# Trans-SEC

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

**Contractnumber: 031A249A**

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| **Work package 3** |
| **November 2013** |
| **Deliverable**<br><br>**D3.1.1** |
| **Title:**<br><br>**Identifying, defining and typologizing FVC and upgrading strategies** |
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| Final | X |
| Submitted for internal review | |

## Overview of work package

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| Work package number | 3 | | Start date or starting event: | | | 15/08/2013 | | | |
| Work package title | Food Value Chains and Risk Analysis | | | | | | | | |
| Activity Type | Qualitative FVC/Food System Scoping study | | | | | | | | |
| Participant number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Participant short name | SUA | ARI | | | | | | | |
| Person-months per participant: | 40.9 | 28.2 | | | | | | | |

### Objective

An overarching aim of WP 3 is to typologize the food value chain and the food system at large – through a participatory approach.

### Specific objectives

(1) To screen the extent to which value chain activities have been successful or failed to improve livelihoods and food security of households
(2) To identify and define potential upgrading strategies of households within value chains to improve food security and livelihoods in a participatory approach

### Description of work

In collaboration with other work packages, WP 3 is supposed to screen, identify, evaluate, and develop upgrading strategies and best practices of value chain activities and institutional frameworks, which can be evaluated in an impact assessment. The value chains are aimed at covering domestic markets, enabling the link to the objectives of national food security policy of Tanzania and its vision 2025. A panel survey will be conducted to assess the impact of value chain activities on vulnerability to food insecurity.

### Task 3.1:

Identifying, defining and typologising FVC and upgrading strategies to establish a comprehensive Tanzanian inventory (data base)

## Milestones

M3.1: Local and regional FVC and their components identified (M8) and prioritization of upgrading strategies carried out (M12)

## Deliverables

D3.1.1 Report and inventory on typologised FVC, their components and upgrading strategies in the case study regions including value chain maps, related stakeholder and participants, institutional framework and their activities. Evaluation and ranking of examples of good practices and FVC failures on the household level: (month 8)

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# Identifying, defining and typologizing FVC and upgrading strategies: A qualitative scoping study

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**March, 2014.**

## 1. Preamble

An initial qualitative scoping study was a quick study that aimed at illuminating the Food System1 (FS) and potential Food Value Chains (FVCs) in the CSS localities – at district and village scales. The study was guided by key analytical domains including: 1) Food sub-sector mapping; 2) identification of potential FVCs; and 3) assessment of existing FVC upgrading strategies. Along with addressing these key aspects, the study helped to identify some key stakeholders in the FS

Food sub-sector mapping: This was aimed at understanding the structure and function of the food system and its potential FVCs and key stakeholders. Related insights will serve as the basis for detailed FVCs and stakeholder analysis.

Identification of potential FVCs: Under this activity the potential commodity FVCs were identifying including assessment of the state of different components, functions, processes (technologies), actors and stakeholders along the chain – Natural resources >>Production >> Processing >> Markets >> Consumption. Other important value chain related aspects of R&D, input system, farm credit and waste management were covered.

## 2. The approach

The study used a series of Focus Group Discussions (FGDs) at CSS districts and villages. Two FGDs were conducted at the 2 CSS districts and 4 FGDs at the 4 CSS villages – 2 in each district. The FGD sessions were planned with the help of ARI-partners in each of the two locations – Morogoro and Dodoma. ARI- partners helped with introduction of the project to the District Executive Directors (DED) who oversees governance and development issues in the district.

The district-level FGDs were attended by officers from different departments – including agronomy, livestock production, irrigation, mechanization, input supply, cooperatives, marketing, and nutrition. At village level, prior arrangements were also made by ARI. Turnouts of farmers with their extensionists and village leaders were very impressive. Actually, the selection criterion of choosing villages with limited past project interventions seems to pay.

FGDs at both district and village level were interesting and interactive – taking an average of 3-4 hours. Such active engagement for a prolonged period suggests that Trans-SEC was well received. Generally, the pre-discussion introduction was made in such a way it demonstrated how Trans-SEC is different from other projects – focusing on invetorizing and auditing best fit innovations, understand them – in and out, learn conditions for transferability/scaling up, understand their sustainability and their impacts (on welfare, environment etc) – hence ultimately in upgrading the FVCs and food system in general.

The qualitative assessments based on the information obtained from the FGDs are presented

[1] Food system is a variety of processes along the food chains that take place in order to bring about food security. FS encompasses activities relate to the production, processing, distribution, preparation and consumption of food. The outcomes of FS contribute to environmental and other securities such as income.

with respect to different components of the FVCs in two CSS – Natural resources >>Production >> Processing >> Markets >> Consumption. The results and insights generated from the FGDs are summarized by CSS locations as presented under the following sections.

# 3. Sub-humid CSS –Morogoro region

## 3.1. Natural resources and production

This component was assessed with reference to key natural resources that are utilized to sustain the food system. The key resources that were identified in Kilosa district include land and forest. Irrigation water important because of the few smallholder irrigation schemes used for rice and vegetable production. Agriculture is largely rainfed. Other natural resources in the districts include wildlife (Mikumi National Park), and minerals (germstones and gold).

In Kilosa district, the predominant land access is mainly through customary tenure. Majority of farmers utilize family land acquired through inheritance. The land is increasingly scarce in most of the villages particularly those neighbouring the sisal plantations that were privatized. There have been tensions between the private owners and the surrounding communities who have been using the plantation lands since the parastatal farm plantations collapsed since early 1980s. The one of the CSS village in Kilosa (Changarawe) is among the most affected villages. Also, the second village has been requesting to be granted the ownership right of around 600 ha of land of the defunct neighbouring sisal plantation.

The agricultural land is generally fertile. However, soil fertility has been declining due to nutrient mining and persistently limited use of organic and inorganic fertilizers. It was reported during the FGD that on average a farming household owns around 1-3 acres. Typically, farming in Kilosa is – a low input system: characterized with limited use of fertilizer and improved seeds.

With reflection on the CSS villages the district level FGD participants estimated the level of productivity of key crops as indicated in Table 1.

Table 1: Estimated level of crop productivity in the CSS villages

| Crop | Changarawe (market access) | Ilakala (poor market access) |
|---|---|---|
| Maize | 6-7 bags/acre | 4-6 bags/acre |
| Paddy | 8-10 bags/acre | - |
| Simsim | 3 bags/acre | 3 bags/acre |
| Sunflower | 6-8 bags/acre | 6-8 bags/acre |
| Cotton | 400-600 kgs/acre | 400-600 kgs/acre |
| Cowpeas | 2-3 bags/acre | 2-3 bags/acre |
| Pigeon peas | 4-6 bags/acre | 4-6 bags/acre |
| Lablab | 3-5 bags/acre | 3-5 bags/acre |

Source: District level FGD, Kilosa

Mixed cropping is the widespread cropping systems. Farmers tend to mix all the crops in their plots. Tillage is done by hand; however, tractors and animal power technologies are used. It costs Tsh 50,000 and 40,000 to hire a tractor and oxen for tilling an acre of land, respectively.

Oxenization has been promoted by the Sukuma agro-pastoral immigrants.

The district has been promoting a number improved technologies including improved seeds (certified and QDS) and general agricultural education and extension. Farmers Field School (FFS) approach is the relatively novel technology transfer approach used in the villages.

The forest resource was perceived to be contributing to the food system through direct exploitation of forest products for food (edible products – e.g. honey, fruits, vegetables, medicines etc), construction (building poles etc), cash and energy (charcoal and wood).

The REDD+ pilot programme (under national REDD programme) has helped the villages to set-up village forest reserves. One CSS village has benefited due to its proximity to the forest conserved under REDD+ compensations scheme. None of the CSSS villages are under the REDD+ pilot project.

Land related conflict is an aspect worth resource governance attention. Kilosa district is among the district marked as hotspot for the bloody land-related conflict between Maasai pastoralists and crop farmers. The government intervention that involved land demarcation for pastoral and crop farming has not solved the problem. The grazing land that was allocated to pastoralists does not match with the stocking rates – and lack watering infrastructures. This seems to be the reasons of pastoralists extending their grazing activities into the cropland areas. Grazing on farmland not only that destroys the crops, it also compacts the soils and demolishes the farm installations – including technologies such as ridges. The participants strongly felt that this conflict undermines food security.

### 3.2. Processing

The agro-processing sector is underdeveloped. Recent developments in agro-processing are found in the oil seed sub-sector (particularly sunflower) and cereal milling (maize and paddy). The agro-processing practices in these sub-sectors are basically primary – oil pressing and milling.

Some traders run commercial sunflower press units – with single refinery process. These are stationed at the district headquarters and in at some rural centres. There also some farmer groups involved in sunflower processing that have been supported by the district council and other development partners. Neither of the oil press units run by the farmer groups nor commercial press units apply double refinery process. Single refinery process oil seeds has an health implications. This is an area for upgrading.

Some farmer groups running the oil presses are attempting to upgrade the oil refinery process (Figure 1). However, the effectiveness of such process has never been evaluated. The single refinery process ends with production of crude oil which is ready for sale to consumers. One liter of oil sells at Tsh. 3,000 at the factory-gate.

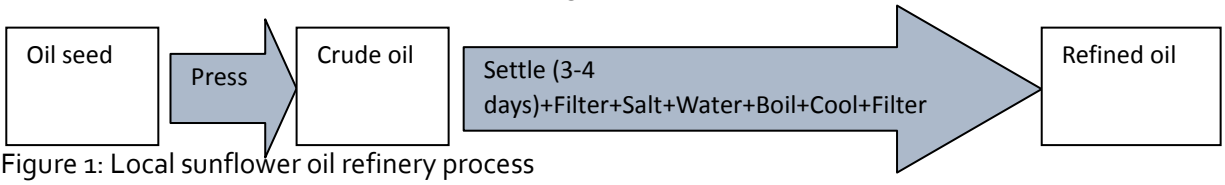


Figure 1: Local sunflower oil refinery process

However, such attempt to locally refine the pressed oil does not generate incremental returns – as the price of crude oil and refined is the same: Tsh 3000/l. It was underscored during the district FGD that the limitation is that the farmer groups that are innovating with the refinery process have failed to secure TBS label and bar code. In this regard, they have not complied with formal quality standards to enable them penetrate lucrative outlets – e.g. supermarkets. The certification process is also a limitation particularly for small-scale agro-processors.

Maize milling involves pounding mills that transform grains into flour. Whereas, the grain mills at district headquarters can de-coat and pound the grain, the rural mills can only pound the grains into flour. Other value addition activities such as grading, branding, packaging and labeling are lacking.

Other value added by products in the oil seeds and cereal value chains include the sunflower cake and maize bran. These products are traded as animal feeds. The gritty sunflower cake sells at Tsh 300/kg – Tsh 100 less compared to ground case that sells at Tsh 400/kg.

Field level wastes such as crop residues are usually burnt. Some farmers sell the crop residues (maize and rice straws) to the Maasai pastoralists – at 30,000-50,000/acre.

The maize bran is mainly collected by the farmers after milling their grains – they feed their local chicken. At the mill gate, maize bran sells at Tsh 2000/tin. The maize cobs are utilized at the household level as source of fuel.

The rice processing has two main side products – rice husks and rice bran. The rice bran fetches Tsh 500/tin at the mill gate. The use of rice husks is limited – to some extent used as energy in the brick making sector. There is also a potential of use of the rice husks in cooking stoves. However, rice is not produced at a tangible scale in the CSS villages. The REDD+ project promotes the biochar using rice husks. Biochar is a solid material obtained from the carbonisation of biomass.

Cowpeas are locally processed into burns (bagia) – a lucrative petty business for women in most of the villages.

Figure 2: An old woman roasting cowpea buns "*bagia*" in Kisanga village, Kilosa
Picture by Mutabazi (2012)

Soybean is a value crop that can be successfully grown in the district including the CSS villages. There has been efforts in the past to promote the crop with limited success due to failure in sustaining its value chain – production bias. The narratives regarding the grain legumes sub-sector and value chain based on the case studies of cowpea and soybean are crafted into detailed maps in Figures 3 & 4 (Mutabazi and Rusike, 2012).

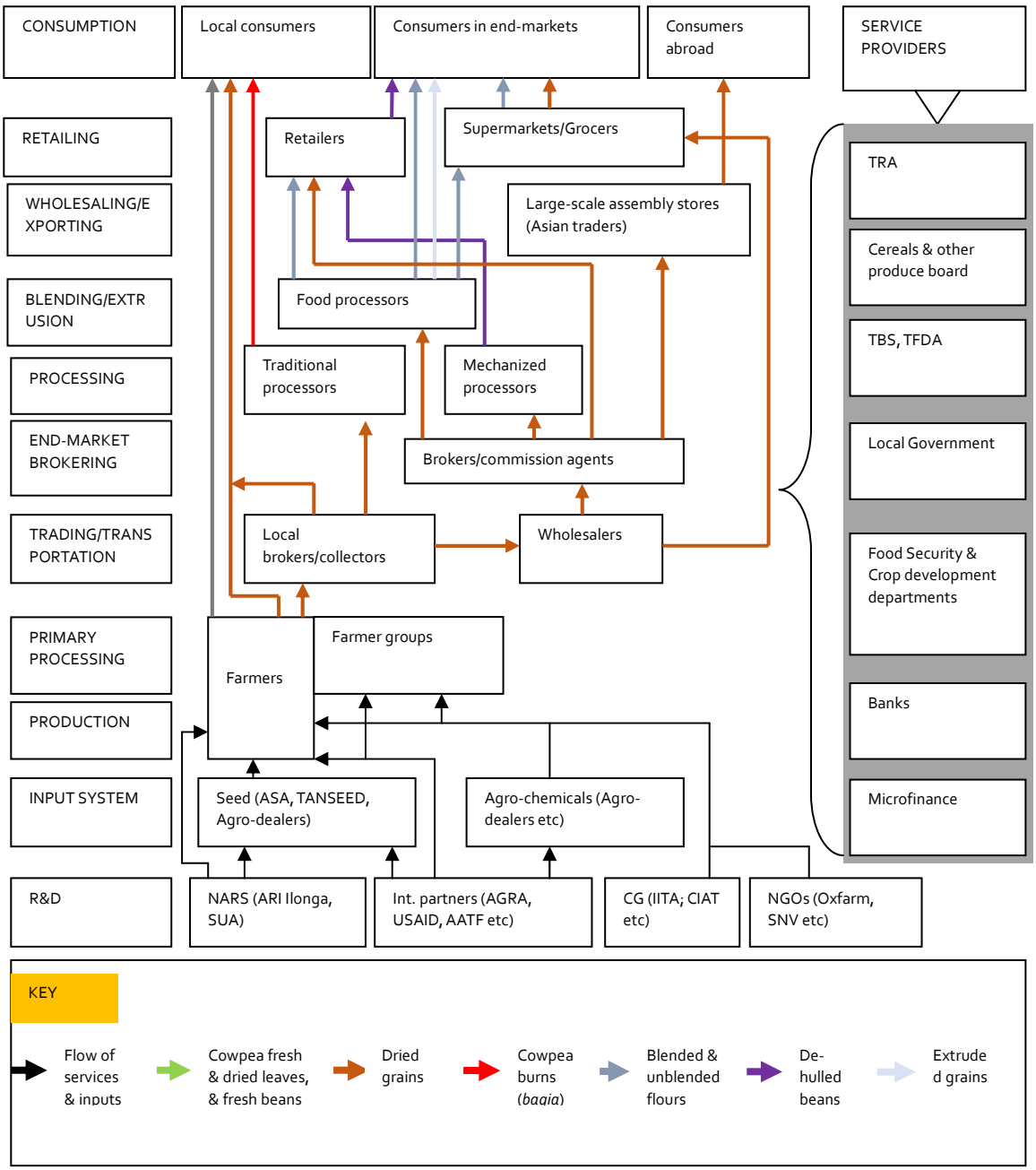



Figure 3: An empirical[2] grain legumes sub-sector map

[2] The map is empirical in the sense that it is based on established findings based mainly on the surveys and also on a desk review. The map presents the market functions, market players, traded product mix, R&D service providers, input system stakeholders, stakeholders in the capital markets, and key regulatory bodies that oversee trade and quality standards.

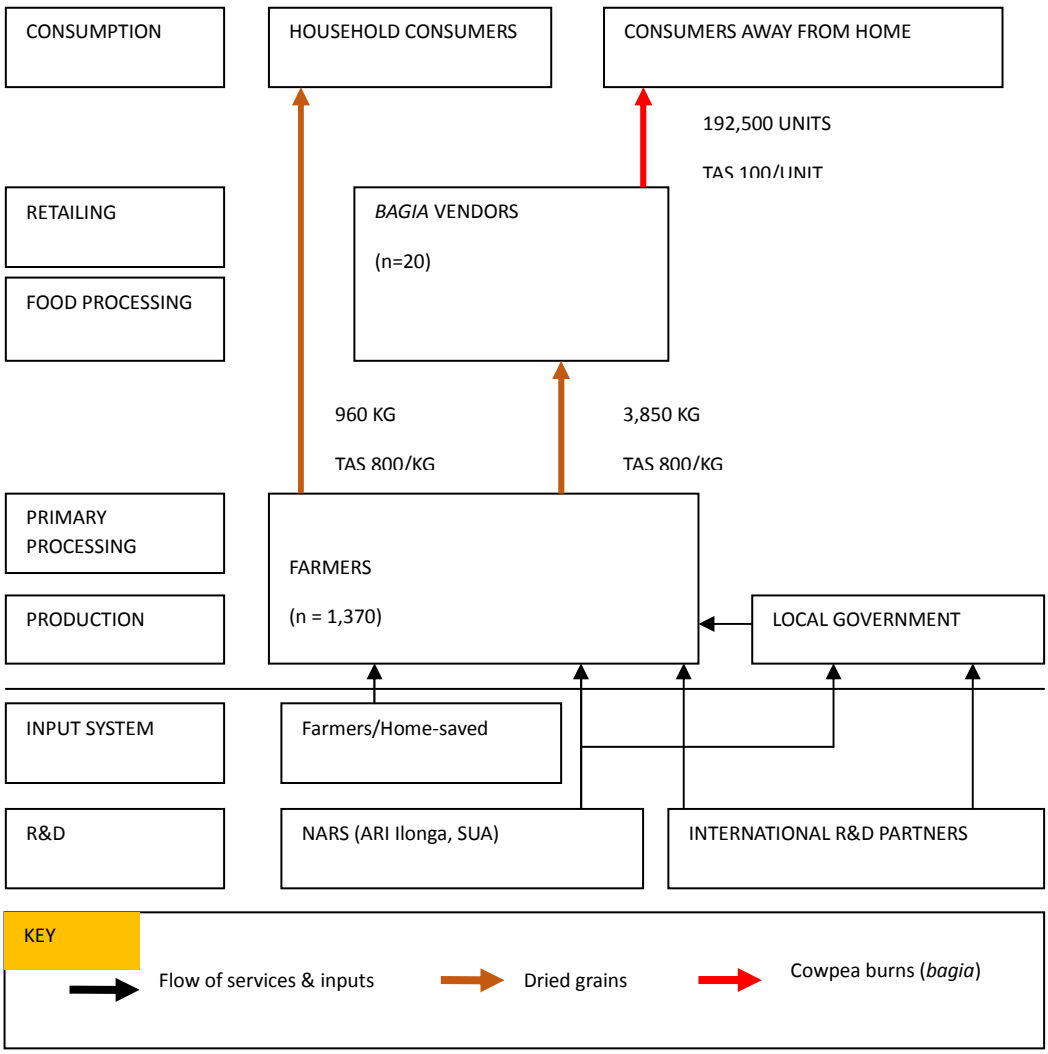


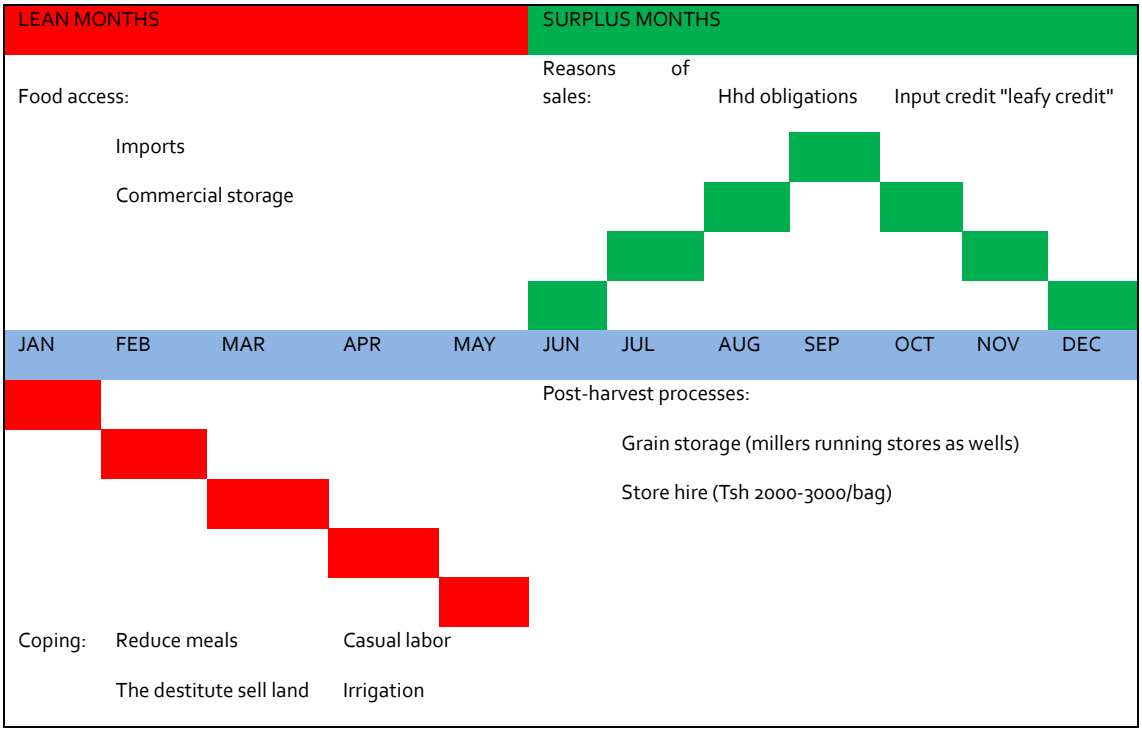

Figure 4: Cowpea value chain for Kisanga village, Kilosa: (Mutabazi and Rusike, 2012)

### 3.3. Markets and consumption

The district exports and imports food crops – mainly cereals (e.g. maize and rice) and legumes (e.g. cowpeas, beans, pigeon peas etc). The oil seeds exports is also growing – sunflower and simsim. The export destination markets include Dar es salaam, Morogoro and Dodoma.

The lean months with food deficit run from January to May (Figure 5). The surplus months span from June to December. The peak harvest months are August, September and October. During the food deficit months maize is imported into the district from Iringa, Songea and Dodoma. Maize import is both in form of grains and flour (sembe). Rice is imported from Ifakara within Morogoro. It will be interesting to understand the spatial integration of the food markets in the CSS districts and regions.

The FGD participants at the district felt that the markets are working properly. However, an empirical analysis is critical to understand the level of integration of the food markets – innovations in the food markets that can sustain the market linkages to safeguard food security.




Figures 5: Food security calendar, Kilosa

Kilosa is a bimodal area, with short (October – February) and long rains (March – May). The long rains form the main productions season. Production during the short rains season used smooth out the food supply over the year. However, with climate change, the short rains are no longer reliable. Under the rainfed system, the crops that are grown during the short rains include cowpeas, pigeon peas and simsim. Pigeon peas remain in the field – through the two seasons. The argument of the farmers is that the crop builds up a bigger canopy with two

rains – hence increased yield.

The local food consumption is shaped by food cultural preferences. The food menu is high-energy cereal based. Maize and rice are major staples. Grain legumes are served as relish in the food menu. Vegetables are also consumed – predominantly leafy vegetables such as cowpeas. Some farmers collect wild vegetables.

Whole grains are not preferred. The grains are de-hulled before milling. Whitish foods that tend to have lost most of the nutrients are preferred to brownish which are nutritionally recommended. This is the common trend in both urban and rural settings. Cooking is increasingly involving frying – growing with growing sunflower oil processing practices.

Drying remains a problem – poses the health risk. For instance, this has prompted some research to assess the problem of afflatoxin (TFDA & Mandela University). USAID also is interested in afflatoxin research.

### 3.4. Potential upgrading strategies

Adoption of a more or less *harmonized cropping calendar* would easy collective management of the problem of pastoralists grazing on planted crop fields. In case the village or sub-village croplands are evenly planted, there will be no unplanted patches of grasslands that attract pastoralists to bring their cattle for grazing. As of current, patches of grasses within the cropland attract pastoralists to graze their cattle amid of planted fields.

*Village land use planning* was considered the solution. Most of the villages have no land use plans.

*Improved tillage and agronomic practices* including tillage practices (e.g. deep, CA), use of improved seeds (certified & QDS) and fertilizers were also areas that the district officials felt that they need upgrading. The niche for Trans-SEC is to understand why such practices that have been promoted for decades are have not been widely adopted3.

Another area that was suggested for upgrading was a better knowledge on *managing the climate risks* associated with climate change and variability. This fits well in the overall task of risk analysis and management in the food system – and FVCs in particular.

*Improved agro-processing technologies*: the food processing technologies need upgrading. Double refinery technology is necessary to improve the quality and safety of the sunflower oil. Other potential agro-processing technologies could be those that enhances nutritive value and reduces post-harvest losses. This is goes hand in hand with optimization of benefits associated with agro-processing by-products and wastes.

Promotion of pro-poor warehouse receipt systems: WRS is basically an upgraded version of the conventional community grain banks. The facilities are underdeveloped in Kilosa district despite of the district potential. The WRS operates in the spirit of improving the prices that

[3] This raises another interesting question. A thorough adoption and diffusion studies of promising innovations whose uptake is still limited is critical. This will help translation of islands of innovation successes in seas of change towards upgrading and securing the food system.

farmers get for their produce through collective storage. The system operates along with a micro-credit scheme that will lend to farmers who have deposited their produce at the warehouse at the peak time of harvest. The farmer will repay the credit out of the proceeds from later sales when prices have improved. WRS model faces some challenges that need further research – design to be pro-poor, integration of the insurance scheme, transaction costs and management.

*Integration of weighing practices at the marketplaces*: this is critical for both crops and livestock. Adoption of standard weights and measures is lacking. Crop produce are sold in different containers and bags of different sizes. Animals (cattle) at the primary/secondary livestock markets are not weighed. The issue of using weights and measures in agricultural markets has been a constant cry of the rural farmers.

*Promoting market information systems*: this is critical in addressing the information asymmetry. Innovative upgrading strategies are required in this area. There some potential upgrading strategies in this area – most of them capitalizing on the use of ICT such as mobile phones and internet: ONE2TWO a market access platform which has partnered with the government to improve the market information networks (for more information visit: www.one2two.co.tz ). KIRSEC is another initiative that involved connecting smallholder farmers with buyers at an agreed commission (for more information visit: www.kilosaruralservices.com).

### 3.5. Potential stakeholders

The key stakeholders in the food system (apart from primary users/actors along the FVC at grass root level, see Deliverable 2.1.1) include:

*REDD+ project (TFCG/MJUMITA)*: the two NGOs collaboratively implement REDD+ pilot project under the national in the district – under the UN REDD programme. They are assisting villages with forest resource conservation, land use planning, promoting agricultural practices and energy technologies that mitigate drivers of deforestation and degradation.

*Mikumi National Park*: the park is located in the district. It implies on the district food security in different ways – restricting agricultural expansion, animal pest and vermins, and limiting access to grazing land.

*Sisal Estates*: the plantations affect agricultural expansion. However, some of them still grant access to undeveloped land to smallholders.

*MKURABITA*: the central government programme dealing with formalization of different undertakings including land titling.

District *Council*: Departments under DAICO (District Agriculture, Irrigation and Cooperative Officer), DLFO (District of Livestock and Fisheries Officer), Forestry department.

*ARI – Ilonga*: dealing with natural resources, crop varieties and management (breeding and agronomy.

*Sokoine University of Agriculture*: SUA as the lead agricultural university in the country has

been an important R&D stakeholder. Different departments at SUA have been working in Kilosa district – e.g. food science (on nutrition), crop science, forestry and nature conservation, agricultural education and extension, and animal science and veterinary medicine.

*ARI-Naliendele*: The institute deals with cashew (a crop now under revival in Kilosa) and oils seeds.

*ARI-Kibaha*: The institute deals with research in roots and tubers, also in sugarcane. Kilombera Sugar Estates (K1) is located in Kilosa district.

*Katrin research centre*: deals with rice research

*Wami Dakawa research centre*: deals also with rice

*ARI-Mlingano*: deals with soil fertility and management issues

*TAHA (Tanzania Horticulture Association)*: work with horticulture farmers on issues related with production and market linkages.

*USAID (i-wash)*: supports agriculture – particularly irrigation.

*Swiss Contact*: deals with issues related with youth in agriculture

*TASAF (Tanzania Social Action Fund)*: the central government funding mechanism for implementing locally raised sectoral development projects.

*Farmers*: these are individual farmers or farmer groups involved in crop and livestock production.

*SUMAGRO (SUMAIYA companies)*: promotes sorghum production and buy sorghum from farmers under contract farming. The purchased sorghum is sold to the brewery industry.

*China Estates*: the estate has a backward linkage involving helping farmers on good farming practices – maize and livestock production.

*Large-scale farmers*: a large-scale farmer called Koriat. Produces cereals and manages the grain storage facility. There also large/medium scale livestock farmers (Iyovi Estates, Mahenda).

*Heifer International*: It is an international NGO involved in heifer-in-trust programme, improvement of dairy cattle and goats, improvement of local chicken, fish farming, bee keeping, and promotion of backyard/kitchen gardens.

*Grain stores operators*: a number of grain storage owners (e.g. Kishai) who also runs grain mills. The storage facilities help with smoothing seasonal supply of grains through trade. Grain and flour shops procure from these stores to supply both urban and rural consumers.

*Milk collection centres*: the district has about 3 milk collection centres – Kimamba, Dumila and Chanzulu. The milk collection centres are owned by urban based dairy processors based in Dar es salaam and Morogoro.

*ASA (Agricultural Seed Agency)*: deals with multiplication and regulation of the seed sector.

*Private seed companies*: TANSEED International – a private seed company dealing with certified seed multiplication and trade. Minjingu Fertilizer Mining – processing and trading of phosphate rock fertilizer (based in Arusha)

*Tanzania Fertilizer Company*: oversees the fertilizer issues including quality monitoring and regulations.

*Stockists*: these are based at the district. They supply agricultural inputs to farmers in the district. Inputs that can be sourced from stockists include fertilizers, seeds, agro-chemicals and simple equipment. Some of the key stockists at Kilosa district were named to be: Robert Mwega, Kilosa Agro-vet and Ronest General Supply.

*District medical office*: Mwanzo bora nutritional programme supported by the USAID.

*Millers*: these are based at the district and in rural townships. These millers also run backyard grain stores. Milled products of large scale millers such as AZAM and AZANIA reach the rural areas through a network of "dukas" – that a linked with a few district/regional based wholesalers.

*Dairy companies*: TANDAIRIES and Shambani graduates run some milk collection centres. Their processed products such as yoghurt are rarely marketed back. However, the Tanga Fresh dairy company which does not procure milk from the district, markets its products (yoghurt) in the district.

*Moneylenders*: these were also considered to be among the stakeholders participating in the food system. However, their practice is unscrupulous. For example, there is a farm credit practice called 1X4 in the sense that based on the standing crop in the field the farm can be given a fertilizer credit on the terms that for each bag of fertilizer the farmer will pay 4 bags of the produce. This is common in high value crops such as onions. Such immoral practices in the marketplace raise a concern on the possible failures of the institutions of the capital markets – i.e. microfinance.

*Microfinance institutions*: these include the commercial banks offering micro-credits (e.g. NMB, CRDB) and micro-finance organizations (e.g. BRAC, PRIDE, BLUE, BY PORT).

*KIRSEC*: this is an innovative market information-brokering agent that connects smallholder farmers with buyers at an agreed commission.

# 4. Semi-arid CSS: Dodoma

## 4.1. Natural resources and production

Land and agricultural water are vital resources for production as identified by the FGD participants at Chamwino district.

Land is generally not limited in terms of supply. Soils were generally perceived to rich in nutrients due to limited leaching. However, at local level soil fertility varies spatially for different soil types – sandy, reddish and clayey. The reddish is locally regarded to be more fertile than other soil typologies. Land use plans are almost non-existent in most of the villages. The land management challenge in the CSS area – Mvumi division was reported to be livestock related degradation. Livestock were removed by order of government under HADO programme in the 1990s as in order to reclaim the land from serious degradation. Farmers were allowed to keep a manageable number of cattle (only dairy). The animals have now returned in the area. While higher-level planners hold an opinion that livestock must again be evacuated farmers want to have their livestock kept with them. Indeed, land management remains a challenge in the ecologically fragile semi-arid tropical drylands.

Given rainfall limitation the strategies to improve water availability for crop and livestock has been through surface water (runoff collection/damming) and underground water harvesting practices. The district has around 3 dams multipurpose dams – used for domestic, agriculture and livestock watering. Local practices aimed at securing access to water include: natural ponds, sand river beds digging, in-situ rainwater capture and to limited extent underground water. The CSS areas have the potential of water harvesting (surface runoff harvesting and underground water extraction) – the water related research issues are mainly vested in these areas.

Crops produced in the area include cereals and roots/tubers (sorghum, bulrush millet, maize, cassava and sweet potatoes), legumes (cowpeas, pegion peas, bambaranuts, groundnuts, chickpeas, green gram, lablab), oil crops (sunflower, sesame, groundnuts), vegetables (pumpkins, cucumber, tomatoes, onions, leafy vegetables, green pepper) and fruits (pawpaw, guava, mangoes, grapes, lemon, dates). There also widespread collection of edible wild products – vegetables, fruits, baobao oil seeds.

Production is predominantly rainfed. Production of water demanding crops utilizes dammed waters, sand river beds, and dug wells. Emerging commercial production of grapes involve modern technologies such as use of drip irrigation system – relying on dams and underground water extraction.

The use of fertilizers and improved seeds by farmers is very limited. Where the soil moisture is low and unpredictable the management of fertilizer is a challenge. The fertilizer needs some level of moisture to be utilized by the plant. However, the use of manure is common. The uptake of improved technologies is low but encouraging for some crops – for example adoption of improved sorghum variety is around 50%. Technological upgrading is uneven for different crops – e.g. bulrush millet has received limited breeding efforts – despite that it is the staple most preferred by the local people.

Major livestock kept include cattle, goats and chickens. A few farmers keep improved cattle and goats. Rural chickens were highly valued in the CSS villages. There has been interventions to improve livestock production particularly chickens – little attention has been given to markets.

### 4.2. Processing

The use of machineries in agro-processing is improving. There are solutions to some tedious jobs like threshing the bulrush millet. Motorized threshers have been introduced – there at least 2 units in Mvumi division (CSS division). The technology also helps with quality improvement particularly avoiding soiling of the produce as in case of traditional practice. Private owners of the machineries provide shelling services at a cost – Tsh 3,000/bag.

The machinery cost remains the hurdle for widespread use of the technology. Related technology is also possible with groundnuts (Figure 6). The machineries can be fabricated by a private factory in Morogoro (Intermech).

Figure 6: A motorized groundnut sheller at Mbande village, Kongwa

(Mutabazi and Rusike, 2012)

Groundnut is a typical crop which is widely traded in Dodoma region – see Figure 7 as an example of a groundnut value chain in Dodoma. There also an investor (VIRTA Tanzania Limited) in Mvumi division buying oil crops including groundnuts. The investor also has started processing the groundnut shells into biochar.

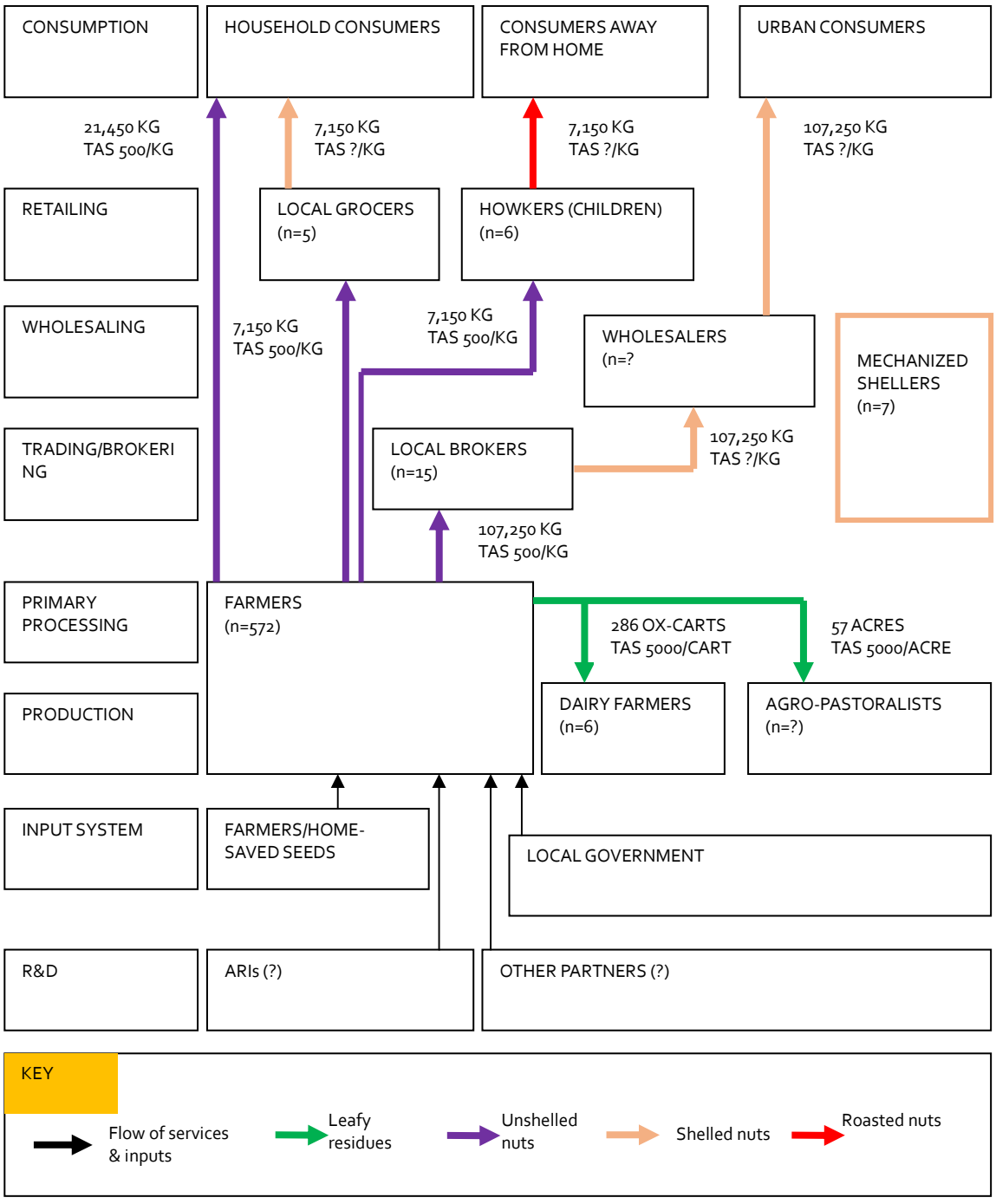



Figure 7: Groundnut value chain in Mbande village, Kongwa (Mutabazi and Rusike, 2012)

Most of the processing machines can be hitched on the power tillers. The government has been distributing the power tillers in most of rural areas.

The district has been also working with some group of farmers on improved solar driers for drying vegetables. The driers are the raised extended compartments that are covered with

plastic sheets that optimize sun-drying. One such drier costs Tsh 30,000 – 40,000.

Sunflower oil processing is practiced in many rural areas where the crop is grown. The processing of sunflower involves pressing the seeds to extract the oil. Rarely, the extracted crude oil is properly refined through local processes such as boiling and filtering.

An interesting breakthrough in agricultural processing at district level is that adding value to hides and skins through turning and manufacturing leather products – belts, sandals etc. The turning process involves a series of activities – such as salting, deliming and softening. A skin which is worth Tsh 4,000 in an unprocessed state generates a value of Tsh 200,000 after processing. The district livestock department is also promoting fattening practices which is an upgrading strategy in the beef sector.

Storage is based on use of traditional granaries (*vihenge*) that are built within the living house. There problems of in-store losses from storage pests – insects and rats. The reason of integrating the storage structures in the houses is to avoid thievery.

### 4.3. Markets and consumption

Much of the bulrush millet produced is consumed at home. Bulrush millet is sold to wholesalers through middlemen. The middlemen are village based traders – who connect the farmers and wholesalers. The wholesalers are based in Dodoma – and manage grain stores. Bulrush millet is exported to India. In case of food shortage in the village the middlemen bring back the bulrush into the villages – of course at higher prices. Some middlemen run local grain stores and lend money to farmers.

Oil crops such sunflower and groundnuts are marketable. The higher market demand of plant based edible oils has attracted mechanized agro-processing activities. The produce and value added products are traded locally, nationally and internationally.

Sorghum is marketed the national food reserve agency (SGR). The brewery industry is also an outlet for sorghum. Tanzania Breweries Limited (TBL) is buying sorghum at Tsh 600/kg from contracted farmers. If both the scale of production and quality are improved the vertical integration of the sorghum sector would be possible. For example, due to such problems, the Dar Brew factory imports sorghum from South Africa.

Grape is a high value crops grown in Dodoma. The produce is used in wine industries. Farmers are not remunerated as the prices remain low. The domestically produced wine face stiff competition with imported wine – the industry is not protected. The market for table grapes is still thin not readily accessible to small producers. The farm supplies are low and inconsistent – plus quality problems. The health risks are high with fresh grapes due to unjudicious sprays of chemicals – best practices are needed. Lack of certification and compliance to standards also undermine farmers reaching the niche and export markets for table grapes.

Bulrush millet is the most preferred staple by the local people. It is consumed as ugali and porridge. Bulrush can be consumed other forms – boiled/fried fresh grains and bulrush pilau. Groundnuts are normally mixed in most of the relishes used together with the main dish.

Groundnuts are rich in protein and fat. Edible wild products particularly vegetables and fruits are important in the local food menus. It may be important to carry-out the nutritional audits of these diets to track the supplied nutrients and food safety.

### 4.4. Potential upgrading

*Promoting adoption of best agronomic practices*: uptake of potential agronomic practices need to be accelerated. These include use of improved seeds and better crop husbandry. This should go hand in hand with improved management of agricultural waters.

*Improved livestock production*: given the fragility of the drylands keeping a limited number animals is critical – hence increasing productivity becomes a must. This can be attained through breeding programs and specie transformations – such as upgrading the local breeds through the use of improved bulls and cocks. Turning scavenging rural chickens into a better managed and profitable enterprise under farmer conditions would be a good option. Despite of some interventions (e.g. by RLDC) to improve the rural chickens in the CSS there are still challenges that farmers face – diseases, low productivity and market disconnects. There some interesting innovations that can be researched to understand their conditions for upscaling – for example the open nucleus initiative. This is designed by introducing improved bulls in a certain homestead where villagers bring their cows to be mated. This is seen as way of upgrading the village herd in a long-run.

*Advancing demand driven agro-processing*: there is still much to be done to introduce and improve existing agro-processing practices. Some areas that require upgrading include oil refinery processes, improved primary processing (e.g. proper drying and storage of grains and vegetables, storage), promoting secondary processing (e.g. milling, labeling, packaging etc). This also requires resolving market institutional issues related with certification and standards, and protection.

*Sustainable school feeding program*: this has been tried for the past 12 years in most of rural areas under the WFP. The concept of school feeding is the result of food insecurity at the household level – as most of the school children go to school empty-stomached. School feeding has advantages in fostering school performance and enhancing child cognitive developments – particularly those in lower classes. As the WFP programme phases out there are concerns that the initiative will collapse. The district is at the cross-roads on how to sustain the programme. For example, government has already ordered every school to manage a school farm – this is a big challenge as pupils may become cultivators! An upgraded food system that adequately feeds everyone in the household including children is a sustainable solution.

### 4.5. Potential stakeholders

The key stakeholders in the food system (apart from primary users/actors along the FVC at grass root level, see Deliverable 2.1.1) include:

*Mpwapwa livestock research centre*: involved in livestock research issues including breeding, artificial insemination programs, pasture management and animal disease control. It is also collaborating with other organizations in livestock market research such as meat value

chains.

*Rural Livelihood Development Company (RLDC)*: it is an NGO promoting rural development enterprises. It has worked on a range of issues including rural poultry improvement such as testing of the Bangladesh Poultry Model.

*ARI-Naliendele*: they conduct research on crop improvement – with mandated crops such as groundnuts, bambaranuts, cassava and simsim.

*ARI-Kibaha*: deals with roots and tubers – crop improvements and agronomy (e.g. bio control of cassava mealbug using wasps).

*ARI-Hombolo/Makutupora*: conduct researches on crop improvements, soils and agronomy.

*MIGESADO*: an NGO that has dealt with promotion of biogas and rooftop rainwater harvesting for domestic use.

*WFP*: the organization has been transformed to give to attention to development of the food systems – in addition to its food relief and emergency activities. As a result, since 2007 it has been promoting RWH for agriculture, charco-dams for domestic and livestock uses. It has also supplied water pumps to vegetable growers.

*FAO*: has helped equip the district extension system with soil test kits. It is also involved in R&D on issues related with promotion of cover crops and conservation agriculture in the dryland farming systems.

*MOVEK*: was a local partner in the DFID programme of "Research Into Use – RIU". The aim of the programme was to translate the research knowledge bulked over decades into practice. The focal area in central Tanzania was on improving the rural chickens. They provided a hatchery unit (incubator) with the capacity of hatching 20,000 chicks per batch. The unit was granted to a retired professional entrepreneur – Dr Sendao. The project also supported related poultry husbandry practices including breed improvements, drugs and the needed management know-how.

L*ay Volunteer International Association (LVIA)*: is an NGO supporting some rural activities – e.g. rural chicken and production of simsim.

*Diocese of Central Tanzania (DCT)*: the church organization has been promoting projects relate with improved dairy goats, and dairy cattle through heifer-in trust arrangements.

*KOICA*: a Korean organization working on food security projects. According to the district participants the organization promotes innovations that enhance food security.

*GNI – Good Neighbours Interactions*: it is involved in land use planning.

# 5. Findings from the case study villages

The food system and FVC issues were also assessed at the village scale. The village level FGDs were conducted in each of the four case study villages as follows:

### 5.1. Ilakala village

Ilakala village is in Kilosa district - Morogoro region. According to the 2012 population census, the village population was estimated to be 4100.

#### 5.1.1. Natural resources

In Ilakala village the natural resources that were reported to important in for the local food system include land, forest and water.

*Land*

The village has a total area of 4277 hectares. The village has an expansive land as village land. The villagers also cultivate in the neighbouring land under the defunct Government sisal estates. A typical farm household operates between 2-5 acres of land.

*Forest*

The village has a forest managed communally. The village forest is categorized into a reserved forest and a productive forest exploited by the community for firewood, charcoal, timber /building poles, medicinal plants, sacred groove, mushroom collection and bee keeping.

*Water*

The village has two seasonal rivers that flow during rainy months - and dry up during off-season dry months. The shallow traditional wells are the major water sources for the villagers. The wells are also used to irrigate vegetables in the valley bottoms during the dry season.

#### 5.1.2. Production, processing, marketing consumption and waste management

A range of crops can be grown in the village. The main crops grown include maize, sorghum, paddy, pigeon peas, cowpeas, sunflower, simsim, green grams, oranges, tangerines and cotton. The village has an agro-climate suitable for cotton production. However, majority of farmers have abandoned cotton production due to lack of reliable and profitable market. The major crops that were reported to be important in the local food system entail – maize, simsim, sunflower and pigeon peas.

**a) Maize**

*Production*

Average area grown maize is 2-5 acres per household. Maize is grown by almost by every farm household in the village (98%). The maize cropping system is of mixed nature – not only with legumes but also with oilseeds. Crop productivity ranges from 1-2 bags per acre (0.25-0.5 t/ha) during the season that the locals perceived to be bad to 7 bags per acre (1.8 t/ha) in a

good season. It was estimated that around 20% of farmers in the village use improved seeds – the remaining grow local seeds mainly home-saved. Farmers use mostly hand hoe for land preparation, only six households have ox ploughs. There is no agro dealer in the village therefore farmers get the inputs from Kilosa town. Farmers do not use fertilizers and farm yard manure.

Due to the bimodal rainfall regime, the village has two seasons – November to February and March to June. However, with climate change they have only one reliable season – March to June – as the other tends to fail.

*Processing*

Processing of maize is involves sun-drying the grains. Such rural drying of food grains is not efficient due to failure to dry to the appropriate moisture content (10-15%). Farmers have no technology to detect the grain moisture content. Poorly dried grains pose the heath risk of aflatoxins and other mycotoxins.

Shelling is done manually by hand – a tedious process in case of the farmer has a larger harvest to process. Fabricated maize shelling machines can be promoted in the village to improve the shelling.

Beyond drying done at the homestead, farmers take their grains to village mills to process them into flour for home consumption. The village has around six milling machines – however, there is an installation of another milling machine managed by the youth group. Currently, farmers also use milling machines in the neighbouring villages. As the villages have not electricity, the rural mills use fossil diesel as a source of energy.

Maize is also fermented into local brew called "komoni". Such value addition increases the profit. A 20 kg tin of maize sold at Tsh 10,000 as grains can be locally fermented to produce 60 litres of liquor valued at about Tsh 30,000. However, the local government discourages use of food staples to produce local brews as a measure to safeguard local food security.

*Marketing*

According to FGD participants, about 70% of maize produced is marketed – the remaining 30% is consumed at home. Despite maize being the major food staple, it seems to be highly commercialized. There is an interesting research question around commercialization of food crops – as it may affect the household food security. The effects of agricultural commercialization on food security and other livelihood outcomes will be further investigated in a comprehensive baseline study.

The maize trade is dominated by local traders who buy from farmers and sell maize to wholesalers in Dar es salaam, Kilombero and Mikumi. Another marketing channel involves wholesalers who buy maize from farmers through local middlemen. The maize price at the farm gate ranges from Tsh 30,000 to 60,000 per bag weighed at around 100 kilogram. The lowest price prevails during the peak harvest season while the highest price is observed during later on towards the starting of another season.

During maize shortage in the village, the grains are brought into the village by wholesalers

from Iringa, Tanga and Kibaigwa areas. Kibaigwa hosts the international maize market. Iringa and Tanga (Handeni) are among major maize growing areas in the country. The wholesalers sell maize to the village-based shop owners who sell to farmers in a measure locally known as "sado" (approx 4 kgs) at Tsh 750/kg.

*Consumption*

Maize flour based foods include boiled green maize, stiff porridge and liquid porridge. Ugali is the most prominent maize based food consumed at the household. The maize grains are de-hulled during milling. De-hulling process results into loss of most nutrients. Tanzanian rural and urban consumers prefer de-hulled whitish nutrient-deprived meals as opposed to nutrient-rich whole grains based foods. Turning around such cultural preference may an interesting area of nutritional upgrading.

*Waste management*

Three maize value chain by-products are utilized to some extent – field stalks, maize bran and cobs. Maize bran is the most valued as it is used as supplementary feed to the rural chickens. A small container locally known as "sado" is sold at Tsh 200. The field stalks that are intentionally left in the field to contribute to the soil nutrient are occasionally forcefully grazed by the maasai. The maasai grazing on farmers fields has been the source of disputes. Farmers complain that cattle grazing on their fields compacts their soils and demolishes their technologies such as ridges.

*Provisional maize value chain*

The value chain starts at a very stage of R&D (Figure 8). For Ilakala village, the existing R&D agents include the District council and ARI-Ilonga. The district council delivers development and agricultural extension services to farmers. ARI-Ilonga was also reported to involved in the transfer of agro-technologies to farmers. The village has limited concentration of R&D interventions, hence creating an ample room for Trans-Sec impact.

Input system is critical in the value chain development. Farmers are supplied with agro-inputs from stockists stationed at the district headquarters. There is not any stockiest operating in Ilakala village. The district council is also involved in distribution of input subsidies.

There are three major strands in the maize value chain in Ilakala village. The first strand composes a relatively longer chain of actors – farmers, local brokers/traders, wholesalers and lastly urban-based retailers and final consumers. As explained earlier the second strand terminates into terminal markets of Dar es salaam Kilombero and Mikumi. The second strand involves direct selling of maize grains to consumer households in the village. The third which relatively small involves farmers who sell grains to local brewers and local brewers sell brew to village-based consumers. Normally, the local brew is traded within the village.

The maize grains are the main product traded in the maize value chain. Some maize grains is sold to local brewers who turn the produce into local brew which is sold to village customers. The outlet for local brew is through local bars and selling at the homestead of the processor. Maize flour is the raw material in brewing. Local brewers process grains into flour at the

village mills.

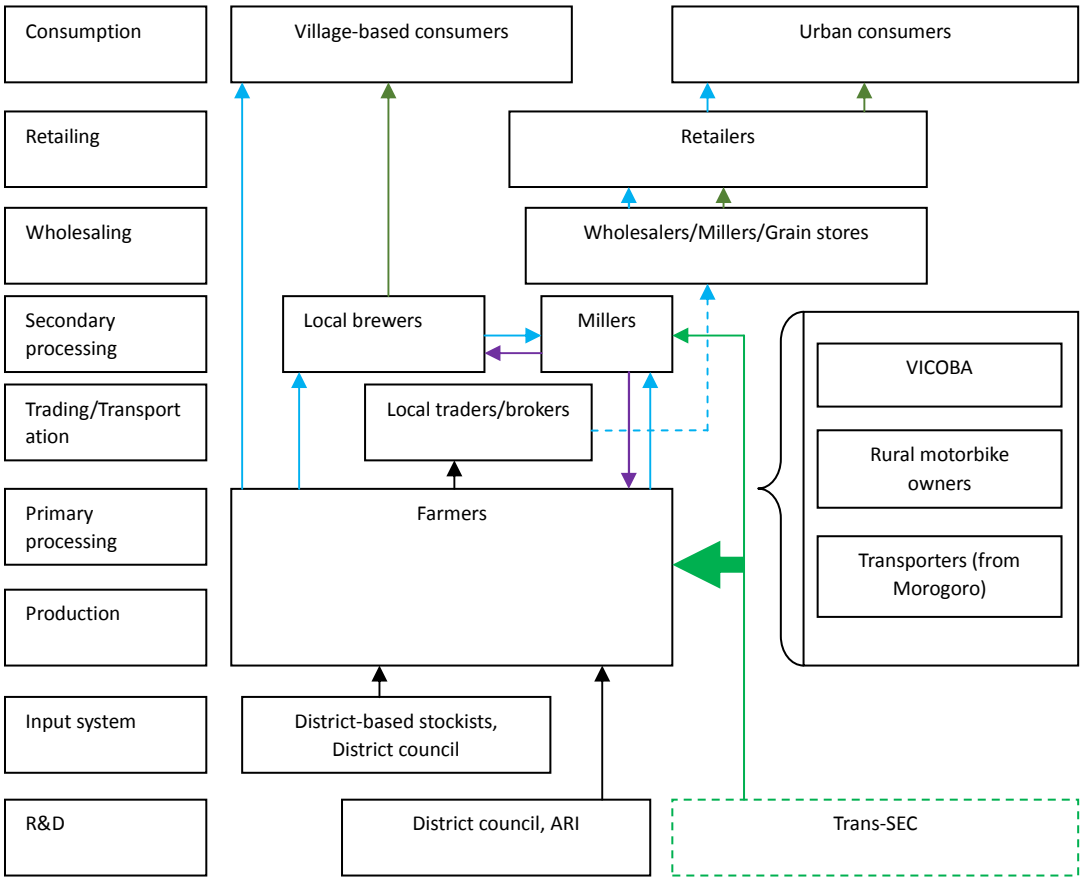



Figure 8: Provisional maize value chain in Ilakala village

### b) Simsim

*Production*

The land cultivated with simsim ranges from 1 to 5 acres per household on average. Simsim is grown by 75% of the villagers. Crop productivity ranges from 1 - 3 bags/acre during bad to good seasons, respectively. Productivity of the crop is generally low – 3 bags/270 kgs per acre during a good season and 1-2 bags/90-180 kgs per acre when the season is poor in terms of rainfall. Farmers also reported that simsim crop is susceptible to pests and diseases that translate into dismal yields.

There is also a general concern that the lucrative simsim market contributes to clearing more land in order to open virgin fertile farms for simsim production (personal experience with SUA-based REDD+ project). The situation is caused by the farmers' motives to produce more without using productivity-enhancing inputs such as fertilizers.

In this regard, the research and upgrading issue regarding simsim would be on devising and

testing technologies that will improve yields while halting unsustainable farm expansion.

*Processing*

Simsim is not processed at all. The oil seeds are sold to incoming large buyers after harvest. Processing of simsim is an area worth investigating as the crop has a huge potential for value addition. It is not clear why simsim is not pressed into consumable oil as it is done for sunflower. It will be interesting to investigate why simsim processing into oil is not a common practice in the village.

*Marketing*

Simsim is entirely grown for cash as over 95% of the produce is marketed – the remaining 5% is consumed and partly saved as seed for the next season. Farm gate price is around 100,000/bag at the harvest time and 200,000/bag later on. With such price levels simsim has the highest producer price compared to other marketed crops. The simsim seeds are marketed at farmers' homesteads through the local intermediaries to wholesalers from Dar es salaam.

*Consumption*

Simsim is almost produced for cash. The market price of simsim seeds is consistently lucrative – hence highly commercialized. Simsim oil is not affordable by majority of consumers in the domestic edible oil market.

*Waste management*

As simsim is not processed, the potential waste is the field stalks that can be used as fuel. The FGD did not report to be using the field stalks as fuel. Instead, the stalks are burnt into ashes – not clear whether this adds to the soil nutrient base.

**c) Sunflower**

*Production*

Over half (60%) of the farming households in the village grow sunflower – at an average farm size of 1-2 acres. Crop yields ranges between 5 and 8 bags/acre in a good season and 2-4 bags/acre in a bad season.

*Processing*

The village has no sunflower pressing machine. The pressing of oil is done in the nearby village called Mwenda where there are two pressing machines. Most of the farmers process their sunflower into oil for both selling and home consumption. It costs Tsh 2500/bag to transport by either public car transport/motorbike, a bag of sunflower seeds to the next village for processing. The costs of processing fall in two categories depending on whether the farmer takes or leaves the seed cake to the processor- Tsh 8,500/bag without taking sunflower cakes and 9,000 when sunflower cake is taken by the farmer.

The oil yield level with the current pressing technology is 20-25 litres per bag of oil seeds (a bag is estimated to weigh 60 kg). The oil yield efficiency of the current pressing machines is

worthy investigating for the possibility of upgrading.

Sunflower processing is a wide-spread value added practices in rural Tanzania. The government and development support agencies such as NGOs have been supporting value addition in the sunflower sector. The major driver of the development of the sunflower value chain is the consumer demand mainly in urban markets. Consumers are increasingly opting to healthy sunflower oil. However, the current processing technology poses health risks to consumers due to inefficient refinery process – currently the crude oil is sold to final consumers after pressing. This is a critical area for upgrading for Trans-SEC – by promoting appropriate sunflower refinery technology.

*Marketing*

Sunflower seeds are marketed outside the village to wholesalers in Iringa and Njombe regions through local middlemen. At the village and district, sunflower is marketed mainly as processed oil. Farmers are increasingly marketing processing oil at the local marketplaces. The farm gate price ranges from Tsh 30,000 to 45,000 when the produce is sold to the middlemen. Two major traded value added products are the cake and processed oil – the former sells at Tsh 50/kg while the later sells at Tsh 3000/litre.

*Consumption*

Due to increased intensity of sunflower processing at the local the consumption of sunflower oil has increased among the rural households. However, the quality of oil is questionable given the current technology, which is characterized with poor refinery.

Waste management

The cake left after pressing is used as animal feed. The sunflower cake is traded mainly at the processing premise. Either the processor buys the cake or the farmer sells it to the customers who visit the premises in search of the product.

**d) Pigeon peas**

*Production*

Average area grown pigeon peas is 1-5 acres per household, in most cases the villagers intercrop pigeon peas with simsim. About three quarters of the farmers in the village grow pigeon peas. On Crop productivity ranges between 3 and 5 bags per acre during a good season and 1 bag/acre during in case of a bad season. About 0.75 to 1.25 bags per acre of pigeon peas is consumed as fresh beans. Therefore, the yield level if the produce would have been left to dry in the field would range between 3.25 and 6.25 bags per acre during a good season, and 1.25 bag per acre during a bad season.

*Processing*

Pigeon peas are not processed into value added products. Only the primary processing involving sundrying is practices at the farm. The dried beans are sorted and bagged for sale or storage in the household. Upgrading areas could be on improved drying, sorting and grading – and even branding.

*Marketing*

Around three quarters (75%) of the produced pigeon peas is marketed – the remaining 25% is consumed at the household. The farm gate price ranges from Tsh. 60,000- 90,000 per bag (100kg) – at harvest and later in the season. The major outlet market for the pigeon peas is Dar es salaam. The wholesalers buy the produce from farmers through the local middlemen/brokers. In Dar es salaam, pigeon peas are exported to Asia particularly India. Most of the larger buyers of pigeon peas in Dar es salaam are traders of Asian origin. The export potential makes branding and certification to be plausible upgrading interventions.

*Consumption*

Pigeon peas are consumed as other grain legumes – with ugali and rice. The producing household consumes about 25% the pigeon peas produced.

*Waste management*

The FGD participants did not mention to be using any waste related with pigeon peas. However, the stalks can be used as fuel wood and the pods peals can be used to feed the livestock.

### 5.1.3 Livestock

The main livestock species kept in the village include cattle and chickens. There are very limited number of goats and pigs. There limited interest of farmers who stay in proximity with the *maasai* to keep cattle mainly due to theft. There is a common perception that the maasai normally think that every cattle seen anywhere belong to the *maasai*!

**a) Cattle**

Cattle are commonly kept in the village especially among the native crop producers. There were only three native households that kept dairy cattle – with average herd sizes ranging between 2 and 4 heads. The cattle were acquired through Heifer international project. The dairy cattle yield 6 to 8 litres per day – in two milking turns in the morning and evening. The little milk produced is marketed in the village to neighbouring household consumers at a price of Tsh 800 per litre.

Indigenous cattle are kept by the immigrant agro-pastoralist of *Sukuma* ethnic. The *maasai* pastoralists who stay in the distant pastoral villages also graze on the village land.

There are normally tensions and conflicts between pastoralists and farmers. The conflicts are tenser with the *maasai* pastoralists than with the *sukuma* agro-pastoralists. From this difference, there are interesting features that can be learned regarding management of conflicts between farmers and livestock keepers.

Contrary to the pastoral *maasai*, the sukuma integrate crop and livestock production. In this regard, the agro-pastoral sukuma can easily co-exist with crop producers as they also value crops. They have experience of using animal power (oxen) in the cultivation process – they introduced this technology to the native crop producers since they arrived in the village. The sukuma villagers are also to some extent involved in the village meetings and decisions –

unfortunately, they were not invited in our FGD. The village has a conflict mediation committee seated by both sukuma and native crop producers.

The *maasai* are isolated in the villages demarcated by the government for pastoralist communities. They are culturally conservative and they rarely interact with crop producers in the vast rural villages. To them livestock is everything hence highly valued. There were sad experiences from farmers that the maasai forcefully graze their crop fields and are ready to compensate farmers. The conflicts mediation process starts at with the village government or ward and when it is out of control at these local institutions, the cases reach the district government and police. Normally, when the cases go beyond the village/ward mediation institutions farmers fail to pursue them as they cannot afford involved costs – which gives advantage to the maasai. There are wide perceptions by farmers that the wealthy *maasai* bribes the conflict mediation institutions particularly at district level.

**b) Chicken**

On average 80% of the villagers keeps rural chickens. The managed flock ranges from 5-50 birds. Price of chicken in the village is around Tsh 8,500 for a hen and Tsh 15,000 for a cock. Chickens are collected by youth middlemen who collect the birds from villagers and export to wholesalers in Mikumi and Kilombero.

There are attempts to improve the rural chicken raring. There is one man who is trying to keep rural chickens intensively and in a modern way. Upgrading of the rural chickens is an interesting area for the Trans-Sec – due to the underlying possibility of integrating it with crop upgrading (e.g. turning some wastes and by-products into feeds). Promising upgrading would be in areas of feeding, management and markets.

### 4.1.4. Technologies, energy and other services

Around 6 households operate oxen and oxen-driven ploughs. The use of draught power is common among the sukuma immigrants. There is not any village-based input shop – instead the inputs are purchased from Kilosa district headquarters. The village is installed with around 6 maize mills that run on fossil diesel – for both de-husking and milling. The same mills are used for paddy milling. Fuel wood is the main source of energy for cooking – using traditional three-stone stoves. There are no improved stove technologies. Around 6 households have installed solar panels that are using for both lighting and charging mobile phones. There are several Chinese solar based handy lighting units in the village. The village is reached by the mobile phone network signals – just in some parts.

There are eight retail shops, which sell consumables and farm hardware – machetes, hoes and axes. The common marketplaces are the periodic markets locally known as 'gulio' convened cyclically after every 1-2 weeks. The village is trespassed by a road connecting Kilosa district headquarters and the Mikumi centre along the Dar es salaam – Zambia highway. This gives an access to 'daladala' public transport between the two centres. There are also Chinese motorbikes for hiring, i.e. locally known as 'bodaboda'.

### 5.1.5. Stakeholders

A number of existing stakeholders involved in FVCs and food system in general were reported

to include:

*Farmers*: These are involved in the managing the natural resources and production of crop and livestock. Farmers operate individually – there are limited tendencies toward collective decisions.

*District Department of Land and Natural Resources*: The stakeholder was also mentioned to be important in ensuring secured access to land and management of the same. The department also oversees management of forestry resources.

*DAICO*: This is the district agriculture, irrigation and cooperative officer. The officer administers the agricultural officers and local extensionists in the district – on respective crop related matters. The livestock and fisheries are administered by a separate office within the district.

*Central Government/Estate*: The FGD participants felt that the defunct sisal estate land which is currently under the central government was important to them. They had an opinion that the government hand-over officially the land to the village so they gain the ownership title.

*Faculty of Forestry and Nature Conservation (SUA)*: Researchers from SUA's forestry departments were reported to be helping the village with management of forestry resources.

*Tanzania Forest Conservation Group (TFCG)*: This is the NGO involved in UN REDD+ pilot project in Kilosa. The NGO had some interest in assisting the village with land use plans. However, interventions on the ground are not pronounced as the village is not among the pilot villages.

*Motorbikes operators (bodaboda)*: These were mentioned as key stakeholder in the rural transport sector.

*Trucks operators from Morogoro*: The local traders hire trucks from Morogoro town when they want to haul their produce to the distant markets. In this respect, the FGD participants thought these truck operators to be key stakeholders in marketing.

*Tanzania Cotton Board*: The village has an ideal agro-climate to grow cotton – it has a history of growing the crop. However, the marketing has remained problematic. In this regard, the FGD participants felt that the cotton board is an important stakeholder in reviving the crop and improve cotton market linkages. Cotton has implication on the FVC and the food system at large – cottons seeds can be processed into edible oil and cotton income can be spent on food. Cotton is also a drought tolerant crop – ideal for the drier sub-humid environment of the village.

*Local middlemen*: These were mentioned to be important stakeholders. They are helping in linking farmers with large buyers. However, farmers are not happy with some practices of the middle particularly regarding the issue of weights and measures. Weighing is not done in standardized units – the containers are altered at the disadvantage of a farmer. In value chain development processes, there are possibilities of forging equity and fairer deals among value chain actors.

*Agro-processors*: These are involved in product upgrading. They include grain millers and

those running sunflower pressing machines. A few of them are village-based and others are found at the district headquarters.

### 5.2. Changarawe village

The village has about 3,000 people – according to the 2012 population census. The village covers a land area of about 6000 hectares. Out the total land area, 2500 hectares are owned by the village. The remaining 3500 of which villagers have use rights belongs to the Government. The average household size is around 2-5 people.

The various components of the Food Value Chain (FVC) were discussed with FGD participants in the village (with around 20 participants). The food value chain components covered include: natural resources, crop agriculture, animal agriculture, agro-processing, and markets, consumption and agri-wastes utilization. The participatory assessment was also made for other aspects that relate to FCV development – stakeholder mapping, technologies, energy and economic services.

#### 5.2.1. Natural resources

*Land*

Land was the mentioned to be the most important natural resource in the village. The resource is used for both crop cultivation and animal grazing.

On average, a household manages around 2 acres mostly found in the central government owned Estate land. Each household was allocated with 2 acres in the Estate farmland. Farmers who want extra land can rent from others at 40,000- 50,000 Tsh per acre for one season.

The land under the jurisdiction of the village is regarded infertile and not preferred for cultivation. However, the land is not that bad – it can be used to grow appropriate crops. The village has been requesting the local government to grant ownership of this Estate's prime land. Currently, they are using that land as tenants where they are allowed to grow annual crops only.

The villagers feel highly deprived of arable land. They regard the land owned by the village (2500ha) to barren and unproductive. It will be interesting for the biophysical work packages under Trans-Sec to assess the suitability of the village land and advice best-bet practices of land uses that will benefit farmers – a land productivity/use upgrading strategy in this sense.

*Forest*

The village has an unreserved forestland, which is used extract charcoal, timber, firewood, local herbs and building poles. The forest also is used for traditional beekeeping. Its proximity to Kilosa town (around 15 km) makes the village forest vulnerable to excessive charcoal extraction.

*Water*

Major source of domestic water is shallow wells (boreholes) and one permanent river (Miombo). There are irrigated vegetable fields near the river using pumps to lift the water into the fields. These irrigated fields are managed by medium-scale commercial farmers from town. There are also natural ponds with fish – tilapia and catfish.

### 5.2.2. Production, processing, marketing and waste management

Different crops are grown in the village – mostly under a rainfed system. The major crops grown include maize, paddy, simsim, sunflower, pigeon peas and cowpeas.

#### a) Maize

*Production*

Maize is the main staple food in Changarawe village and is grown by every household (100%) in the village. On the mixed crop stands, maize occupies about 90% of the field. The crop is often intercropped with pigeon peas, cowpeas and simsim.

Maize yield ranges from 10-15 bags/acre during good years and 1-2 bags/acre during bad years. The use of improved seeds is limited – most of the farmer use home-saved recycled seeds. Limited purchasing power was the reason mentioned to be underlying limited use of improved seeds. Long rains are the most dependable as the short-rains are increasingly becoming less and volatile.

Tillage is either done with hand hoe or use of hired tractors. A significant number of farmers use tractors at an hire cost of Tsh 50,000 per acre. The use of animal power in non-existent.

*Processing*

There are around 10 mills in the village – 4 can do both de-husking and grinding and 6 can only grind. The cost for both de-husking and milling is Tsh 100/kg. The flour is not packaged after milling. Milled maize is use for household consumption and selling in the local shops 'dukas'.

*Marketing*

Maize is sold at the farm gates in the village. About 50% of maize produced is sold and the remaining half is consumed at the producing household. At harvest maize is sold at Tsh 30,000 per bag and later on (after 3-4 months) when the produce is scarce at the marketplace; the same bag sells at Tsh 90,000-100,000. Some farmers sell the standing green crop to the moneylenders when they are in urgent need of cash – the practice is locally known as 'kuuza majani' – in English 'selling leaves'. The bag of dried maize grains is delivered later after harvest to the moneylender at Tsh 20,000.

The largest share of marketed maize (90%) goes through the local brokers/middlemen to wholesalers and ultimately to urban consumers in Kilosa town and beyond. In case of food shortage, the maize flows back from wholesalers/grain store businesses through local brokers/middlemen to household consumers in the village. The middlemen who now become traders buy maize from the grain stores in Kilosa at Tsh 90,000/bag and sell to villagers at Tsh 105,000/bag.

*Consumption*

Maize is the main food stable – but is also considerably commercialized (50% marketed). Shortage of foods starts 4 months after harvest – from December. Selling of labour is the

survival strategy used mostly by relatively poorer households to transition through food shortage periods. During food shortage maize is not de-husked before milling. The whole grains are milled in order to maintain the volume not for reason that whole grain flours are healthy and nutrient-rich. The meals are also cut from three per day to one during the critical food shortages.

*Waste management*

Maize produces around three wastes that can be turned into utilizable by-products – maize stalks after harvesting, cobs after grain shelling and bran after milling. As the villages have limited populations of ruminants the maize stalks are not profitably utilized. However, there is an increasing trend of selling the field leftovers to the maasai for in-situ grazing. Allowing the maasai to graze on the fields is not the option that farmers like – but it is seen at least as a way of recovering something otherwise the maasai will anyway bring their cattle to the fields. Maize cobs are used as fuel wood for cooking. Maize brain is the highly used to feed chickens and ducks – farmers buy it at Tsh 200 for a 3-kg container locally known as 'sado'.

*Preliminary maize value chain*

Based on the information given by the FGD participants, the maize value chain of Changarawe village is more or less similar to that of Ilakala (Figure ?). Some differences are that Kilosa town is the main market outlet of the maize produced in the village – whereas in Ilakala buyers enters the village via Mikumi. The value chain strands through which the marketed maize (50%) move from farmers include: farmers directly to household consumers (5%), local brokers to household consumers (2%) and local brokers/middlemen to wholesalers through retailers to final urban consumers (43%). In Changarawe FGD participants did not specifically indicate any maize sold locally for making local brew. As this is a common practice in most of the maize growing villages – very likely than not, part of the 2% sold locally goes to local brewing.

**b) Rice**

*Production*

Rice is grown in valley bottoms using residual moisture – basically a rainfed system. Valley bottoms rainfed rice is grown by around 50% of the households in the village – with an average of 1 acre. The yield is about 10 bags/acre during a good season and 4-5 bags/acre during a bad season – a bag of harvested paddy produces about 75 kgs of milled rice. Entirely farmers use local rice varieties. There is a potential of introducing high-yieding rainfed rice varieties – e.g. the NERICAs.

*Processing*

There are no specialized rice mills in the village – the common grain mills are used to mill rice. There are private rice mills in Kilosa town. The efficiency of two types of mills differ – the special mills yield more rice from the same volume of paddy: 10% more effient than the common grain mills. The cost of milling rice in the village is Tsh 250/kg. However, milling rice in town with medium-scale rice mills is cheaper even after taking into account the transport costs – Tsh 106/kg. The transport cost for a round trip to and from Kilosa town is Tsh 5000/bag

and the cost of milling a 75-kg bag of paddy is Tsh 3000.

*Marketing*

Paddy is mostly grown as a cash crop – about 90% of the produce is sold. The price of paddy rice is around Tsh 40,000/bag during peak supply at harvest time and Tsh 120,000/bag later when the produce is scarce at the marketplaces. Some farmers sell the green stadning crop in order to get credit from buyers (Tsh 30,000/bag) – the practice that can be termed as "green marketing for credit adance". The main buyers of rice millers who also operate grain stores in Kilosa town.

*Consumption*

Consumption of rice was estimated to be only 10% of the produce at the household. Production of rice has a commercial orietentation.

*Waste management*

Paddy produces a number of useful wastes and by-products: field stalks, husks and bran. The field stalks and bran can be used to feed livestock. The husks can be used as source of energy. In some parts rice growing areas, husks are used as source of in brick-making. The FGD participants did not mention to utilize the rice related wastes and by-products.

**c) Simsim**

*Production*

About 60% of the households in the village grow simsim on an average of 2 acres. Average yield of simsim is around 2 bags/acre – half a ton per hectareco. Farmers claimed that the crop can be grown on poor soils. Generally, productivity of simsim is very low – less than a ton per hectare. The potential yield of simsim is around 2-3 tons per hectare – under a low input system with improved management.

*Processing*

Simsim does not undergo secondary processing beyond sundraying of the oil seeds done at the farm. This area has to be explored as to why the crop is not pressed into oil as is the case with sunflower.

*Marketing*

Simsim is marketed within the village to incoming large buyers from Dar es salaam through local brokers who buy and assemble the produce from farmers. The demand for simsim is higher and always the supply is limited. The price ranges between Tsh 150,000 and 250,000 per bag of 100 kg. Green-marketed simsim is sold around Tsh 50,000/bag – this is desperate selling of a standing crop by farmers to moneylenders for credit advances.

*Consumption*

Only very little (2%) of simsim is consumed at home. The seeds are pound in a mortar – the crashed seeds are cooked with soup used as relish with the main dishes.

*Waste management*

The field stalks could be used as fuel wood. However, the farmers did not report to be using the stalks as fuel wood.

**d) Sunflower**

*Production*

About 20% of HH grow sunflower at an average of 1 acre. Yield levels range from 4-5 bags per acre – a bag weighs at 60 kgs.

*Processing*

Sunflower processing is widespread practice in most rural sunflower-growing areas. This makes sunflower value chain to be the most developed of all rural agri-related value addition initiatives. As explained earlier, the rapid development of the sunflower value chain is propelled by the growing urban consumer demand form healthy sunflower oil.

There is no sunflower pressing machine in the village. Farmers take their produce to Kilosa town for processing. There two pressing charges arrangements – Tsh 100/kg of sunflower if the cake is left with the processor and Tsh 250/kg in case the farmer takes the cake after processing.

*Marketing*

Farmers prefer to sell oil instead of sunflower seeds. Some farmers sell their seeds to the processors – at a price of Tsh 30,000/bag. Either the farmers sell oil in town immediately after processing or bring their oil back to the village where they sell to household consumers. The oil which is brought back into the village after processing is retailed to the household consumers at Tsh 3,000/l. At the processing premise the oil is either sold to the processor at Tsh 2,000/l or other customers at Tsh 2,500/l. The processors who run the pressing machines are the large buyers of the oil from farmers.

*Consumption*

Farmers save some oils for home consumption. The sunflower oil is used as cooking oil at the household.

*Waste management*

Sunflower cake is the highly traded by-product – used to feed livestock.

**e) Pigeon peas**

*Production*

About 10% of household grow pigeon peas at an average of 2 acres – 90% of the produce is sold. The crop is intercropped with maize and other legumes such as cowpeas. Majority of farmers plant local varieties and the average yield is 2 – 3 bags/acre. The local seeds sell at Tsh 1,000/kg compared to improved seeds that sell at Tsh 1,500/kg. Trans-Sec can promote the production of quality seeds by empowering some groups of farmers. The government in

collaboration with the ASA (national seed agency) is promoting production of Quality Declared Seeds (QDS) through village-based individual farmers and farmer groups. Farmers can be trained on good practices of producting seeds that can be made available to wider farming communities.

*Processing*

Pigeon peas are not processed beyond the primary processing involving sundrying. Other value added activities such as grading are not done – just limited to sorting to remove foreign material.

*Marketing*

Pigeon peas are sold throgh local intermediaries to large buyers from Dar es salaam. Pigeo peas are exported mostly to India by the Asian wholesalers who operates grain warehouses in Dar es salaam. At peak supply, a bag sells at Tsh 60,000 and twice as much (Tsh 120,000) later in a season when there is scarcity at the marketplace.

*Consumption*

The green beans consumed at home account for 25% of the final produce – i.e 50-75 kgs/acre. The dried beans are meant for marketing.

*Waste management*

The stalks can be used as fuel wood. The shelled pods can be used as livestock feed – particularly ruminants. However, the FGD participants did not mention to use the shells as animal feed.

**f) Cowpeas**

*Production*

Almost 100% of households grow cowpeas – but on tiny plots or as strips of intercrop with maize. Very few grow it as single stand. Production of cowpeas is meant for houme consumption as its market was perceived to be non-existent. On average, a household produces 3 tins to a bag (60-100 kgs) in a season.

*Processing*

The crop is not processed. There are widespread processing of cowpeas into burns locally known as 'bagia'. Roasting of bagia is the business of rural women.

*Marketing*

Cowpeas are traded locally in the village among household consumers. At peak supply the grains sell at Tsh 300/kg and during a slant supply the price rises to Tsh 500/kg.

*Consumption*

Cowpeas are mostly grown for home consumption.

*Waste management*

As the crop is not cultivated at a meaningful scale, the related utilizable wastes are not obtained.

### 5.2.3. Livestock

Livestock kept include local chickens and ducks. Keeping of cattle and goats is very limited – farmers fear to lose their animals through theft by the *maasai*.

#### a) Cattle, goats

Only 4 people had dairy cattle at an average of 2-8 cattle – acquired thoguth Heifer in Trust project. None kept traditional cattle that are normally stolen. Average milk production is about 1.5 l per dairy cow. A litre of milk sells at Tsh 600 in the village. Selling milk is a proble as consumers can alternatively source from the maasai. Only three households had goats.

#### b) Chicken

Chikens are rared by almost every household in the village – with an average of 5 birds per household. Chickens are marketable with prices ranging from Tsh 8,000 to 15,000 per bird. As chickens are kept in every household, upgrading the performance of the enterprise would benefit the majority in the village.

### 5.2.4. Technologies, energy and other services

A number of technologies are available in the village. Tractors for hiring are available when the season is about to start at Tsh 50,000/acre. Animal power is not used as the village soil is regarded to be heavy. The village is connected to national grid – about 20 households have afforded electricity in their houses. There some employment created through welding centres and a motorized saw mill operated in the village. Charcoal and firewood are the source of cooking energy – the improved stoves technology has not reached the village yet. The mobile phone signals reach the village – Vodacom and Airtel. There around 10 Chinese motorbikes for hiring and bicycles that can also be hired. There are around 8 shops selling household consumables and some farm tools e.g. hoes, axes and matchetes. There are four boreholes and one permanent river (Miombo) that serve as sources of water.

### 5.2.5. Stakeholders

The key stakeholders in the food system (apart from primary users/actors along the FVC at grass root level, see Deliverable 2.1.1) include:

*Government*: The government has allocate the Estate farm to villagers. However, the villagers which the government grant them the ownership right beyond the current usufructuary right.

*Livestock keepers*: These are the *maasai* pastoralists. The relationship between livestock keeper and farmers is negative due to regular conflicts that sometimes are deadly.

*Private farmers*: These operate medium to large commercial farms. Farmers in the FGD felt that the villagers are not benefitting from these private farmers as they do not rent out their land to smallholders.

*Tractor operators*: The tractors are brought from Kilosa town during the start of farm

operations.

*Casual labourers*: These include migrant labourers from Dodoma (gogo) and native casuals that sell labour to the farmers.

*Stockists*: These are important stakeholders that sell farm inputs – they are based in Kilosa town.

*Traders*: These buys produce from farmers. Others such as those running local dukas provide services by making the consumable supplies available to village consumers.

Local brokers: These helps with linking farmers and incoming buyers.

*Processors*: These helps with processing of farmers' produce. Some also operate as buyers. Majority of these also operate grain stores – helping with storage which smooth temporal supply of food grains. The processors are based in Kilosa town.

*Motorbike operators (bodaboda)*: These are based at the village centre. There are around 10 operators (mostly youths) running the bodaboda services – helping with transportation of people and agricultural produce.

## 5.3. Idifu village

The village covers about 6000 ha out of which 2000 ha are suitable for agriculture. The village is estimate to have a population of 5086 people living in 1169 households – making an average household size of 4 people.

### 5.3.1. Natural resources

Key natural resources that imply on FVCs and local food system include – land, trees (not forest as such), water and pasture (grasses and crop residuals). The FGD participants did not consider their village to have forests but just trees found in patches.

*Land*

In the first place, the FGD participants describe the land resources based on soil types. Soil types at Idifu village can be categorized into sandy (75%), clay (Nyika) (15%) and Red soil (10%). Generally, the fertility of the soil is low particularly with sandy soils. Crop suitability differs according to soils. On the sandy soils, crops grown include pearl millet, bambaranuts, groundnuts, and cassava. On clayey soils, suitable crops grown include rice, maize, sorghum, sunflower, and vegetables. Moreover, on red soils the crops grown include groundnuts, maize and simsim.

The farm holding stands at an average of 5 acres. There is a provision of renting in land among farmers – but very few rent in land (10%). The land rent is around Tsh 20,000 per acre – and the cost of buying land is around Tsh 100,000/acre. The red and clayey soils are the most exchanged land types, as they are considered fertile.

*Trees*

The area is highly deprived of vegetation covers. The area has patches of baobab trees and dryland shrubs. The mountainous areas that used to be covered by forests are highly degraded – as they are unsustainably exploited for fuel wood and charcoal. Production of simsim, which involves clearing vegetated land every season, is threatening the surface vegetations on hills– hence exposing the land to erosion. Some farmers are involved in beekeeping.

*Water*

The village as other semi-arid areas is water-scarce. Sources of water include a few deep wells installed with pumps, shallow wells, and rainwater. The water from shallow wells is used to irrigate vegetables. The deep well does not dry-up. The deep well is operated by the community. Residents use a hand mechanical pump to life water from the deep well. There are so several depressions where residents dig out shallow wells –for both domestic use and watering animals. Rainwater resource collects as surface runoff in natural dug out and natural depressions to form water ponds. The rainwater is also harvested beneath the sand rivers. Sand river beds are renowned natural reservoirs of water in drylands. Rooftop rainwater harvesting is limited by the type roofing of most of the houses in Dodoma – that are mud-thatched (locally known as *tembe*).

*Pasture – grasses and crop residues*

The place is drier and vastly de-vegetated. This reality made the farmers to think beyond the natural pastures and underscore crop residues as a vital feed resource. Households with livestock tend to stock dried crop residues to feed livestock during the critical dry season. Supplementary feeding is targeted to oxen that are to be adequately fed in order to operate the farm implement – oxen ploughs and carts.

### 5.3.2. Production, processing, marketing, consumption and waste management

A number of crops are grown in the area. The major crops grown in the village include pearl millet, sorghum, groundnuts, bambaranuts, sunflower, and simsim. Other crops grown include tomatoes, cowpeas, cucumbers, watermelon, and pumpkins. Furthermore, a range of wild fruits and vegetables is important in the local food security.

**a) Pearl millet**

*Production*

Pearl millet is the main staple food in this village – every household grows it at an average of 3 acres. The crop occupies 70% of the farmed village land. Yield levels are 0.6-6 bags and 8 bags per acre during bad and good years, respectively. The intercrops in the millet fields include cowpeas, cucumber, watermelon, and pumpkins.

*Processing*

Processing of pearl millet involves primary processing – drying and manual threshing. The threshing area is prepared by first sweeping the ground and then spreading a thin layer of cow dung slurry. After threshing, the produce is winnowed by a blowing wind. Storage is done in local indoor storage silos "vihenge" and in gunny bags. About 3% of households have "vihenge". Pearl millet is not attacked by insects so it can be kept for long time without treating it with insecticides. However, it is eaten by rodents – cats are kept in the house to control rodents.

Another level of processing is to grind the shelled grains into flour. The grain husk is either removed by using traditional grinding stones or milling machine before it is ground into flour. The grain can also be ground into flour without de-husking particularly during food shortage.

*Marketing*

The crop is normally not sold unless there is surplus. Selling might happen in case the family has critical need of money and there is no other alternative. In case of selling, a tin weigh 20 kg is sold at Tsh 5,000 (Tsh 30,000/bag) with peak supply and twice as much (Tsh 10,000/tin or Tsh 60,000/bag) in years of bad harvest or scarcity.

The middlemen assume the trading role by transporting the produce to large buyers in Dodoma town. Farmer sells at Tsh 30,000/bag to local buyers who sell at Tsh 36,000-40,000/bag wholesalers in Dodoma town. During food shortage, the produce is brought back into the village by the middlemen who sell to farmers at Tsh 45,000/bag.

*Consumption*

Pale millet is utilized mostly for food and small amount for making local brew. Shortage of millet for food normally starts six months after harvest.

*Waste management*

The pearl millet stalks are fed on animals – particularly oxen during the critical dry period.
*Provisional pearl millet value chain*

There are about three strands in the pearl millet value chain: farmers to household consumers in the village (Figure 9). Second farmers to local intermediaries through urban-based wholesalers to urban consumers and farmers to village-based millers back either to farmers or through to household consumers in the village. Pearl millet grains is the only product sold by farmers. Millers who tend to integrate with grainstores business handle both raw grains and flour.

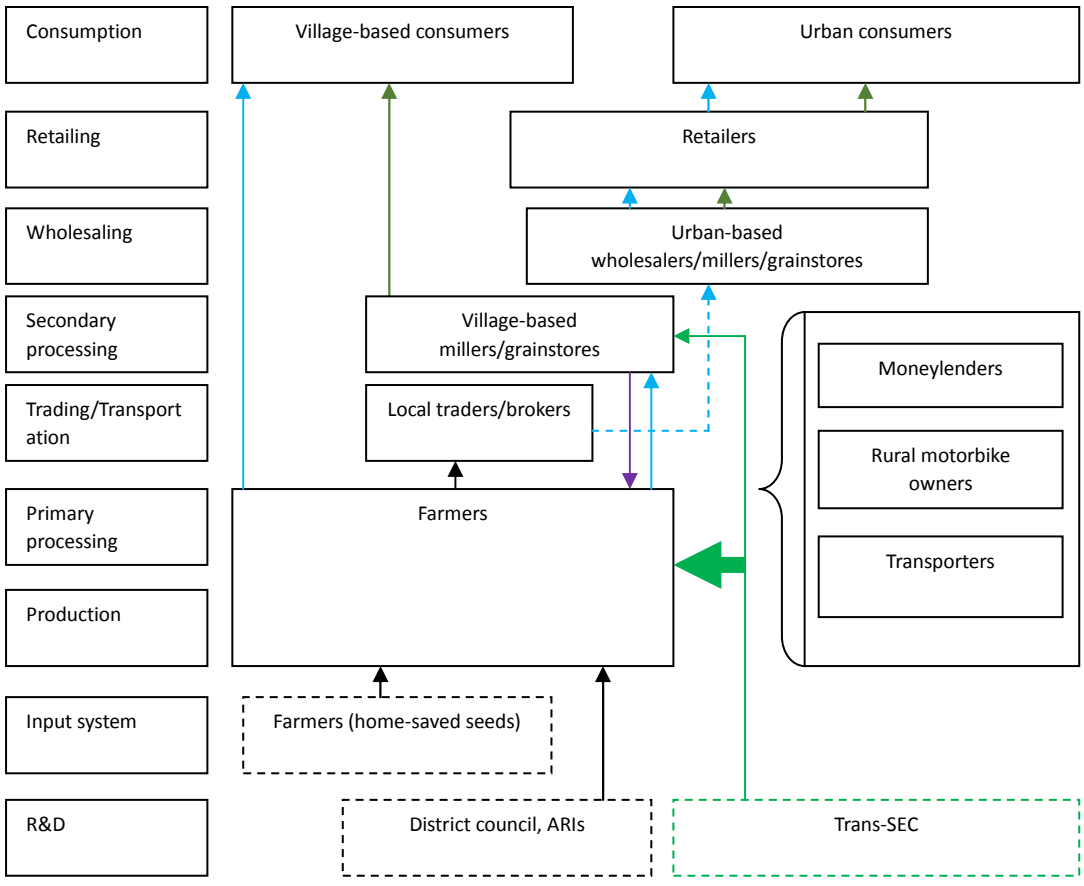



**Figure 9: Provisional pearl millet value chain**

The R&D and input system are overly underdeveloped – seems to be an orphan crop in terms such interventions. Despite of being the most preferred staple in the local food system, there is little research and development support for pearl millet as compared to sorghum. These are

potential upgrading domains for the Trans-Sec project – to strengthen the input system and other productivity-upgrading practices.

**b) Sorghum**

There was generally little attention to sorghum during FGD. This because of limitation and low local importance of sorghum compared to other crops. However, there some key general issues regarding sorghum:

*Limited cultural preference as staple*: In the case study village, millet is preferred over sorghum.

*Low adoption of the crop at the farm level*: Despite of decades of promotion of the crop, adoption of improved sorghum varieties has remain low (<30%).

*Value addition potential*: The crop has a potential for value addition not only at the household but also at commercial level. The brewing industry is already buying large amount of sorghum in other parts of Dodoma region. Sorghum sells at Tsh 10,000 per tin of 20 kg.

It should be noted that the crop would be covered in follow-up detailed FVC study. The study is designed to upgrade this report with more details.

**c) Groundnuts**

*Production*

Almost all households in the village groundnuts. The crop is normally intercropped with h sunflower, maize, pearl millet and white sorghum. The average household farm size under groundnuts in a particular season is around 5 acres. In good years the yield ranges between 28 and 32 bags/acre of shelled grains and in bad years it can be as low as 0-1.6 bag/acre.

*Processing*

There are shelling machines at Mvumi centre, which is the division's centre. Farmer can either shell the produce manually by hand or do the same at a charge to the shellers' operators. An example of a groundnut shelling machine is presented in Figure ? At the village level, groundnuts processing is restricts to shelling – no other value added produced. A number of value added products can be produced from groundnuts – e.g. oil and peanut butter.

*Marketing*

Groundnuts is highly commercialized. The largest amount is produced for the market and only little is consumed at the household. Shelled groundnuts sell at Tsh 625 – 875 per kg. During the bad seasons the price goes down because of poor quality of the nuts – most of kernels are empty.

*Consumption*

Groundnuts are consumed as an additive to indigenous vegetables. The nuts are crushed and ground into flour using traditional mortars. The flour is cooked together with vegetables.

*Waste management*

There two wastes that are utilizable – crop residues and shells. Crop residues are used to feed animals. However, the shells are not fully utilized at the household. However, there is a large groundnut buyer (UK based) at Mvumi that has recently embarked on processing the shells into fuel briquettes.

**d) Bambara nuts**

*Production*

It is an important crop grown by most of the households in the village (100%). The average household farm size under bambara nuts production is 1 acre. It is normally intercropped with maize and pearl millet. In good years, production can range from 2.5-5 bags/acre while in bad years it can go as low as zero.

*Processing*

The nuts have harder kernels. Shelling includes beating the dried kernels to make them release the nuts. However, the machines used for shelling groundnuts can be used to shell bambaranuts.

*Marketing*

The largest part of produced bambaranuts produced is consumed at home. A small part is sold at the village marketplace. The price of bambara is around Tsh 700 per kg.

*Consumption*

About 50% o of the nuts are eaten fresh. The nuts is a good source of protein and energy. The nuts are boiled and taken as a meal.

*Waste management*

As the production level is generally low – related wastes are not in plenty supplies. The wastes can be utilized the same way as in the case of groundnuts.

**e) Sunflower**

*Production*

About 50% of the households grow sunflower at an average farm size of 1 acre. It is normally intercropped with groundnuts, bambaranuts, pearl millet and maize. Production in good years is about 300 kg/acre and 46 kg/acre during bad years.

*Processing*

Sunflower processing is widely undertaken in rural areas. There is a number of pressing machine across the village centres.

*Marketing*

Seventy percent of sunflower produced at the household in marketed. Due to the possibility of processing the seeds into oil, a farmer has an option of either selling seeds or processed oil.

The sunflower oilseeds are sold at Tsh 550 per kg while the oil sells at Tsh 3,000 per litre.

*Consumption*

Farming households consume around 30% of the produced sunflower as oil – 70% is marketed.

*Waste management*

Sunflower seed cake is used as animal feed – therefore it is tradable.

**f) Indigenous vegetables**

In Dodoma as in other parts of semi-arid central Tanzania, indigenous and wild vegetables and fruits play a significant role in the local food systems. Common indigenous vegetables in Idifu village include *mlenda*, cowpea leaves, chuwandagulu (wild sweet potatoes), *likuyu* (younger baobao leaves), *yambu*, wild amaranths and pumpkin leaves.

The indigenous vegetables are prepared at the household. In some cases, they are traded within and beyond the village – in dried form. Indigenous vegetables are meant for local consumption. However, there is a potential for commercialization if they are made available at a large scale with improved food quality and safety.

For possible upgrading interventions, it is important to understand how the vegetables are processed and utilized currently:

*Mlenda*

The leaves are picked from the bush and dried for 1-2 days. After drying they are sorted and crashed in a traditional mortar and then stored for future consumption. Processing and storage of indigenous vegetables are aimed at ensuring availability of vegetables during the critical dry period in a year. A family normally processes and stores about 5 kg per year (in a 20-litre bucket). A family of 8 people consumes around 2 tins per year.

Aspects for upgrading might include hygienic preparation particularly during drying and understanding its nutritive value. Drying is done on the soil surface, which makes the produce trap sandy particles from rain splashes. The leaves are mixed with sandy particles causing nuisance during eating. Farmers argue that they have to dry on the soil ground in order to accelerate drying. There are fabricated simple solar driers that can be used to dry the vegetables.

*Cowpea leaves*

Immature leaves are picked, sorted to remove the midribs and then blanched by adding a pinch of water and boil overnight. The blanched leaves are then dried and stored in local containers 'vibuyu'.

*Baobab leaves (likui)*

Baobao is an endemic tree species of the tropical drylands. The young leaves of baobao are picked and boiled – then blended *(pekecha)*. The prepared babao leaves are locally known as

*likui.* Normaly, the add rocksalt (magadi) during boiling. The babao also produces the dried fruits that produce a sour-tasting powder (*ubuyu*) – an additive into porridge. The powdery ubuyu value-added products are widely traded up to urban markets: can be used to make juice and pellets for chewing. The seeds are pressed into baobao oil – increasingly traded as medicinal product. The seeds are sold at Tsh 500-1000 per tin. Of recent, there has been a concern from Tanzania Food and Drugs Authority (TFDA) to the public regarding the health risks of consuming inadequately refined baobao oil.

*Wild potato leaves 'Chuwandagu'*

The tender leaves are picked, sorted, pounded then rolled into pie, then dried and stored in '*vibuyu*'. The processed product can be mixed with meat during cooking and only small amount is required per meal.

*Simsim and paddy: newly grown crops*

Simsim not grown successfully due to its susceptibility to insects and fungal diseases. It was estimated that around 10 households in the village grow simsim – mainly for cash. Some farmers tend to grow it on the hills that are cleared from vegetations – exposing it to degradation from erosion. The simsim market is lucrative – with a producer price of Tsh 3,000/kg. With such level of payoffs, the crop can be promoted for income generation. In this regard, its susceptibility to insects and fungal diseases would also be areas of upgrading.

Paddy is a promising crop that can be promoted in the village. Approximately 600 acres are suitable for lowland paddy production – under *majaruba* rainfed system. However, the crop is recently being grown by a few households – around 10%. A few farmers trying to grow paddy face some hurdles including drainage and labour intensive hand-based transplanting. There could also be problems associated with access to quality seeds of the right varieties. The yield per acre is about 1.2 ton/ha – around the national average. A tin of paddy (equivalent to 11 kg of milled rice) sells at Tsh 10,000 in the village.

### 5.3.3. Livestock production

*Cattle*

The farming system is basically agro-pastoral – with about 20% of the households in the village keeping cattle. The average cattle herd is around 10 animals per household. The use of cattle (oxen) in agro-mechanization is widespread. Some households that do not own oxen do hire oxen and associated implements from others. The price of cattle ranges from Tsh 400,000 to 500,000 per animal. From the mid 1980s and early 1990s, the government prohibited keeping grazing livestock in Mvumi division – due to the threat of land degradation. Within the past decade, herds of cattle have been returning into the area – without official authorization from the Government.

The issue of livestock in Mvumi area (where the CSS villages are located), has a complex socio-political dimension. Farmers want to have livestock back in their farming system; planners at district feel that the return of livestock would degrade land, which had started to heal, whereas the ruling party is at the crossroads to stress on evacuating livestock fearing to

lose votes. The contribution of Trans-SEC project among other things could be to demonstrate through science and practice how livestock can be sustainably integrated with crop agriculture while enhancing the resource integrity.

*Pigs*

Piggery is a booming activity in the village – around 50% of households in the area keep pigs. Pigs are mostly kept under a free-range system – with limited supplementation with oil seed cake and cereal bran. On average, a household has two pigs. A pig of one year that has reached the market weight is sold at Tsh 200,000. There is limited extension services on animal husbandry. The extensionist trained in crop agriculture help livestock as well. The extensionist invests in drugs and charges livestock keepers for both drugs and treatment services. Areas of upgrading in the piggery enterprise could be on improved husbandry.

*Chicken*

Almost every household in the village keeps local chickens – at an average of 5-10 birds. A she chicken is sold at Tsh 5,000-6,000 and a cock sells around Tsh 7,000-10,000 at the village periodic marketplaces. Rural chicken has the potential of reducing income poverty and nutritional insecurity. Upgrading could in areas pertaining husbandry and marketing strategies. The Bangladesh rural chicken model could be tested as an upgrading intervention. There are possibilities of linking with past efforts – e.g. the DIFID Research Into Use (RIU) which had some groundworks on promoting profitable rural chicken enterprise.

*Goats*

About 20% of households in the village keep goats – at an average of 10-15 animals. The price of a goat ranges between Tsh 40,000 and 50,000.

### 5.3.4. Technologies, energy and other services

Farmers use tractors and oxen in tilling their farms – the use of oxen is predominant. A significant number of households own oxen and a few own associated implements – oxen carts and ploughs. The tractor and oxen hire costs are Tsh 40,000 and 25,000 per acre, respectively.

Fuel wood is the main source of energy for cooking – followed by charcoal. It is increasingly taking them longer (> 5 hours) to reach the forests where they collect firewood. The woods are carried in oxen driven carts – owned or hired by the household. It was estimated that the village has around 50 oxen carts.

There some limited practices of planting trees – most of planted trees include neem (shade), *misonobari*, eucalyptus (poles) and *miti maji* (shed). Mangoe trees are also widespread – they seem to be over-aged and unattended, hence less productive. The villagers also collect wild fruits such as *ngwelu*, *ng'hafuta* and *fulu*. Promoting dryland suited agro-forestry would generate both economic and ecological payoffs to the communities.

There are round 13 Chinese motorbikes in the village – 3 operated commercially by youths. A ride on a motorbike to the division centre (Mvumi) costs Tsh 5,000. The fare with public

transport by bus from Mvumi to Dodoma town is Tsh 4,000.

The village is reached by the mobile phone signals – airtel and Vodacom. This enables communication and internet access.

There are over 20 households with solar energy installations. The solar installations are used for lighting and mobile phone charging. The solar equipment are serviced at Mvumi centre.

The village has one deep well, three community tap water stations, and several shallow wells in the depressions. The tap water stations charge Tsh 50 per 20l bucket.

The village has four maize milling machines. There is no stockist in the village – the nearest place where they can get agricultural inputs is Mvumi.

### 5.3.5. Stakeholders

The key stakeholders in the food system (apart from primary users/actors along the FVC at grass root level, see Deliverable 2.1.1) include:

*Crops buyers:* There are around three buyers of the crops in the village. These buyers also operate as moneylenders that provide farmers with advance credits. The lending is connected with buying crops. They also stock produce and mobilize food into the village for selling to farmers during food shortages. One of the three traders sells agricultural inputs as well.

### 5.4. Ilolo village

The village is located the Dodoma CSS region. According to the 2012 population census, the village had around 4,015 people and an average household size of 4 people. The state of the art with respect to different components of the FVC are described below.

#### 5.4.1. Natural resources

Important natural resources that imply on the FVCs and the local food system at large included land, natural water catchment and the community water harvesting pond.

*Land*

An average size of landholding per household was estimated at 4 acres.

A substantive proportion of households (20-30%) hire specific type of land – mainly the reidsh clayey soil. The land rent ranges between Tsh 20,000 and 30,000 per acre. The hired land is added up to the owned land.

The soils of the village are subdivided into three distinct categories namely Sandy (70%), Clay (25%) and mbuga soils (5%). The different land types differ in terms of crop suitability. Sand soils are prominently used for cultivation of pearl millet, sorghum, bambaranuts, groundnuts and cowpeas. Redish clayey soils are used cultivation of sorghum, bambara nuts, maize, grapes and simsim. Mbuga soils used for cultivation of maize, sugarcane, sorghum, sunflower, sweet potatoes, sunflower and simsim.

*Natural water catchment*

The village is at the frontier with an extentisively sloping hill that serves as a rainwater catchment area. The catchment drains the runoff into Mtera hydro dam. The farmers felt that the generated runoff would have been utilized for agriculture dowstream at the village with proper water harvesting techologies. Currently, the runoff causes gully erosion and renders the low-lying village at risk of flash floods.

*Community water harvesting pond*

Another important resource reported by farmers during the FGD is the water pond that was made in the early 1960s. The pond mainly serves a dual purpose of watering animals and domestic water supply. There are also limited vegetable irrigation practices during the dry off-season. The pond is facing siltation problem. There are no means of trapping silts and debris that come with collecting surface runoff. Improvements could be in the areas of de-silting and installing silt traps at the runoff inlets.

#### 5.3.2. Production, processing, marketing, consumption and waste management

**a) Pearl millet**

*Production*

The crop is cultivated by all households in the village (100%). The average land under pearl millet during a particular growing season is around 2 acres per household. The grown varieties

are predominantly local ones – under an mixed-cropping system mainly with sunflower, sorghum, cowpeas, groundnuts, sunflower and Bambara nuts. The yields are around 4 bags/acre (400 kg/acre) during a good season and 0-1 bag/acre during a bad season.

*Processing*

Primary product upgrading practices involves sun-drying and threshing. Shelling is done on a soil surface which is plastered using cow dung. The millet is then spread on the ground throughout a sunny daytime as a drying process. Threshing is done using direct pounding sticks. Winnowing process takes advantage of the winds by pouring down the grains against the wind direction. Storage is done in polythene bags (70%) and a few households store the dried grains in traditional granaries (30%). The traditional granaries are installed in the living houses. The ultimate processing activity is milling – using the common grain mills. There is a range of potential upgrading in this area – improved drying, threshing technology, and storage.

*Marketing*

Pearl millet is mainly traded locally – the local traders buy from farmers and stock the produce for selling in future times when villagers are depleted of own stocks. These local traders operates shops in the villages – likely to be involved in moneylending businesses. When in the supply is high, for example during the peak haverst time, the price is around Tsh 5,000 per a 20-kg tin. The producer price hikes between Tsh 10,000 and 15,000/tin when the market supply is limited.

*Consumption*

Around 90% of the pearl millet produced is meant for home consumption. Pearl millet is utilized as range flour-based products: stiff-porridge (*ugali*), liquid porridge (*uji*) and local brew. There could be other pearl millet based value added products – an upgrading area for research.

*Waste management*

The bulky wastes include the stalks – that are used as animal feed. The stalks are stocked for dryseason feeding of oxens. Farmers operating oxen ensure that they have enough feed for the oxens before the season commences – the necessary fuel for such living tillage machines. There is no millet bran produced as by-product as the grains are milled whole.

**b) Sorghum**

As in the case of Idifu, sorghum is not a priority crop to the locals. A few explanations made for the crop in Idifu holds in this case. An adoption study may be important to understand why the crop has not diffused in the farming communities despite the past efforts by the government to promote it.

Utilization of sorghum is the same as that of pearl millet – consumed as ugali, uji and used in local brewing. The stalks are used as animal feed. There is a growing trade and commercialization of sorghum in the brewing industry. However, the challenge remains on how the smallholders can supply this market required amount, consistency, and quality.

### c) Pigeon peas

*Production*

The crop is cultivated by 40% of the households in the village. Around half of the households growing pigeon peas grow improved seed – whitish variety. The improved seeds cost Tsh 1,200/kg. Usually the crop is mixed with other crops such as sorghum, pearl millet and sunflower.

*Processing*

Pigeon peas are not processed apart from primary processing involving sun drying. Market oriented product upgrading might include grading and packaging.

*Marketing*

Pigeon peas are produced mainly for home consumption. Most of the produce are consumed as green. In addition, the limited proportion of the produce market is sold while green in Dodoma at Tsh. 8,000 per 20-kg tin.

*Consumption*

Pigeon peas are produced mainly for home consumption – mainly consumed while green.

*Waste management*

It was not established from FGD participants on how the stalks are utilized. However, the stalks can be used as fuel wood and the peels can be used as animal feed.

### d) Cassava

Cassava is grown be around 25% of the households. However, the local importance of the crop is still limited – it is necessary to find out why. Not only that cassava can thrive under dry conditions but the crop has an industrial trade potential. A variety of value added products can produced out of cassava: e.g. starch and high quality cassava flour. Cassava can be consumed as boiled and roasted roots, ugali and can serve as a substitute of wheat in the bakery industry.

### e) Grapes

*Production*

It was estimated during FGD that only 5% of households grow grapes. On average an individual farmer manages around one acre. The crop is grown in the trenches – an acre constitutes 21 trenches 7 feet long. Current yields are around 1.4 and 0.7 ton/acre during good and bad season, respectively. Farmers perceived productivity to be low. The major production constraint that reduces yield was reported to be animal pests: birds, bees, mosquito, snake and hyena.

The adoption of the crop is very limited – the farmers attribute this to unreliable and unprofitable grape market.

Upgrading may be need in areas related with improvement of productivity. There is also a possibility of introducing table grapes. As grapes is a commercial crop – the decision on growing it should be based on requirements in the end markets.

*Processing*

The grapes are not locally processed. The farmers sell their graps to the wine industries.

*Marketing*

Like sugarcane, the price of wine grapes depends on the level of sugars. During the rain season the sugar level is low and the price is around Tsh 500/kg. During the dry season, the sugar level rises and the producer price doubles to Tsh 1,000/kg.

The grape market is unreliable. The buyers include the industrial wine processors (CETAWICO and TAVICO, wholesalers from Dar es salaam, Uganda and Kenya, and small traders and vendors. The wineries have contract with farmers – however contractual arrangements have never worked smoothly to farmers. As the wineries seem to be overwhelmed in terms of the amount of grapes they can absorb – linking farmers to other market outlets would be a promising market upgrading.

*Consumption*

The graps are consumed either as fruits or wine. Currently, the table grapes are not produced. Other areas of concerns would be in relation to food safety – managing the chemical sprays at the farm level.

*Waste management*

It was not clearly established what wastes and by-products are comprised in the grapes value chain.

**f) Groundnuts**

*Production*

Groundnuts are grown by all farming households in the village. On average an household operates 1-2 acres. During good seasons the yield (of unshelled nuts) is around 50-60 tins per acre; whereas in bad seasons the yield was estimated at 0-12 tins/acre. A tin of unshelled nuts produced around kgs of shelled nuts (actual standard weights have to be established). During a poor season, most of pods are empty without and or with wrinkled nuts.

*Processing*

Currently, the major processing practice involves shelling. There some private processors operating manual shellers. There are around 10 units of manual shellers. Shellers are fabricated by SIDO (a national small industries organization) – one unit sells at Tsh 150,00. The shellers operators charge Tsh 500 per 20-kg tin of shelled nuts.

*Marketing*

Groundunts is the highly commercialized crop (an example of a typical value chain has been reviewed in Kongwa district – in Figure 8 ). Unshelled groundnuts are sold at Tsh. 5,000 and Tsh 7,000 per tin durin during bad and good season, respectively. The price is low during bad season when the supply is also low because most of the pods are not filled with nuts.

Farmers sell to the middlemen and traders who ultimately sell to wholesalers. The local traders also procure and sell to wholesalers based in Dodoma.

*Consumption*

Groundnuts is locally consumed as an additive in the meals – as an oil ingredient. The nuts are also roasted and consumed as a confectionary product.

*Waste management*

Important wastes produced in the groundnuts value chain include the leafy remains and shells. Both are currently used as animal feed. However, still a significant number of farmers burn them. A few farmers also incorporate the wastes into the grape trenches to improve the soil fertility. There is a potential of using such wasts especially the shells as source of energy.

**a) Rozella**

It is a newly introduced herbal crop. Around 3% of the households grows the crop. The crop is intercropped with other crops and sometimes grown in the fields borders. The farm scale is still low – at an average ofo.25 of an acre per farmer. It used to make a local brew (locally called choya), but the crop is also good for juice. It is increasingly traded in urban markets including supermarkets.

### 5.3.3. Livestock production

The livestock system is not different from found in Idifu. However, in Ilolo there ar a few household keeping dairy cow – around three households. One farm is also keeping a dairy goat.

### 5.3.5. Technologies, energy and other services

Tillage technology is predominantly animal based – use of oxen hired at Tsh 30,000 – 40,000 per acre. The draught animal power is also used for rural transportation – of loads. There is one tractor in the village – recently bought an innovator farmer. There is one village based transporter operating a 3.5 ton truck – hauling agricultural produce from the rural area to Dodoma town. There are around 15 solar panel installations in the village.

### 5.3.6. Stakeholders

Contrary to Idifu, FGD participants at Ilolo mapped a quite high number of stakeholder in the local food system (apart from primary users/actors along the FVC at grass root level, see Deliverable 2.1.1); they include:

*INADES Formation (1998-To date)*: involved in projects on water and sanitation, training on

poultry keeping and promoting the village information centre to enhance good governance.

*Diocese of Central Tanganyika (DCT)*: provides maternal and child health care services, training on establishment and management of Village Community Bank (VICOBA), and caring for the orphans.

Rural Livelihood Development Company (RLDC): involved in training on poultry keeping and marketing, poultry feed compounding, animal nutrition and health, and formation of SACCOS. A group formed by LRDC still exist with 60 member – 43 being females and the remaining 17 are males.

*Roman Catholic Church*: involved in training on bee keeping project including provision of improved beehives. There are around three bee keeping groups with around 16-18 members each – managing around 5 beehives each. The church has promised to buy honey that will be produced.

*MIGESADO*: an NGO involved in training on the use of biogas and solar power.

*Naliendele ARI*: conducted participatory groundnuts variety selection on the farm with farmers in 2009.

LVIA: an international NGO based in Kongwa. In 2008, the NGO had interventions in the village on better farming, operated a seed and ox-plough credit scheme, training on exenization and linking farmers with markets.

# 6 Conclusions

This report is a qualitative work that was aimed at shedding light on the local FVC and the food systems at large. The report will inform the selection of the food commodities and upgrading domains. The report also presents preliminary information on stakeholders – advanced stakeholder mapping is covered in a report under deliverable 2.1. It also modestly highlights niches for further research works for different Trans-SEC WorkPackages.

# 7 References

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| ACT | Agricultural Council of Tanzania |
| AIDS | Acquired Immune Deficiency Virus |
| ARI | Agriculture Research Institute |
| ASA | Agricultural Seed Agency |
| CSS | Case Study Sites |
| DAICO | District Agricultural Irrigation and Cooperatives Officer. |
| DRT | Dar es salaam Regional Trading |
| FFS | farmer field school |
| FGD | Focus Group Discussion |
| FO | Farmers Organisations |
| FS | food security |
| FVC | Food Value Chain |
| HH | household |
| HIS | HELVETAS Swiss Inter-cooperation |
| HIV | Human Immuno Deficiency Virus |
| IFTz | INADES Formation Tanzania |
| MAMADO | Maji na Maendeleo Dodoma |
| MeTL | Mohamed Enterprise Tanzania Ltd |
| MIGESADO | Miradi ya gesi ya Samadi Dodoma. |
| MJUMITA | Tanzania Community Forest Conservation Network |
| MVIWATA | Mtandao wa Vikundi vya Wakulima Tanzania (Tanzania Farmers' Group Network) |
| PAR | participatory action research |
| POA | Planning of Action |
| REDD | Reducing of Emissions from Deforestation and Forest Degradation |
| RLDP | Rural Livelihood Development Programme |
| SC | Swiss Contact |
| SDC | Swiss agency for Development Cooperation |
| SFF | sheets of facts and figures |
| SUA | Sokoine University of Agriculture |
| TAPP | Tanzania Agricultural Production Programme |
| TASUPA | Tanzania Sunflower Promoters Association |
| TaTEDO | Tanzania Tradition Energy Development Organisation |
| TBL | Tanzania Breweries Limited |
| TBS | Tanzania Bureau of Standards |
| TFA | Tanzania Farmers' Association |
| TFC | Tanzania Federation of Cooperatives |
| TFCG | Tanzania Forest Conservation Group |
| TFCG | Tanzania Forest Conservation Group |
| TFDA | Tanzania Food and Drugs Authority |
| TZ | Tanzania |
| TZS / TSH | Tanzanian Shillings |
| UPS | Upgrading Strategies |

| | |
|---|---|
| UPS | upgrading strategy |
| USAID | United States Agency for International Development |
| WP | work package |