cooking and heating (Eleri and Eleri, 2009; Belward, 2011). Traditional stove cooking technology has adverse affects not just on the citizen's health, livelihoods, and local environment, but also on climate change via the excessive burning of biomass. The use of improved firewood cooking stoves will contribute much to the economic wellbeing of the community, by reducing firewood consumption, thus reducing time spent on firewood collection and cooking, while also reducing pollution emissions (Lusambo, 2009).

Figure 3: Fact Sheet synopsis of UPS 2 of Pyrolizer, UPS 3 maize sheller and millet thresher, UPS 4 Improved wood supply, and UPS 5 Improved Cooking Stoves



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UPS 6: Sunflower processing for high quality cooking oil

Christopher Magomba, Yusto Yustas, Valerian Silayo, K. Mutabazi, L. Mwinuka, Joachim Mueller

Key Objective The main objective of the UPS was to improve the livelihood of farmers by introducing the oil expelling technology to increase the efficiency and benefits accrue to the communitythroughcheaper oil of high quality.

FVC component(s): Processing

Key constraints addressed

Some of the key constraints in sunflower oil extraction are inefficient oil expelling technology because of lack of standards; Limited R&D on planting materials, diseases and pests pose a serious risk to the industry growth. Land degradation leading to loss of soil fertility and return on investmentis on the increase.Packaging industry is yet to be developed and adds significant on cost to final price.In terms of marketing, despite its potential, there are no initiatives at national level to support seedcake exportmarket.Financially, the rural sunflower producers have limited outreach (availability) of financial services in the CSS (i.e. Ilolo and Idifu), this include stringent credit terms–security, interest rates and repayment patterns.

Description

Sunflower oil production has great potential in Tanzania because of the availability of the raw material and the growing market for sunflower oil in the country. SMEs that are involved in sunflower oil production have the challenge to increase production of good quality, safe oil for consumers who are becoming more health conscious. Cooking oil has been produced using traditional technologies for millennia in many areas of Tanzania, these processes are often very slow, extract a small percentage of the available oil, and use a considerable amount of energy for heating. Improved extraction technologies can increase oil yields, reduce fuel consumption and enable higher production rates. The success depends on the processors' ability to pay for the improved technology, and having facilities for local maintenance and repair of equipment. It especially depends on the value that can be added to crops by processing, the skills of the processor to make good quality oil, and to manage the enterprise effectively.
Sunflower was mentioned in Trans-Sec UPS as one of the oil crops with high potential for contract farming in the targeted regions. SUA researchers conducted a participatory business plan with farmers group from two villages of Ilolo and Idifu in order to determine the potentiality and profitability of sunflower oil processing business. This exercise was a result of the discussion with actors in field visit to different potential producing area in Dodoma region especially Mvumi ward where most of the farmers (sunflower producers), processors of sunflower oil are.

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Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer

UPS 7: Optimized storage for earning better prices and for impro ved grain quality

Christopher Magomba, Lutengano Mwinuka, Khamaldin D. Mutabazi and Valerian Silayo

Key Objective Smoothen temporal food availability, enhance stored grain quality, and increase poor farmers' income through grain selling over an extended period of up to six months or even more.

Key constraint addressed

Optimized market oriented storage addresses the post-harvest grain losses in storage, the poor quality of stored grains, and stress selling often encountered immediately after harvest when prices are overly low.

Description

In most countries, grains are among the most important staple foods. However, they are seasonally produced and in many places there is only one harvest a year, which itself may be subject to failure (de Graaff et al., 2011). This means that in order to feed the world's population, most of the global production of maize, wheat, rice, sorghum and millet must be stored for periods varying from one month up to more than a year (Ezezika and Oh, 2012). Thus, grain storage occupies a vital place in the economy of individual households, especially in rural areas.
The main function of storage in the economy is to even out fluctuations in market supply, both from one season to the next and from one year to the next, by taking a product off the market during surplus seasons and releasing it back during lean seasons. This, in turn, smooths out fluctuations in market prices (Guidi, 2011). The desire to stabilize the prices of basic foods is a major reason why governments try to influence the amount of available storage, if not directly undertaking storage themselves (MAFAP, 2013). This UPS aimed at building the capacity of individual farmers regarding market-oriented storage practices in order to engage them in profitable and sustainable storage. The improved, proper, storage facilities will help increase the volume of supply and quality of grains, thus enabling farmers to obtain competitive prices during the lean season.

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Trans-SEC
Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer

UPS 8: Poultry-crop integration for enhanced rural income and food security

Charles Moses Lyimo (SUA), LutenganoMwinuka(UDOM), Christopher Magomba (SUA), FlorentinPhilipoLagwene(ARI-Ilonga), Said Mbaga (SUA) and Khamaldin D. Mutabazi (SUA)

FVC component(s); key constraint addressed

PRODUCTION: Low integration of crop-livestock systems for improved livelihoods. MARKETS: Lack of utilization of by-products from both the livestock and crop sectors produced under integrated livestock-cropping system. WASTE MANAGEMENT: Increased utilization of poultry manure for improving crop production and the use of crop by-products as animal feed.

Description

The need to improve poultry production was identified by farmers themselves as an alternative source of income, especially during harvesting time when the prices of harvested crops are too low. The majority of rural communities regard chickens as "a walking bank" because they are an immediately available source of petty cash in times of need (Moreki and Dikeme, 2011). These chickens are primarily raised under free-range management systems that permit minimum or no care in terms of health, breeding management, housing, and supplemental feed given to the birds (Msami and Young, 2009). The Trans-SEC baseline survey observed that majority of farmers in the study area spend their income from their poultry enterprise on basic-home needs. Very few use the same income to purchase farm inputs or re-invest in poultry and other non-farm activities.

Farm inputs ■ Reinvest in poultry ■ Home needs
Usage of farmers income (Trans-SEC household survey)

Following the Trans-SEC baseline survey, the knowledge gap and materials needs were identified in order to encourage rural farmers to exploit the potential of poultry-crop integration to improve their income and food security. For the sustainability of this UPS, farmers were trained in poultry management, feed ration formulation, chicks broodiness, and marketing. The main objective of this UPS is to increase household income and nutritional security through the optimized integration of poultry-cropping systems at the household level. Specifically, the project developed different packages to assist farmers with improving traditional poultry management, developing capacity building to farmers regarding utilization of crop by-products in raising poultry, introducing cheap and efficient poultry feeding systems, increasing utilization of poultry manure in crop production, introducing improved local chicken populations that are suitable to the project area and traditional management system.

Trans-SEC
Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer

UPS 9: Mobile integrated Market Access System (m-IMAS)

Claude Maeda (SUA), Kadeghe Fue (SUA), Siza Tumbo (SUA), Devotha Mchau (ARI – Makutupora), Florentin Lagweni (ARI – Ilonga) and Khamaldin Mutabazi (SUA)

Key constraint and objective addressed

MARKETS: Farmers fail to market their produce due to a lack of market information. CONSUMPTION: Lack of consumer linkages with the producers and marketers. The main objective is to improve the market access of smallholder farmers through increased access to market information.

Description

The system is designed to link smallholder farmers to food markets both among themselves and with external food traders. Building capacities to increase market access by linking buyers and sellers of commodities in the villages with traders outside the village through the m-IMAS system. Increase marketing of agro-products through m-IMAS whereby farmers market their produce and buyers bid for the same via mobile phones. The system registers and provide full information of the seller and buyer, including the location, contacts, quantity offered, and prices. After the system matches the requests of buyers and sellers, it notifies them by sending text messages.

Figure 4: Fact Sheet synopsis of UPS 6 Sunflower processing, UPS 7 Optimized Market oriented storage, UPS 8 Poultry crop integration, and UPS 9 Mobile Integrated Market Access System

Trans-SEC
Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer

UPS 10: Household centered nutrition training and kitchen gardens of green leafy vegetables for improved dietary diversity and family health

CHRISTINE LAMBERT (UHOH), JOYCE KINABO (SUA), HADIJAH MBWANA (SUA), HANS KONRAD BIESALSKI (UHOH), NURU MGALE (ARI-MAKUTUPORA), RASHID ALLY (ARI-ILONGA)

KEY OBJECTIVE The main objective of this UPS was to improve the food consumption patterns, nutrient intake, and dietary diversity of rural household family members.

FVC COMPONENT(S): Production

KEY CONSTRAINTS ADDRESSED
Rural areas in Tanzania face a number of nutrition problems, including poor nutritional knowledge, inadequate consumption of micronutrient green leafy vegetables, stereotypes about vegetables, low dietary diversity, inadequate domestication efforts for vegetables, as well as the low use of vegetable cultivation during off-season.

Figure 1: A Nutrition training session taking place in Idifu village

DESCRIPTION
The implementation were done in semi arid (Ilolo and Idifu) and sub humid (Ilakala and Changarawe) villages. A baseline survey assessed needs in order to identify the nutritional needs of the population. Nutritional training materials were developed based on the knowledge gap and needs identified from the baseline survey. Household nutritional training was provided to both male and female household members. In rural areas where water is scarce, the introduction of pocket/bag gardens is feasible because they require very little water compared to conventional ground gardens. Typically pocket gardens are on the doorstep, thus ensuring the immediate availability of vegetables. Pocket bag demonstrations were conducted at one central household close to the seedling nursery bed. Materials required to start pocket gardens include: manure, sand, soil, pebbles, pocket bag, water, spade, and buckets. Another type of gardening that was implemented was the 'tray' garden, where a plastic material is inserted into a square hole then filled with pebbles, dry grass and a mixture of soil, sand, and manure. Crops are planted on top. These types of kitchen

Figure 2: Pocket/bag making demonstration in progress at Ilolo

Figure 5: Fact Sheet of UPS 10 Household Nutrition training and Kitchen Gardens

6 UPS Farmer groups formation and dynamics in the four CSS

This task involved FGDs and workshops of all 150 grassroots level stakeholders in the CSS who participated in the baseline survey. The activity aimed to organise farmers into strong and sustainable groups around each prioritised UPS to ensure better and easy coordination, accessibility, monitoring and training of members on specific aspects related to the UPS they are engaged in. In each CSS, a two day workshop was organised for farmers to share the prioritized UPS for each specific FVCC together with proposed criteria for selecting members of different UPS groups for better decision making. This activity resulted into formation of 27 UPS groups: 7 in Ilakala, 7 in Changarawe, 7 in Ilolo and 6 groups in Idifu villages. After formation of UPS groups, MVIWATA organised workshops to facilitate formalization of groups in all CSS through establishment of UPS groups' leadership structures and strengthening to ensure that they are capable to manage themselves the activities and any business related to the group. The strengthening mission involves capacity building trainings to all group members on leadership skills, group dynamics and business model. Monitoring of group dynamics to see stakeholder drop outsandmovement between groups is a continuing process. Three groups out of 27 have terminated due to different reasons.

7 Implementing UPS in the CSS and on farm to test and validate prioritised UPS

The task involved participatory design and implementation of all UPS selected. Each farmer from specified UPS group was required to implement a selected UPS to verify its sustainability and the proposed management practices. All UPS within the CSS were supervised by ARIs and PhD students. The UPS are sets of various activities and cover up to 4 different FVC components (Table 2). Implementation costs, time range, and the type of stakeholder group differed depending on the UPS.

Table 2: UPS implementation status for each food value chain component

UPS	FVC component[1]	Implementation cost [2]	Implementation time range[3]	Stake holder group type[4]	Implementation Status[5] (0-3)
1 Rainwater harvesting & Fertiliser micro-dosing & Optimised weeding	NR, P	15-20 € per person & ha	3-5	B,C	3
2 Byproducts for bioenergy (pyroliser for charcoal making)	PH, E, P, C	35-50 € per pyroliser	12-24	B	2
3a Improved processing (maize sheller)	PH, E, M	2600 € per CSS	13-24	A	2
3b Improved processing (millet thresher)	PH, E, M	1800 € per CSS	13-24	A	2
4 Improved wood supply	E	2-3 € per person	5-10	B	3
5 Improved stoves	E, C	3-4 € per person	6-8	B	3
6 New product : sunflower oil pressing	PH, E, M	3500 € per CSS	24	A	2
7 Optimised market oriented storage	PH, E, M, C	2,5-3 € per bag	10-12	B,C	2
8 Poultry-crop integration	P, M, C	20-50 € per person	13-26	A	1-2
9 Market access system (m-IMAS)	M	none	24	C	1-2
10 HH nutrition education & Kitchen garden training	NR, P, C	1-5 €	3-6	B	3

[1] Natural Resource Management: NR; Crop/Animal Production: P; Post-harvest processing: PH & biomass / energy supply: E; Markets and income generation: M; Consumption: C; [2] initial investment in €; [3] duration in months across different CSS after UPS decision making; [4] well organized farmer group with by-laws, bank account, and official registration: A; loosely organized farmer group with by-laws: B; no farmer group required: C;
[5]not fully implemented: 1; just implemented: 2; fully implemented since > 2 years: 3

8 UPS monitoring

Participatory monitoring of impact of all Trans-SEC UPS tested along the selected FVCs in all CSS is done by project partners. During this process, Trans-SEC partners with expertise in the selected UPS jointly evaluate with grassroots level stakeholders (farmers) the UPS for their success, adaptability and adoption basing on pre-defined criteria and indicators of food security. This task aims to generate knowledge to support (1) capacity building and (2) decision making at community, regional, and national level and (3) other research networks active in Tanzania and East Africa. Promising UPS among the FVCs tested are demonstrated as central lessons learnt.

Five monitoring types of are done in UPS namely: 1) Household survey (HH survey wave 1 and 2), 2) UPS intensive weekly –monthly monitoring, 3) UPS groups tri-monthly monitoring, 4) UPS annual impact assessment (FoPIA), 5) UPS experts' impact assessment (ScaLA-FS) (Figure 6). All monitoring data are collected and stored in a systematic project repository at SUA.

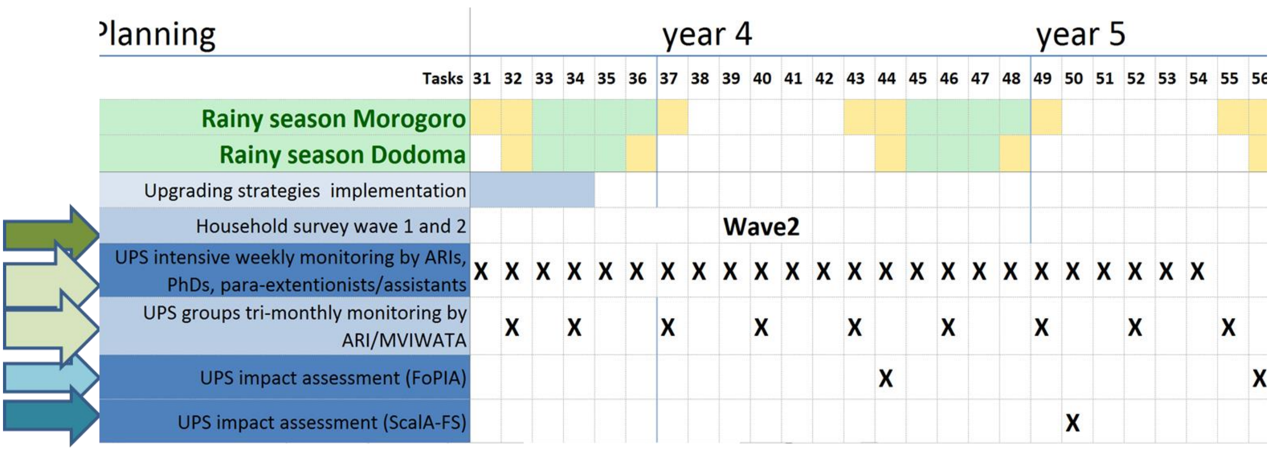

Figure 6: UPS monitoring framework for each method and time schedule in CSS

The second HH survey (wave 2) was done after two years of UPS implementation. The survey in both wave 1 and 2 covered all 150 HH which are involved in UPS implementation in each CSS village and also 150 HH in the control village. The intensive UPS weekly-monthly monitoring is done by ARI staff, PhDs students and field assistants. It entails HH specific UPS monitoring where HH implementing each UPS are monitored intensively every week and at the end of each month for 3 days per CSS with the aim of reaching every HH once per month. UPS groups tri-monthly monitoring involves UPS group specific monitoring after every three months. It is done by MVIWATA who covers the sections of group dynamics and ARI who covers the technical part of UPS implementation. In both UPS weekly-monthly and tri-monthly monitoring, reports are prepared and sent to Sokoine University of Agriculture (SUA) for compilation and storage in Trans-SEC repository.

UPS impact assessments were done by project scientists using the ex-ante impact assessment tool ScalA-FS (Graef et al. 2017). The tool is used as a simple instrument to assess the UPS that are adaptable, applicable and most likely successful in the Trans-SEC context (Ex-ante assessment) and will also be used in assessing ex-post the impact of all UPS (Crewett et al 2011, FAO, 2013, IFAD 2014). The Framework for Participatory Impact Assessment (FoPIA) is another method for conducting a participatory impact assessment with the implementing stakeholders . This method is being used once per year for assessing all UPS in the CSS where 10-12 members of each UPS are involved.

9 UPS Outscaling to neighboring villages

After two years of UPS implementation, the project started receiving requests from neighbouring and even distant villages for the upgrading strategies (UPS) being tested in the project's case study sites. This came while the project was still devising how it will outscale the UPS within the case study village and beyond. Following this, the project designed and tested an UPS promotional and outscaling strategy that was used for the first time in Kilosa 14th April 2016. That strategy used conventional farmers' field days to showcase the UPS to farmers within the CSS villages and neighbouring villages. That promotional event was carried out in all case study sites. The invited farmers from neighbouring villages had time to learn about the implemented UPS and exchange experience with the farmers that are testing the UPS of their interest.

Outscaling protocol

In the due course of the outscaling of UPS to other farmers in the neighbouring villages, the following approach developed by the project was employed: Establishment of a short profile of target village and requesting farmers; Establishing how requesting farmers/villages knew about Trans-SEC's innovations; Organizing farmer exchange visits to Trans-SEC villages where few farmers from the outreach village were facilitated by the project to visit the UPS in the CSS accompanied by champion farmers in CSS and researchers and UPS experts. A technical presentation of the UPS was carried out during the exchange visit. The project's expert explained the technical dimensions of the innovations. These entailed how the innovations are practically implemented, what it takes in terms of material, requirements and payoffs or benefits, both qualitative and quantitative. The experts simplified the descriptions and improved visibility through pictorial presentations of some UPS.

Future outscaling strategies to neighbouring villages

(i)Formation of farmer champion groups

After the farmers realized what it takes to be involved in respective innovations they will be facilitated to form groups by MVIWATA organization taking into account the group management requirements (Table 2).

(ii)Evaluation of the outreach outcome

After 6-12 months the project will send UPS experts to evaluate the out-scaling and implementation results. This evaluation will be based on agreed upon indicators during the closure of the visit in the Trans-SEC's case study villages.

Upscaling at District, Regional to National level

To disseminate the knowledge generated to district, regional to national level, the following means and communication channels are employed: (1) publishing Trans-SEC results in peer-reviewed and preferably open-access journals; (2) involving partner NGOs to disseminate Trans-SEC results to farmer schools, governance groups and other associations. This task is relevant to stakeholders at multiple scales from local to regional up to national levels. The recommendations are reported annually among policy makers and funding organisations ,Trans-SEC partners, and experts from the Ministry of Agriculture Livestock and Fisheries and Tanzanian media to create avenues for outreach to other Tanzanian policy sectors.

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