



# Trans-SEC

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

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Baseline**

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## Work package 3.2:

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### Implementation of the Household Survey (Wave I)

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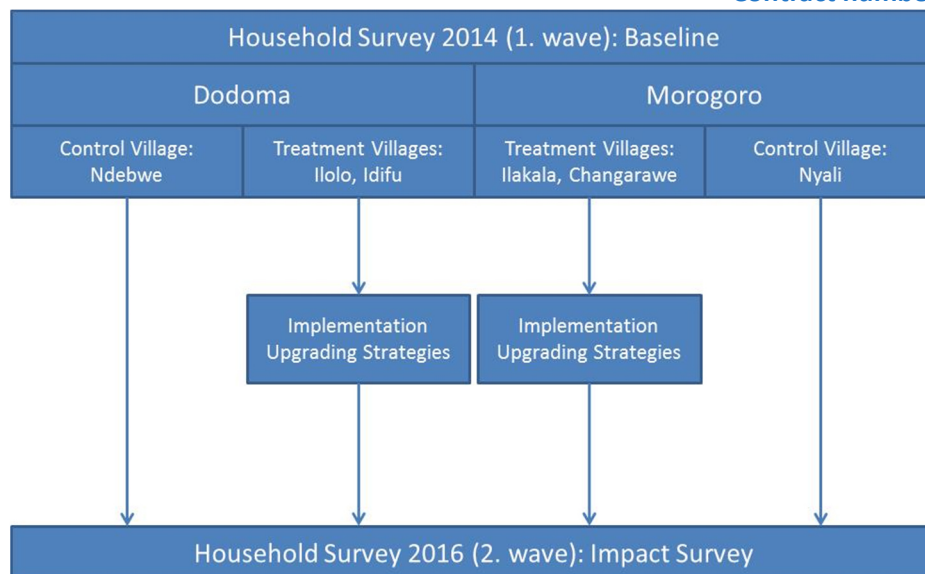
#### Selection of the Case Study Villages

For Tanzania two target regions were selected representing two different food systems: Morogoro and Dodoma. The Morogoro region (600–800 mm of annual precipitation) is predominantly semi-humid with flat plains, highlands and dry alluvial valleys. The prevalent food system is based on maize, sorghum, legumes, rice and horticulture, partly with livestock. In the semi-arid Dodoma region (350–500 mm of annual precipitation) characterized by flat plains and small hills, the food system is primarily based on sorghum and millet with a strong livestock integration (Mnenwa and Maliti, 2010) (Graef et al. 2014).

The Morogoro region contains areas with different levels of sensibility regarding food security, mostly due to its more abundant precipitation. Dodoma, in contrast, features a predominance of high food insecurity areas. With regard to the natural environment, both regions together account for 70–80% of the farming systems types found in Tanzania (USAID, 2008) (Graef et al. 2014).

Within the two target regions, three case study sites (CSS), more specifically villages, were selected representing the farming systems in the region. The main criteria for selecting the CSS were (a) similar climates; (b) market access; (c) rainfed cropping systems, (d) integration of livestock; and (d) similar village sizes with 800–1500 households. Villages were chosen where the Tanzanian smallholder farmer association MVIWATA is active and no other large R&D project intervenes. Each CSS consists of at least one local market place and surrounding 2–3 sub-villages and has at least partial access to markets for cash crops. This creates a design with comparable and at the same time diverse environmental and socio-economic conditions enabling the investigation of food security along agricultural food value chains (FVC) (Graef et al. 2014).

The design of the household survey is depicted in figure 1. In Dodoma and Morogoro three case study villages were selected each based on a scoping study. Since Trans-SEC aims at implementing upgrading strategies (UPS) in order to improve food security and livelihoods of the rural households along the FVC direct and indirectly, two villages were chosen for implementation of upgrading strategies (UPS) called “treatment villages” and one as a control village without any implementation serving as a counterfactual. This enables to evaluate possible impacts on income and food security a) over time (wave 1 compared to wave 2) and b) among treatment group and the counterfactual in both regions for each wave separately.



**Figure 1: Structure of the household survey**

The treatment villages are Ilakala and Changarawe in Morogoro and Ilo and Idifu in Dodoma respectively. The control villages are Nyali in Morogoro and Ndebwe in Dodoma.

## Selection of the Households

The households were randomly selected from village household lists provided by ARI Kilosa and ARI Hombolo. These lists contained information of the household heads' names and the corresponding sub-village they live in. After sorting the lists alphabetically for each sub-village, 150 households were selected randomly for each village (proportionally regarding the sub-village size) summing up to 900 households in total for Dodoma and Morogoro. One household was removed from the data set subsequently due to inconsistent and unreliable answers. The total sample then amounts to 899 households.

## Data Collection

The baseline survey (wave 1) was conducted in January to February 2014. The overall objective of WP 3.2 is to collect representative data on smallholders and their integration in agricultural food value chains and possible related challenges. Therefore, the questionnaire consists of different sections in order to capture the different aspects.

The focus of the questionnaire is to collect detailed information on income generating activities, expenditures and food security on household level. The collected data depicts the household activities for 2013 (January to December). Thereof, different indicators such as income (per capita and total household income), expenditure, assets, and food security indicators can be derived, whereby the latter are of special interest to the project. The questionnaire is compiled based on data requirements and subsequent requests by all project partners. It consists of 45 pages segmented in different sections (Figure 2).



# Trans-SEC

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

Contract number: 031A249D

Questionnaire checked by team member


Questionnaire number 10001

Computer ID and entry number


## Food Security and Agriculture in Tanzania Household Survey TransSec

2014

Version 1.1

### Introductory statement

We are a group of Tanzanian and German university researchers working together to study the food security and agriculture in rural Tanzania.

To achieve the objective of our research we kindly ask for your cooperation.

We assure you that all information you give during the interview is kept strictly confidential. Data will be used for scientific purposes only and will not be given to any outside person. We appreciate very much your participation in this important exercise.

	Page			Page
Section 1	2-3	Survey information	Section 5	62-63 Off-farm employment
Section 2.1	4-7	Household Members	Section 6	64-65 Non-farm self-employment
Section 2.2	8-9	Health		
Section 2.3	10-11	Household dynamics / Remittances	Section 7.1	66-73 Borrowing, Lending, Credit Rationing and Savings
			Section 7.2	74-75 Public transfers, other payments and insurance
Section 3.1	12-13	Shocks		
Section 3.2	14-17	Subjective Assessment of Wellbeing and Time Preferences	Section 8.1	76-77 Household expenditures
Section 3.3	18-19	Climatic Changes	Section 8.2	78-91 Food security,
Section 3.4	20-21	Environmental Changes		
Section 3.5	22-23	Networks, Spillover Effects	Section 9.1	92-93 Household wealth
			Section 9.2	94-95 Housing conditions
Section 4.1	24-27	Land		
Section 4.2	28-41	Crops		
Section 4.3	42-45	Livestock		
Section 4.4	44-45	Livestock products		
Section 4.5	46-49	Upgrading strategies		
Section 4.6	50-51	Fishing, hunting, collecting, logging		
Section 4.7	52-53	Agroforestry		
Section 4.8	54-59	Water		
Section 4.9	60-61	Energy		

**Figure 2: First page of the questionnaire**

In addition to the household survey, the following data were collected:

- The GPS coordinates of each surveyed household
- Focus group discussions (FGD) on coping strategies in the case of food insecurity (1 FGD per village)
- Interviews with the village executive officers to collect general information on the individual villages. This included information such as on infrastructure (availability of schools, health centre, credit facilities), the condition of forests and other natural resources used by the villagers, and the off-farm employment situation in the village (role of out / in-migrants).

The pdf scans of the 899 questionnaires are available on the server of ZALF. They are needed for the cleaning process of the data and provide some important details at household level.

## Definition of the Household

The household survey enables the project partners to use two household definitions:

- a) a nucleus household definition and
- b) a wider definition

In the nucleus household definition, any person (including infants less than 6 month old) listed in section 2.1 (household member) is included who spent at least 6 months in the household during the reference period and thus normally eat their meals together in this dwelling. Using 180 days as a threshold avoids double counting of persons in who could be living in two different households included in our sample in different periods of the year.



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Any HH member absent for more than 6 months (including the HH head) consequently is excluded from the calculation of per capita income. Any remittances of these persons to the nucleus household as well as remittances from the nucleus household to any of these persons are treated as transfers in the income calculation. In the wider definition, any person listed under section 2.1 is included which the respondent considered to be a member of the household. The World Bank includes those persons in a household who stay there at least 90 days (Grosh and Glewe, 1995).

## Data Cleaning

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All collected survey data was entered into a database (Ms-Access, SQL) and later exported to statistical software STATA 13 for data cleaning. The data cleaning process was as follows:

### Data Cleaning in Income Aggregation

Prior to the calculation of the income (sub-) aggregates the relevant variables were checked for missing and outlying observations. Checking means, the scans of the questionnaires were cross-checked with the data entered. Afterwards, the data set has been checked again for remaining missing data points and outliers. It was tried to change as few of these observations as possible. Thus, not all observations on income that were identified as outliers have been treated. The standard procedure for the identification of outliers is to calculate lower and upper bounds by adding and subtracting, respectively, two standard deviations from the median of any group of at least ten observations (e.g. groups with less observations, e.g. production of fruits in units of quantity that cannot be transformed into kg, were checked by hand). In total, 18 households (2 % out of 899) were identified to exceed the total household income threshold due to the standard procedure. The lower bound is exceeded by one household with a negative income. Any negative income values are plausible, since they are net values. Additionally, the data was checked for the very low and high income values whether the household's economic situation corresponds to the data reported in the scans. The values are not treated or excluded from the data set so that every user can decide on the thresholds depending on their aim of analysis.

### Data Cleaning in Consumption Aggregation

Prior to the calculation of the consumption (sub-) aggregates the relevant data was checked again for missing and outlying observations. Generally, it was tried to change as few of these observations as possible as above. Thus, not all observations that were identified as outliers have been treated. The standard procedure for the identification of outliers is to calculate lower and upper bounds by adding and subtracting, respectively, two standard deviations from the median of any group of at least ten observations (e.g. food expenditures; groups with less observations were checked by hand). 202 household members (4,6 % out of 4,326) were identified to exceed the total per capita annual consumption threshold due to the standard procedure. The lower bound was checked for very low consumption levels (which are all above, but closest to zero), and whether the data corresponds to the household's economic situation. Calculation of Important Indicators

### Income Aggregate

The income aggregate and related variables are merged in the STATA file "hhinc.dta" on household level (899 households). Income has been calculated in purchasing power parity adjusted US Dollars (PPP USD). Please find more information on this adjustment at the end of this document. For this



baseline and the follow up survey, we calculate the income aggregate according to the definitions and procedures suggested by Johnson et al. (1990).

The income calculation is based on the following components:

- Remittances received
- Income from rents
- Income from agriculture
- Income from natural resource use
- Income from employment
- Income from self-employment
- Returns on capital assets

Remittances received: Those remittances from non-household members to the household are fully considered as household income. Transfer income (monetary value) from absent household members to members in the nucleus sense is calculated. In addition, transfer income (money, gifts, remittances) received by the household between January and December 2013 from other persons (friends/ relatives) are included.

Income from rents: The income from renting out agricultural or other land paid in cash or in kind, is calculated individually and in total. In kind payments are valued at the farm gate price obtained from the receiving household's price information in the crop section, if it was given. In case it is not, the mean of the farm gate prices given for the commodity by at least five households from the village, ward or district level was used.

Income from agriculture: A separate income estimate was calculated for crops and livestock. The former takes the total value of output, including home consumption. After calculating total revenues, the next step is to calculate total cost of production for that crop (or livestock) by summing up all kinds of costs. In the end, the net income of each crop (livestock) is generated by subtracting the total revenue by total cost.

Capital income from lending, savings or bonds etc. was not included in the income calculation, because we had only very few of those cases and lending was very informal with no apparent rate of interest. Since there is no insurance market, the income component of indemnity payments received was not included. Also, besides health insurance, there is no specific section on insurance.

The calculation is based on the nucleus household definition: Incomes accruing to household members in their function as head of business, as an employee or government transfer payments are accounted for as income. Four households were identified to have only migrants who live not in the village for more than six months in the reference period 2013 (household questionnaire ID: 134, 268, 548, and 1003). The variable “\_x12122” indicates the number of nucleus household members per household and is included in the income variable set. It is used to calculate the per capita per year and per month, respectively.

- [\_x10100] Total household income in reference period in PPP (USD)
- [\_x10101] (Per capita income in reference period in local currency) = [10100] / [12122] (Household nucleus size)
- [\_x10112] (Per capita per month in local currency) = [\_x10101] / 12



The aggregation of all net-income components to total household income is the final step.

Income component	Step 1		Step 2
	Data file name	Individual activity	Household aggregate
Remittances received from former household members	mem	[_x21080]	[_x10080]
Remittances received from related persons	migr		[_x10081]
Income from land rent	land	[_x41083]	[_x10083]
Income from crops (total production)	crops	[_42086]	[_x10084]
Income from livestock	anim	[_x43185] / [_x10085a]	
	animby	[_x43285] / [_x10085b]	[_x10085]
Income from natural resource extraction	hunting	[_x44086]	[_x10086]
Income from off-farm wage employment	offempl	[_x50087]	[_x10087]
Income from non-farm self-employment (profits)	selfempl	[_x60088]	[_x10088]
Public transfers received	transf	[_x72193]	[_x10093]
<b>Deduct:</b>			
cost of land rent for agricultural purposes	land	[_x41096]	-[_x10096]
cost of land rent for business	land	[_x41096a]	-[_x10096a]
cost of loans for productive assets	credits	[_x71197]	-[_x10097]
depreciation of productive assets	asset	[_x91098]	-[_x10098]
<b>Step 3</b>			
<b>TOTAL ANNUAL HOUSEHOLD INCOME IN 2013</b>			<b>[_x10100]</b>
<b>Total annual household income per nucleus member</b>			<b>[_x10101]</b>
<b>Per capita income per month (nucleus)</b>			<b>[_x10112]</b>

Table 1: Overview of income calculation procedure

## Consumption Aggregate

The consumption aggregate and related variables are merged in the STATA file “cons\_aggr.dta” on individual level (4,326 individual members forming 899 households). Total consumption equals the sum of food and non-food related consumption (Deaton et al., 1999). Consumption has been calculated in purchasing power parity adjusted US dollars (PPP USD). Please find more information on this adjustment at the end of this document. All consumption (sub-) aggregates and their variables are presented in table 2. Yearly consumption is calculated for the time span ranging from January to December 2013 (subsequently referred to as the reference period).

Explanation (in PPP USD)	Variable
total consumption per household and year	_x11100
total consumption per capita and year (nucleus)	_x11101
adult equivalent total consumption per household and year	__11102
household nucleus size used for “per capita” calculation	__12122
food consumption per capita and year	Cap_food_100
food consumption per household and year	food_100
non-food consumption per capita and year	Cap_non_food_100
non-food consumption per household and year	Non_food_100
maize consumption per capita and year (part of Cap_food_100)	Cap_maize_100
maize consumption per household and year	Maize_100

Table 2: Variables of consumption (sub-) aggregates

In the “cons\_agg” data set one will find the above overall consumption relevant variables, each are provided per year as per capita (nucleus) and per household, respectively. In addition, the dataset provides information on sub aggregates for each overall variable, i.e. “cap\_food\_100” is the total of





food consumption, which is based on section-wise food consumption. For example, “cap\_food\_420” is referring to food consumption input from section 4.2 (crop section), and so on. The social (incl. education and health) and transport/ communication sub-aggregates are part of the non-food sub-aggregate.

Type of consumption	Sources in the questionnaire
Food	<ul style="list-style-type: none"> <li>• 4.1: land (in-kind rental payment for land)</li> <li>• 4.2: crops</li> <li>• 4.3: Livestock</li> <li>• 4.4: Livestock products</li> <li>• 4.6: Fishing, hunting, collecting &amp; logging</li> <li>• 6: self-employment</li> <li>• 7.1: Borrowing (in-kind loans received during the reference period)</li> <li>• 7.2: Lending (in-kind repayment of loan)</li> <li>• 7.5: Public transfers (in-kind, if food)</li> <li>• 8.1: expenditures</li> </ul>
Non-Food	<ul style="list-style-type: none"> <li>• 4.4: Livestock products (e.g. hides &amp; skins)</li> <li>• 4.6: Fishing, hunting, collecting &amp; logging (e.g. firewood)</li> <li>• 6: self-employment</li> <li>• 7.5: Public transfers (in-kind, if non-food)</li> <li>• 8: expenditures</li> </ul>
Maize	<ul style="list-style-type: none"> <li>• 4.1: land (in-kind rental payment for land)</li> <li>• 4.2: crops</li> <li>• 8: expenditures</li> </ul>

**Table 3: Sources of consumption data household survey**

In the case of off-farm employment, consumption has been left out because monetary values can neither be assigned to in-kind payments, nor to computing expenses. Also, consumption related to durable goods (see asset section 9.1) is not included in the consumption aggregate. There are the following good reasons to leave – unlike the income aggregate – depreciation values out:

- First of all, valuation of assets was seen to be very subjectively done.
- It is not known, when assets other than the most recently obtained one were bought, i.e. the age of most of them is unknown.
- It is not known at what prices assets other than the most recently obtained one were bought. This is very problematic since, for example, the most recently obtained furniture item might have been a bed and thus very expensive. Instead, the other 5 furniture items stated by the household might only be cheap plastic chairs.

## Data Files' Structure and Instructions for Use

The dataset is structured according to the tables in different sections. Please be aware that some sections refer to the household as a unit (hh.dta) and others to individuals in the household (mem.dta) or to specific items produced by the household (crops.dta). Variables from different tables can be combined by merge operations available in all statistical packages. The following identifying information can be used for this purpose:



hhkey	The household key is a unique identifier for each household in the database
memID	Unique household member ID
__10002	District ID
__10003	Ward ID
__10004	Village ID
__10005	Subvillage ID
ID	SQL database row identification, relevant for data management

## Conversion of Monetary Values from TZS to PPP USD

To enable comparison of welfare indicators between local and international contexts, Purchasing power parity conversion factors are used. This represents the country's currency (TZS for Tanzania) required to buy the same amounts of goods and services in the domestic market as USD would buy in the United States (World Bank, 2014). Calculation of the conversion factor that was used in converting all monetary values from TZS to PPP USD involved a number of steps and information. Information used for conversion:

- Current Consumer price index (CPI), 146.6: This is the all items index annualized CPI for 2013 referenced 2010=100. (Tanzania National Bureau of statistics, 2014)
- CPI ratio (2013 /2010), 1.466. This is obtained by  $[CPI_{2013}/CPI_{2010}]$
- PPP conversion factor, private consumption (local currency units per international USD) for the year 2010: 535.98 (World Bank, 2014)

### Procedure<sup>1</sup>:

- i) The current PPP exchange rate is calculated by adjusting the 2010 PPP for cumulative inflation since 2010 as follows:

$$PPP_{current} = PPP_{2010} * [CPI_{2013} / CPI_{2010}]$$
$$785.74668 = 535.98 * 1.466$$

- ii) To convert local currency units to international dollars, the local currency unit is divided by the PPP exchange rate:

$$\text{Therefore } 1 \text{ TZS/PPP \$} = 1/785.74668 = 0.001272675.$$

This factor (0.001272675) can then be used by multiplying any TZS units to get the equivalent PPP USD. Therefore, all TZS monetary values in the data were converted to PPP USD values by multiplying by the conversion factor 0.001272675.

<sup>1</sup> This procedure is adopted from Poverty assessment Tools Training Manual. For detailed information, see Poverty Assessment Tools 'Calculating PPP conversion Factors' document available at: [http://www.povertytools.org/training\\_documents/Introduction%20to%20PA/CalculatingPPPConvFtrs.pdf](http://www.povertytools.org/training_documents/Introduction%20to%20PA/CalculatingPPPConvFtrs.pdf)





## Food Security Indicators

The household survey provides different indicators (single or aggregate) to assess the food security status of the households (see files “cons\_aggr”, “foodsec”, “fsid”, “season”, “fs\_shocks” and “impr”). Four aggregated indicators are provided together with University of Hohenheim (Dr. Christine Lambert):

- Food consumption score (FCS)
- Household Food Insecurity Access Scale (HFIAS)
- Household Hunger Scale (HHS)
- Coping strategy index (CSI)

### Food Consumption Score (FCS) (see WFP 2008)

The FCS is a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups. The necessary information is collected for country specific food items and food groups. The household member responsible for food preparation (see table “hh” variable 82004) is asked about frequency of consumption (in days) over a recall period of the past 7 days. Food items are grouped into 8 standard food groups with a maximum value of 7 days/week. The consumption frequency of each food group is multiplied by an assigned weight that is based on its nutrient content. Those values are then summed obtaining the Food Consumption Score (FCS). Table 4 shows typical thresholds for food consumption levels

Food Consumption Score	Food Consumption Level	Threshold with oil and sugar eaten on a daily basis (~7 days per week)
0-21	Poor food consumption	0-28
21.5-35	Borderline food consumption	28.5-42
> 35	Acceptable food consumption	> 42

**Table 4: Typical thresholds for food consumption levels**

Source: WFP (2008)

### Household Food Insecurity Access Scale (HFIAS) (see Coates et al. 2007)

The information generated by the HFIAS can be used to assess the prevalence of household food insecurity (access) (e.g., for geographic targeting) and to detect changes in the household food insecurity (access) situation of a population over time (e.g., for monitoring and evaluation).

In the context of the HFIAS, food quality questions do not refer directly to nutritional quality. Rather these questions attempt to capture the household’s perception of changes to the quality of their diet regardless of the diet’s objective nutritional composition (e.g., households may perceive that a change from rice to corn has caused a decline in the quality of their diet when the nutritional quality has not in fact changed significantly).

The generic occurrence questions, grouped by domain, are:

- 1) Anxiety and uncertainty about the household food supply:
  - a. Did you worry that your household would not have enough food?
- 2) Insufficient Quality (includes variety and preferences of the type of food):
  - a. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?
  - b. Did you or any household member have to eat a limited variety of foods due to a lack of resources?



- c. Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
- 3) Insufficient food intake and its physical consequences:
  - a. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
  - b. Did you or any household member have to eat fewer meals in a day because there was not enough food?
  - c. Was there ever no food to eat of any kind in your household because of a lack of resources to get food?
  - d. Did you or any household member go to sleep at night hungry because there was not enough food?
  - e. Did you or any household member go a whole day and night without eating anything because there was not enough food?

The answers are valued 0= not at all, 1 = rarely (once or twice in the past four weeks), 2 = sometimes (three to ten times in the past four weeks), 3 = often (more than ten times in the past four weeks).

The HFIAS score is a continuous measure of the degree of food insecurity (access) in the household in the past four weeks. First, a HFIAS score variable is calculated for each household by summing the codes for each frequency-of-occurrence question. Before summing the frequency-of-occurrence codes, the data analyst should code frequency-of-occurrence as 0 for all cases where the answer to the corresponding occurrence question was “no” (i.e., if Q1=0 then Q1a=0, if Q2=0 then Q2a =0, etc.).

The maximum score for a household is 27 (the household response to all nine frequency-of-occurrence questions was “often”, coded with response code of 3); the minimum score is 0 (the household responded “no” to all occurrence questions, frequency-of-occurrence questions were skipped by the interviewer, and subsequently coded as 0 by the data analyst.) The higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) a household experienced.

HFIAS Score (0-27)	Sum of the frequency-of-occurrence during the past four weeks for the 9 food insecurity-related conditions  Sum frequency-of-occurrence question response code (Q1a + Q2a + Q3a + Q4a + Q5a + Q6a + Q7a + Q8a + Q9a)
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Source: Coates et al. (2007)

## Household Hunger Scale (HHS) (see Deitchler et al. 2011)

The Household Hunger Scale (HHS) is a simple indicator to assess household hunger in food insecure areas. The HHS consists of three questions and three frequencies that, when administered in a population-based household survey, allows for estimating the percent of households affected by three different severities of household hunger: 1) Little to no household hunger; 2) Moderate household hunger; and 3) Severe household hunger.

The HHS items pertain more to household food deprivation than household food access more broadly, and thus represent only one of the three domains perceived as integral to the experience of insecure food access.



Recall Period: 4 Weeks	
Scale items	Response codes
<i>Household items:</i>	<i>Frequency categories:</i>
1. No food to eat of any kind in your household	Never, Rarely or Sometimes, Often
2. Go to sleep at night hungry	Never, Rarely or Sometimes, Often
3. Go a whole day and night without eating	Never, Rarely or Sometimes, Often

**Table 5: Response codes Household Hunger Scale**

Source: Deitchler et al. 2011

When the HHS is administered, a continuous scale score (with a minimum possible score of 0 and a maximum possible score of 6) can be tabulated for each household in the sample by summing a household's responses to items 1, 2, and 3 (refer to Table 5) where never=0, rarely or sometimes=1, and often=2. The sample median HHS score can then be used for targeting, assessment, or monitoring and evaluation purposes.

Using this framework to guide our decision making, we identified cut-points between the scale scores of 1 and 2 and the scale scores of 3 and 4 as appropriate. We named the categories "little to no household hunger" (scores 0–1), "moderate household hunger" (scores 2–3), and "severe household hunger" (scores 4–6).

### **Coping strategy index (CSI) (see Maxwell and Caldwell, 2008)**

The Coping Strategies Index (CSI) is an indicator of household food security that is relatively simple and quick to use, straightforward to understand, and correlates well with more complex measures of food security. A series of questions about how households manage to cope with a shortfall in food for consumption results in a simple numeric score. In its simplest form, monitoring changes in the CSI score indicates whether household food security status is declining or improving. It is much quicker, simpler, and cheaper to collect information on coping strategies than on actual household food consumption levels. Hence, the CSI is an appropriate tool for emergency situations when other methods are simply not practical or timely.

The CSI can be used to measure the impact of food aid programs, as an early warning indicator of impending food crisis, and as a tool for assessing both food aid needs and whether food aid has been targeted to the most food insecure households. During food aid needs assessments the tool serves to identify areas and population groups where the needs are greatest. It can also shed light on the causes of high malnutrition rates, which are often very difficult to identify. Finally, if coping strategies are tracked over a long period, CSI is useful for monitoring long-term trends in food insecurity.

Overview of the Method: "What do you do when you don't have enough food, and don't have enough money to buy food?"

The answers to this simple question comprise the basis of the CSI tool. There are two basic types of coping strategy. One includes the immediate and short-term alternation of consumption patterns. The other includes the longer-term alteration of income earning or food production patterns and one-off responses such as assets sales etc. While it is important to understand longer-term livelihood strategies in an emergency, research has shown that the management of short-term consumption strategies is an accurate indicator of food security.



## GPS Mapping of the Surveyed Households

The following maps have been developed based on the collected GPS data. They depict the study sites with some details on infrastructure and households.



Figure 3: Case study regions in Tanzania, Dodoma and Morogoro (IUW 2014)

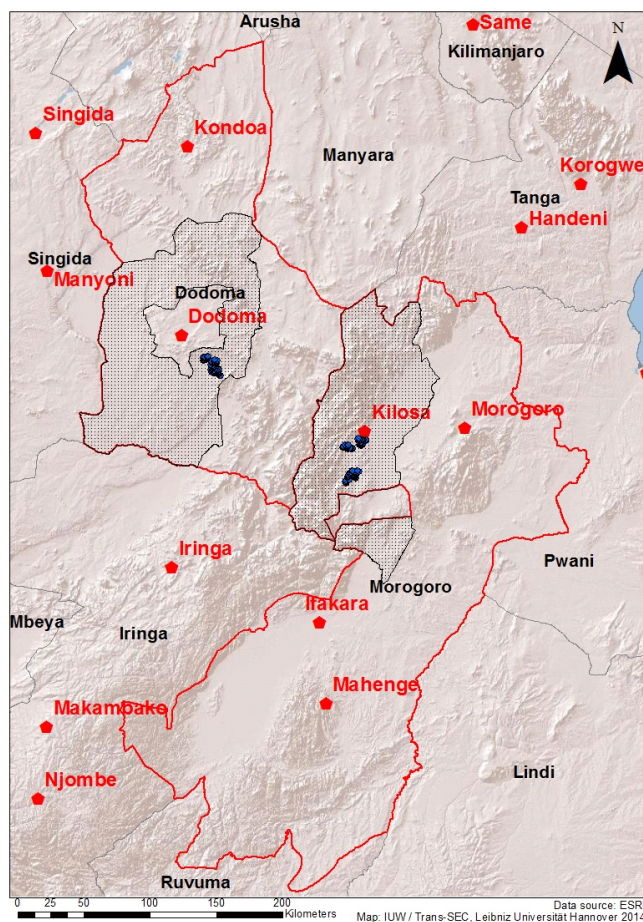


Figure 4: GPS coordinates of surveyed households in Morogoro and Dodoma (IUW 2014)

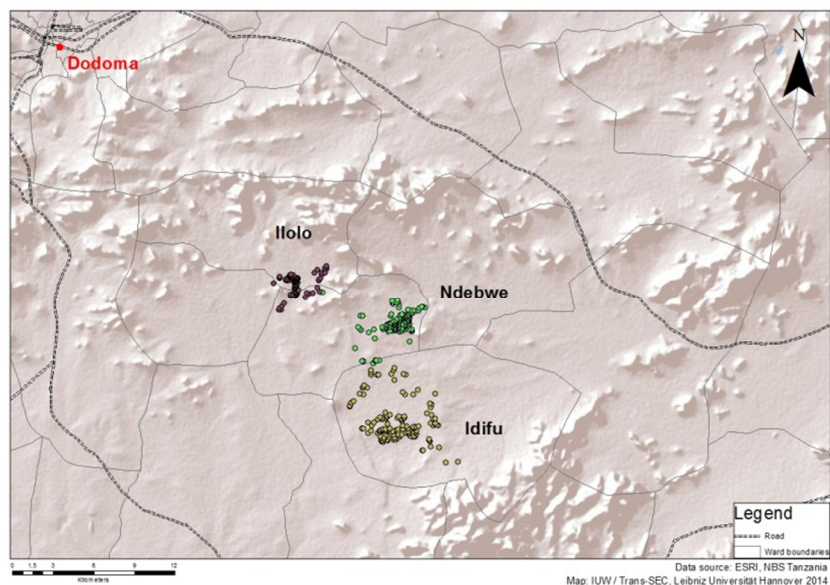




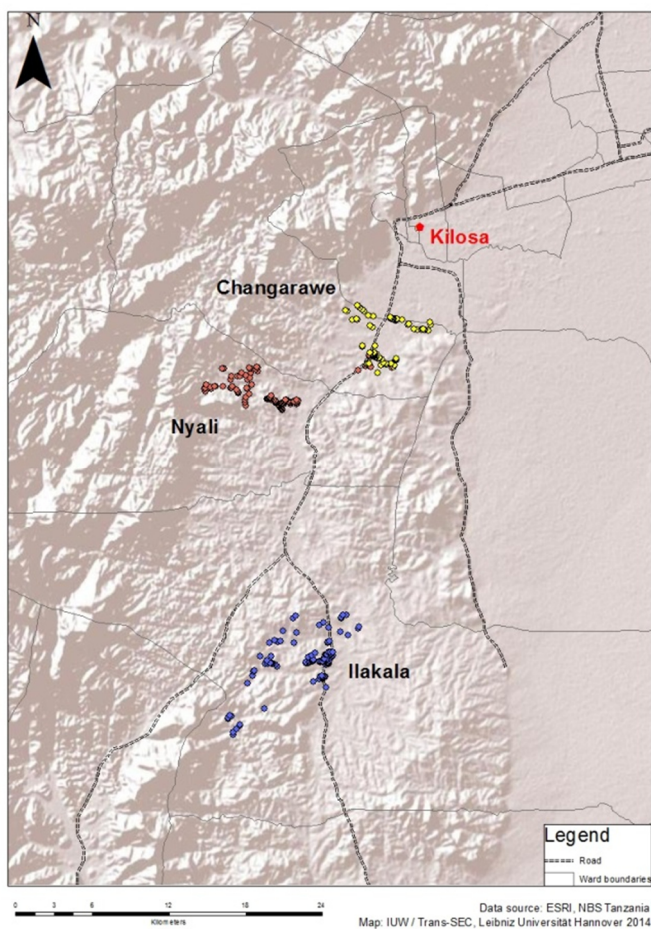
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**Figure 5: GPS coordinates of surveyed households in Dodoma (IUW 2014)**



**Figure 6: GPS coordinates of surveyed households in Morogoro (IUW 2014)**



## Farmers' Integration in Agricultural Value Chains and the Role for Food Insecurity

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### Introduction

In Tanzania, 80% of the population relies on agriculture for their livelihoods. Small-scale farmers with surpluses need the ability to access markets in order to increase their income and hence food security (World Bank 2008). The objective is to explore the livelihood strategies of small-scale farmers based on their vertical and horizontal market integration and assess the impact on food insecurity and welfare status in rural Tanzania.

### Theoretical Background

Linking small-scale farmers to markets is assumed to improve welfare and increase their utility (Adelman & Taylor 2003). Market access enables farmers to produce goods in which they have a comparative advantage. The profits from the sold surplus can be used to buy other goods and services the households need, but for which they do not have a comparative advantage in producing (Barrett 2008). Market participation is heterogeneous and can be characterized by horizontal and vertical integration as well as the quantity sold to the market.

### Method

To explore the objective, the livelihood approach is applied. A livelihood strategy represents a cluster of various income generating activities. This bundle of different activities is conditional on the quantity and quality of available capital (Brown et al. 2006). The underlying assumption is that each household maximizes its welfare based on its livelihood strategy which again depends on its available resources. Therefore, a factor and a two-step cluster analysis are applied as statistical data reduction methods. The factor analysis is used to reduce the number of metrical variables condensed into uncorrelated factors. The two-step cluster method is able to reckon up different variable scales, esp. nominal distributed data (Chiu et al. 2001). Additionally, the Akaike's information criterion (AIC) or Bayes information criterion (BIC) enables the user to select the correct number of clusters based on robust statistical criteria (Moi and Sarstedt 2011).

Selected variables for the analysis are: Vertical (market channels, volume sold) and horizontal market integration (collective action), subsistence level, share of relevant crops sold (maize, millet, sunflower, and sesame), off-farm and self-employment, transfer payments, livestock, gender of household head, available storing facilities.

### The Study Region and Underlying Data

The data sample contains 899 households from Morogoro and Dodoma in Tanzania. The Morogoro region (600–800 mm of annual precipitation) is predominantly semi-humid with flat plains, highlands and dry alluvial valleys. The prevalent food system is based on maize, sorghum, legumes, rice and horticulture, partly with livestock. In the semi-arid Dodoma region (350–500 mm of annual precipitation) characterized by flat plains and small hills, the food system is primarily based on sorghum and millet with a strong livestock integration (Mnenwa and Maliti, 2010) (Graef et al. 2014).



The focus of the questionnaire was to collect detailed information on income generating activities, value chain participation, food and non-food expenditures and food security status on household level. The collected data depicts the household activities for 2013 (January to December).

## The Clusters' Integration in the Value Chains

The cluster analysis formed 5 clusters (see table 6).

	Cluster 1 (n=157)	Cluster 2 (n=192)	Cluster 3 (n=183)	Cluster 4 (n=141)	Cluster 5 (n=212)
Male household head % (male=1)	0	100	100	79	100
Collective action in general (%) (1=yes)	4	4	3	100	6
Collective action: maize % (1=yes)	0	0	2	100	0
Collective action: sesame % (1=yes)	1	1	0	21	1
Storing for selling % (1=yes)	37	100	39	65	0
Average months stored for selling	0.9	2.2	0.2	2.5	0
Using Middlemen Channel (%) (1=yes)	43	90	37	72	46
Subsistence share (%)	65	44	58	51	63
Tropical Livestock Unit (TLU)	0.4	0.8	1.2	0.17	0.98
Land (ha)	1.5	2.3	2.9	1.7	2.6
Located in Morogoro (%) (1=yes)	38	64	8	91	56
Located in Dodoma (%) (1=yes)	62	36	92	9	44

**Table 6: Value Chain Characteristics of the derived Clusters**

Cluster 1 contains only female-headed households (100%). The land endowment is with on average 1.5 ha the lowest compared to the other clusters. The market integration is characterized by a high subsistence level on the one hand and by the low level of collective action e.g. farmer groups. Only 37 of the households are storing own produce for selling over an average period of 0.9 months. The overall participation and integration in the market is very low.

Households in cluster 2 comprise only men-headed households. Specified value chain activities are storing and the linkage to middleman as main buyers. All households reported to store for selling activities over an average period of 2.2 month.

Cluster 3 contains mainly households located in Dodoma. They are well-resourced with land and livestock. However, the market integration is very low. Only 29% of the households use storing facilities, and almost nobody is participating in collective action.

Households of cluster 4 are mainly located in Morogoro. All households participate in collective actions to either to produce, process, or sell agricultural produce. They are characterized by a relatively long storage period for selling.



Cluster 5 cannot be clearly specified regionally or gender-wise. The endowment with land and livestock is relatively high; however the linkage to collective action or use of storing facilities is very low. The level of subsistence is similar to the cluster 1 and cluster 3.

## Income Composition of the Clusters

	Cluster 1 (n=157)	Cluster 2 (n=192)	Cluster 3 (n=183)	Cluster 4 (n=141)	Cluster 5 (n=212)
Income per capita per month (USD PPP)	17.8	28.9	19.6	27.7	24.8
Agriculture (%)	37	60	36	58	46
Livestock (%)	13	12	17	6	8
Natural resource (%)	26	15	24	15	18
Off-farm wage (%)	8	4	9	6	8
Self-employment (%)	10	6	12	11	9
Remittances (%)	7	3	6	3	5
Public transfers (%)	2	0	1	0	0
Received food aid / transfers (1=yes)	32	0	93	2	0
Main crop cultivated	Maize / Millet	Maize / Sesame	Millet	Maize / Sesame	Maize / Sesame / Millet

**Table 7: Income composition of the Clusters**

Cluster 1 and Cluster 3, which are sparsely endowed with land and characterized by low market integration, achieve the lowest income per capita per month (17.8 USD PPP, 19.6 USD PPP). With 26% and 24% the households highly depend on natural resources for generating income. The households reported to receive food aid and transfer payments (32% and 93%), however, the contribution to income is with 2% and 1% very low. The main cultivated crops are food crops with maize and millet.

Cluster 2 and 4 achieve the highest income per capita per month (28.9 USD PPP and 27.7 USD PPP). These households are highly specialized in agriculture (60% and 58%). The good market integration due to storing and collective action supports a good market positioning.

Cluster 5 seems to play an intermediate position. Since the households are well endowed with land however not very well integrated in the market, they achieve a midsize income level of 24.8 USD PPP.





## The Clusters' Welfare and Food Security Level

	Cluster 1 (n=157)	Cluster 2 (n=192)	Cluster 3 (n=183)	Cluster 4 (n=141)	Cluster 5 (n=212)
Not enough food (%)	78	60	73	48	64
Not enough money to buy food (%)	74	55	68	42	60
Only access to low quality food (%)	58	44	48	24	41
Low quality water for food preparation (%)	20	15	20	4	11
Vulnerability to expected poverty	85	70	80	71	82
Headcount Ratio (%) <sup>5</sup>	78	59	70	61	67

**Table 8: The clusters welfare and food security level**

Cluster 1 (female headed) and 3 (Dodoma located) are the poorest and most food insecure clusters, which highly depend on natural resources and are poorly integrated in markets. More than 70% of these households are below the national poverty line. The vulnerability to expected poverty underlines that these households will stay in poverty. Even for the wealthier clusters 2, 4 and 5, more than 48% of the households report that they do not have enough food for at least 1 month in a year.

## Conclusions

The objective of this study was to explore the livelihood strategies of small-scale farmers based on their vertical and horizontal market integration and assess the impact on food insecurity and welfare status in rural Tanzania.

The results show that female headed households face a high level of food shortages and vulnerability to expected poverty. In general the level of food insecurity is higher for households living in Dodoma than in Morogoro. The clusters which are well integrated in the market are wealthier and less food insecure than those which are less integrated. Storage facilities and the length of storage as well as collective activities seem to increase the welfare level and decrease the level of food insecurity. Small-scale farmers' choice of marketing channels is mainly limited to middlemen.

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## Annex

### Important Crops for Income and Consumption

Total	Total	Dodoma	Morogoro
	N (n=899)	N (n=449)	N (450)
Maize	621	195	426
Millet	448	436	1
Groundnuts	332	331	1
Sesame	318	104	214
Sorghum	199	183	16
Sunflower	173	151	22
Bambara nuts	145	145	0
Rice	70	7	63
Cowpeas	68	39	29
Pegion peas	55	3	52
Cassava	18	5	13
Tomatoes	17	10	7
Green gram	15	8	7

Table 9: Frequencies of crops cultivated by the households (cropping section)

Total	Total		Dodoma		Morogoro	
	N	%	N	%	N	%
Maize	219	24.4	6	1.3	213	47.3
Sesame	194	21.6	50	11.1	144	32.0
Groundnuts	150	16.7	150	33.4	0	0.0
Millet	104	11.5	102	22.7	2	0.4
Sunflower	37	4.1	34	7.6	3	0.7
Sorghum	20	2.2	20	4.5	0	0.0
Rice	14	1.6	0	0.0	14	3.1
Pegion peas	10	1.1	0	0.0	10	2.2
Total	899	100	449	100	450	100

Table 10: Crops most relevant for income (upgrading section, variable 45003aa)



Total	Total		Dodoma		Morogoro	
	N	%	N	%	N	%
Maize	427	47.5	25	5.6	402	89.3
Millet	289	32.1	287	63.9	0	0.0
Sorghum	69	7.7	67	14.9	2	0.4
Groundnuts	13	1.4	13	2.9	0	0.0
Sesame	12	1.3	4	0.9	8	1.8
Rice	11	1.2	2	0.4	9	2.0
Bambara nuts	10	1.1	10	2.2	0	0.0
Total	899	100	449	100	450	100

Table 11: Crops most relevant for consumption (upgrading section, variable 45003ba)

Total	Total		Dodoma		Morogoro	
	N	%	N	%	N	%
Chicken	232	64,4	78	43,8	154	84,6
Goats	45	12,5	36	20,2	9	4,9
Pigs	40	11,1	36	20,2	4	2,2
Cattle	33	9,2	28	15,7	5	2,7
Ducks	10	2,8	0	0,0	10	5,5
Total	899	100	449	100	450	100

Table 12: Most relevant Livestock (upgrading section, variable 45005-9)

Total	Number [n]	Percentages [%]
Will not test	25	2.8
Test after some time	231	25.7
First to test	642	71.4
Do not know	1	0.1
Total	899	100

Dodoma	Number [n]	Percentages [%]	Morogoro	Number [n]	Percentages [%]
Will not test	14	3.1	Will not test	11	2.4
Test after some time	118	26.3	Test after some time	113	25.1
First to test	317	70.6	First to test	325	72.3
Do not know	0	0	Do not know	1	0.2
Total	449	100	Total	450	100

Table 13: Willingness to participate in new production technologies



## Farmers' Perceived Problems along the Value Chain for Maize

Problems	Total	Dodoma	Morogoro
	N	N	N
insufficient rainfall	300	78	222
No problems	109	13	96
crop pests and diseases	49	17	32
declining fertility	24	10	14
availability of inputs	13	1	12
no access to inputs	13	2	11
lack of agricultural credit	9	1	8
heavy rainfall	8	1	7
increasing costs of inputs	8	0	8
increasing cost of inputs	6	1	5
Other	13	2	11
Total	553	126	426

Table 14: Problems during maize production (maize)

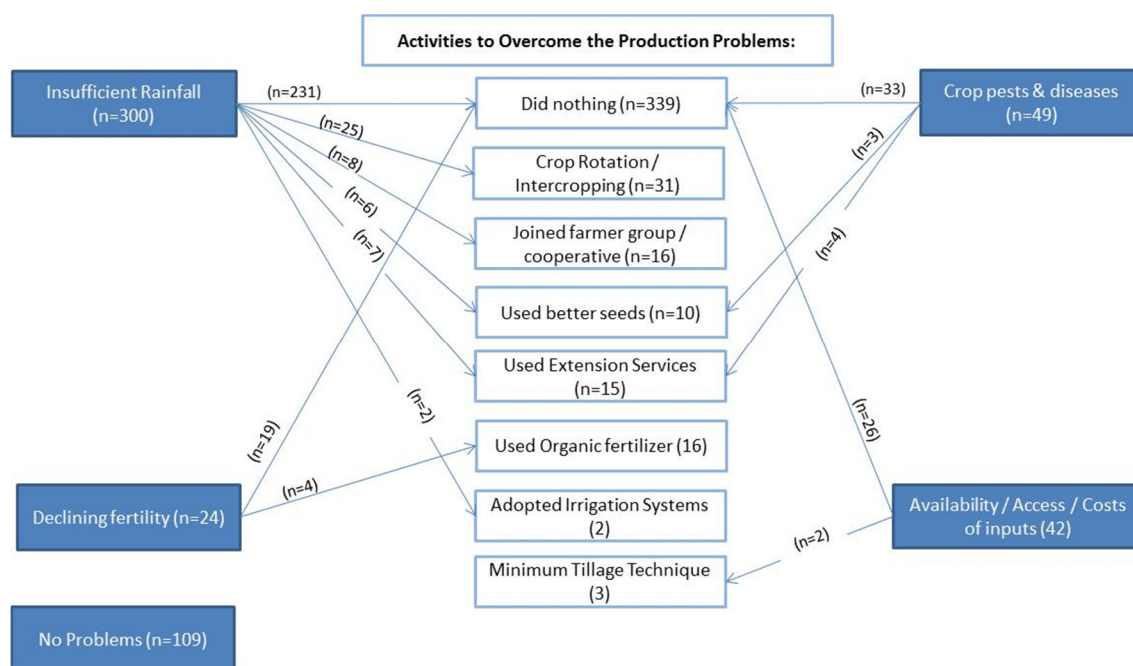
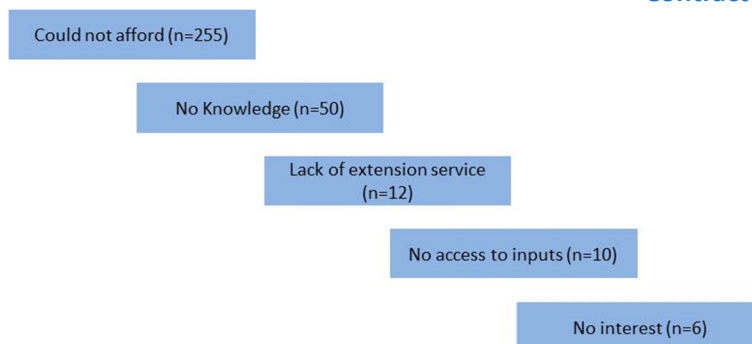


Figure 7: Activities to overcome problems in production (maize)



**Figure 8: Reasons for inactivity to overcome production problems (maize)**

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	218	23	182
Increase production area	64	12	52
to join farmer groups/ cooperatives	47	16	31
to use extension services	39	9	30
use better seeds	32	16	16
use more organic fertilizer	27	21	6
take part in agricultural training	25	8	17
to invest in irrigation system	19	2	17
search credit in formal institutions	13	0	13
to adopt intercropping	13	3	10
to adopt crop rotation	6	2	4
search credit in informal sources	5	0	5
Total	553	126	427

**Table 15: Investment plans in the next 5 years in production (maize)**

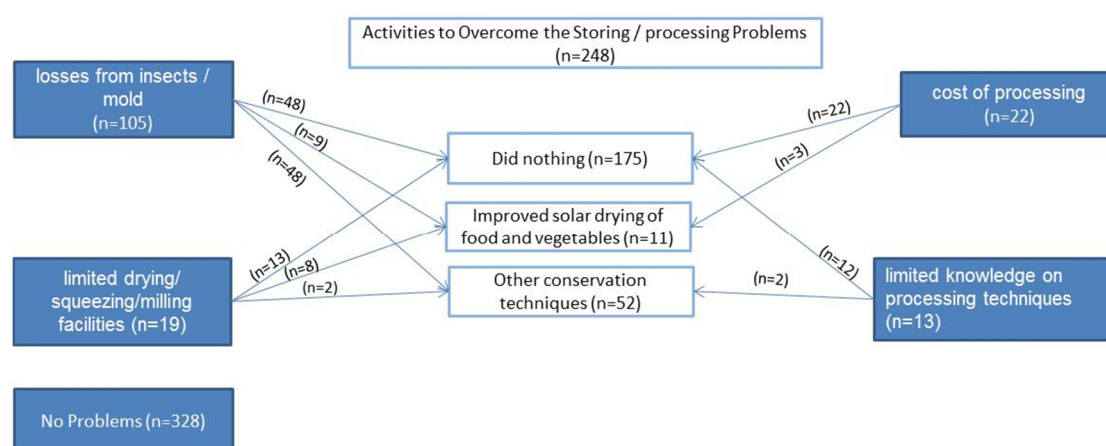
Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford inputs	169	17	152
No interests to change anything	42	5	37
Cannot afford new breeds	7	5	2
Total	218	27	191

**Table 16: Reasons for not investing in agricultural production (maize)**

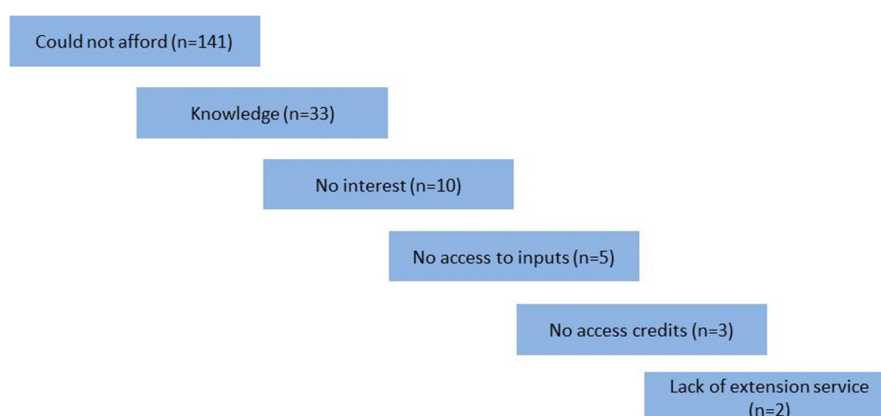


Problems	Total	Dodoma	Morogoro
	N	N	N
no problems	328	59	269
losses from insects / mold	105	37	64
cost of processing (e.g. rice milling)	22	2	20
limited drying/ squeezing/milling facilities	19	4	15
limited knowledge on processing techniques	13	1	12
limited storage facilities	8	2	6
Total	512	113	399

**Table 17: Problems during storing (maize)**



**Figure 9: Activities to overcome problems during storing (maize)**



**Figure 10: Reasons for inactivity to overcome storage problems (maize)**



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Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	328	46	282
Learn new conservation techniques	82	36	46
To improve solar drying	25	7	18
Buy processing equipments	9	2	7
Use government storage systems	4	3	1
Build crop storage room	1	1	0
Certification	1	1	0
Total	450	96	354

**Table 18: Investment plans in the next 5 years in storing (maize)**

Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford equipments	250	43	207
No interests to change anything	57	3	54
do not own land	1	0	1
no alternatives	1	0	1
too old	1	0	1
Missing	18	4	14
Total	310	46	264

**Table 19: Reasons for not investing in storing (maize)**

Problems	Total	Dodoma	Morogoro
	N	N	N
no problems	319	57	262
Low prices	104	31	73
Less buyers	33	8	25
Cheating (weight, money)	25	7	18
not trustworthy	3	2	1
Many buyers	2	0	2
buyers set price instead of producers	1	0	1
Missing	66	21	45
Total	512	113	399

**Table 20: Problems in marketing (maize)**



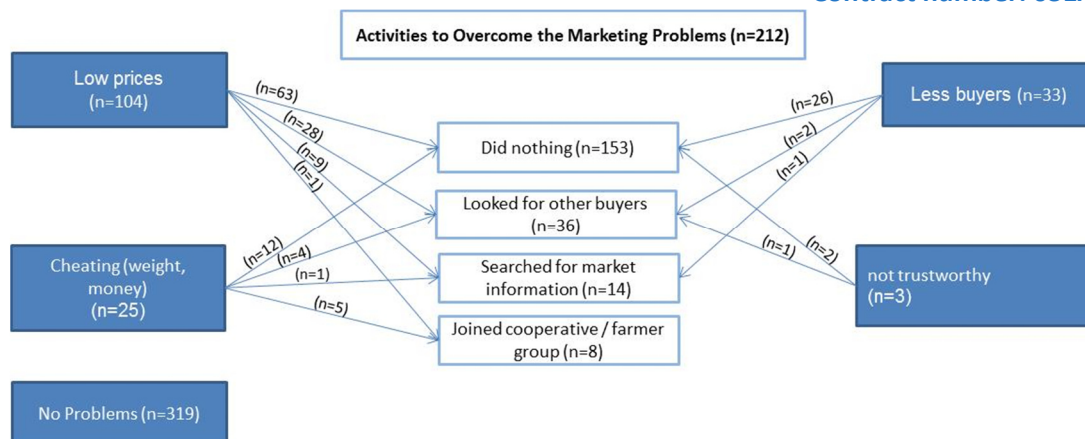


Figure 11: Activities to overcome marketing problems (maize)

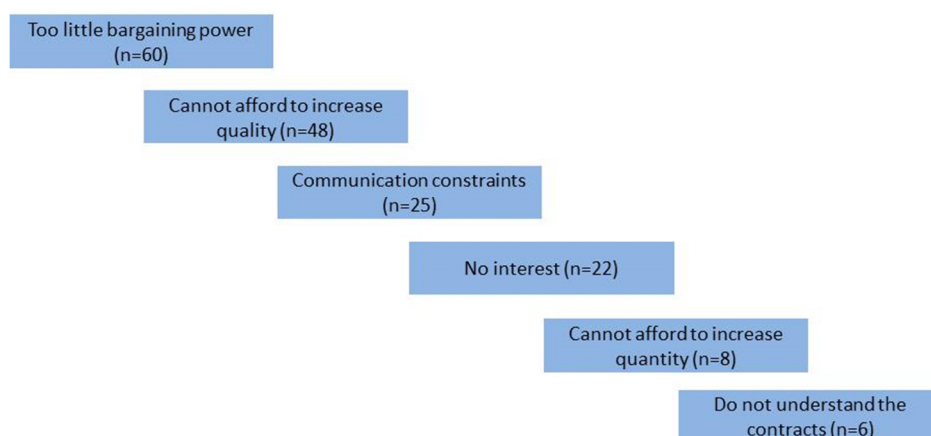


Figure 12: Reasons for inactivity to overcome marketing problems (maize)

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	292	32	260
To search for market information	43	16	27
To look for more buyers	27	17	10
To join a cooperative/farmer group	16	10	6
Sell ist directly to the consumer by myself	2	1	1
Other	2	2	0
Total	382	78	304

Table 21: Plans to change buyer (maize)



## Farmers' Perceived Problems along the Value Chain for Millet

Problems	Total	Dodoma	Morogoro
	N	N	N
Insufficient rainfall	260	257	3
Crop pests and diseases	51	50	1
No problems	42	40	2
declining fertility	22	22	0
Availability of inputs	8	8	0
No access to inputs	6	5	1
Heavy rainfall	5	5	0
Increasing cost of inputs	4	4	0
Lack of agricultural credit	3	3	0
Lack of education to use inputs	3	3	0
Livestock diseases	1	1	0
Total	407	400	7

Table 22: Problems during millet production

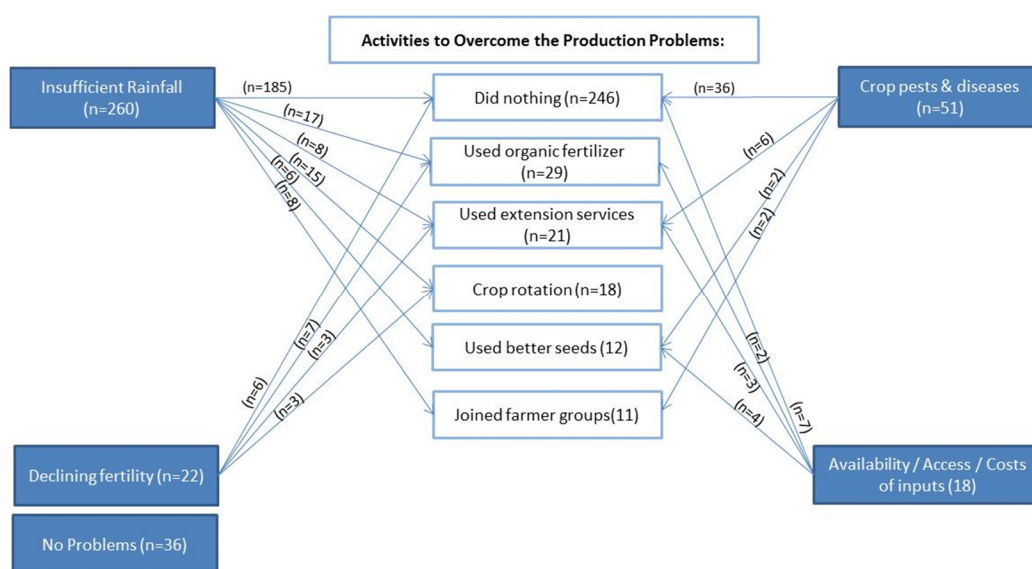


Figure 13: Activities to overcome problems in production (millet)

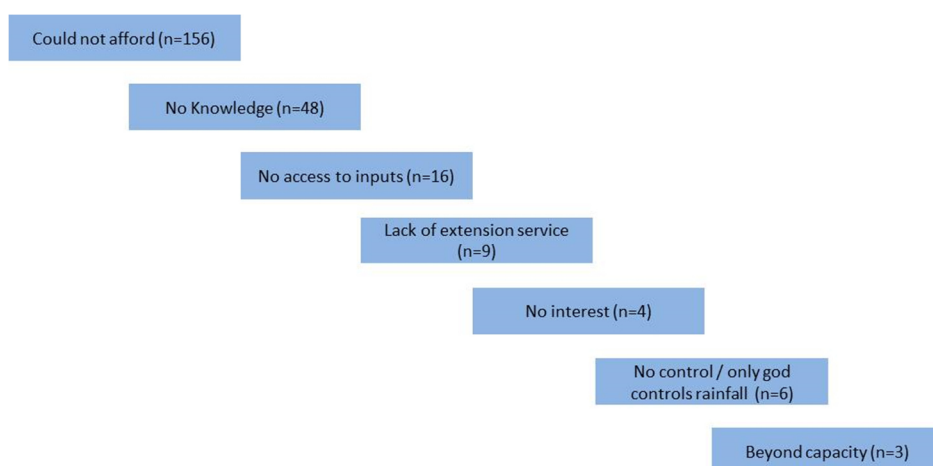


Figure 14: Reasons for inactivity to overcome production problems (millet)



Problems	Total	Dodoma	Morogoro
	N	N	N
use more organic fertilizer	71	71	0
use better seeds	63	62	1
No plans	46	45	1
Increase production area	42	39	3
To use extension services	31	31	0
to join farmer groups/ cooperatives	37	37	0
Take part in agricultural training	33	33	0
To adopt crop rotation	6	6	0
To adopt intercropping	6	6	0
To invest in irrigation system	9	9	0
use cover crops	4	4	0
use soil erosion control	3	3	0
Total	411	404	7

**Table 23: Investment plans in the next 5 years in production (millet)**

Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford inputs	47	46	1
No interests to change anything	7	7	0
Age effect	1	0	0
Total	63	62	1

**Table 24: Reasons for not investing in agricultural production (millet)**

Problems	Total	Dodoma	Morogoro
	N	N	N
no problems	225	220	5
losses from insects/ mold	109	109	0
limited knowledge on processing techniques	14	13	1
limited storage facilities	14	14	0
limited drying/ squeezing/milling facilities	11	11	0
cost of processing (e.g. rice milling)	4	4	0
Total	411	404	7

**Table 25: Problems during storing (millet)**



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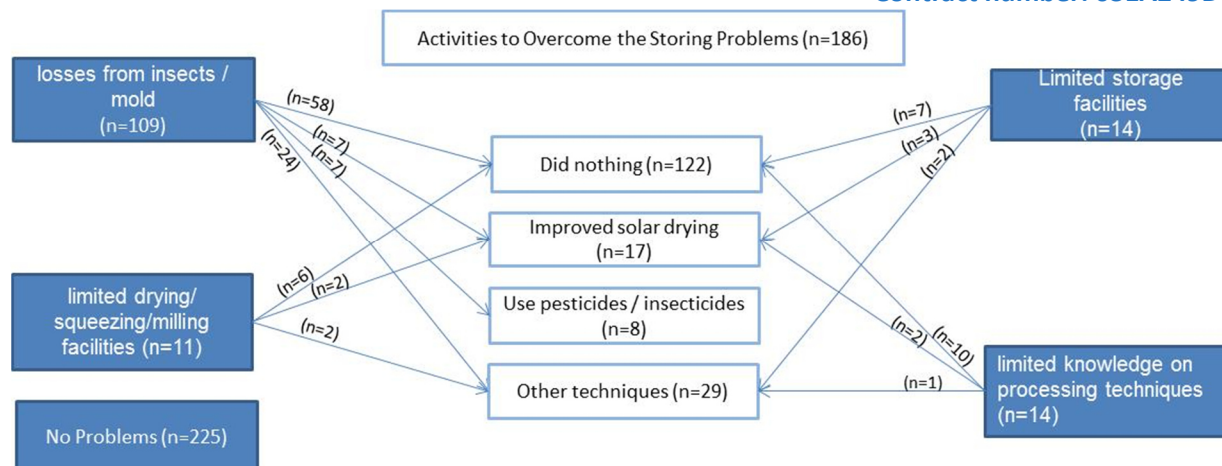


Figure 15: Activities to overcome problems during storing (millet)

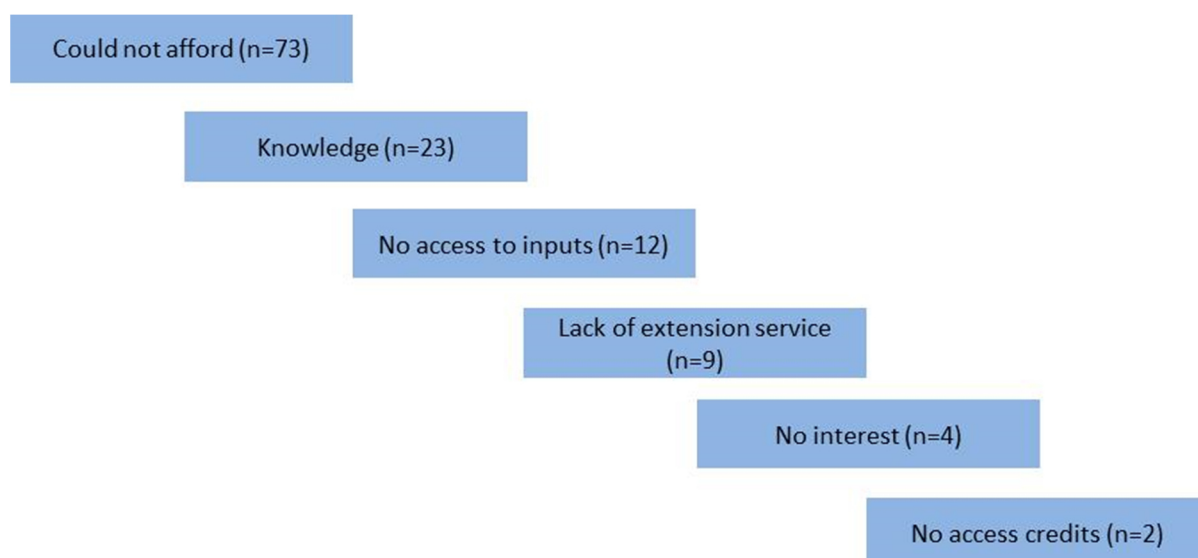


Figure 16: Reasons for inactivity to overcome storing problems (millet)

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	151	148	3
Learn new conservation techniques	104	104	0
To improve solar drying	22	22	0
Buy processing equipments	14	14	0
Use government storage systems	6	6	0
Build crop storage room	1	1	0
help from extension officer	1	1	0
Store in traditional cribs	1	1	0
Total	411	404	7

Table 26: Investment plans in the next 5 years in storing (millet)

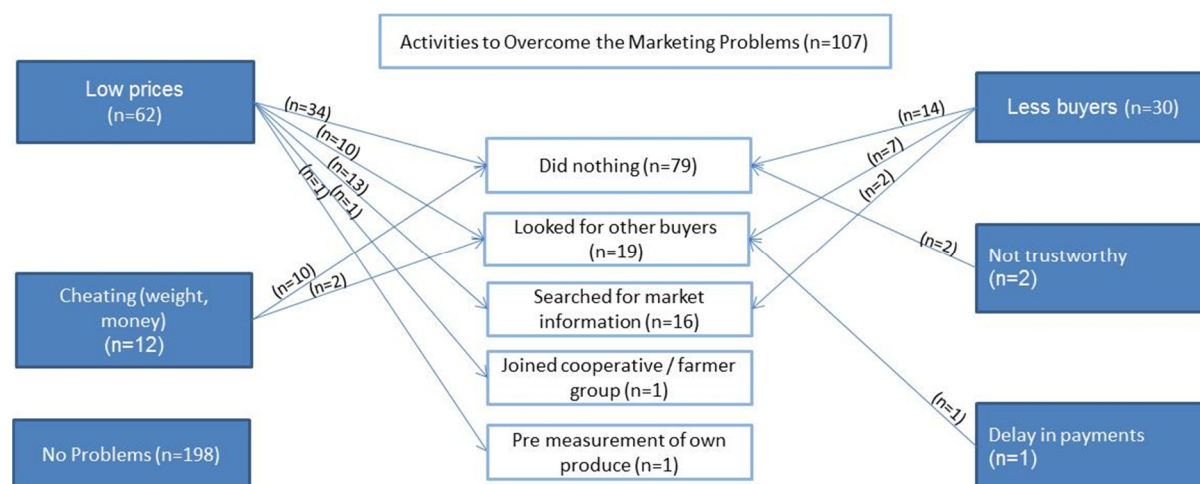


Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford equipments	264	260	4
No interests to change anything	26	26	0
No knowledge of other storage techniques	1	1	0
Total	151	148	3

**Table 27: Reasons for not investing in storing (millet)**

Problems	Total	Dodoma	Morogoro
	N	N	N
no problems	198	197	1
Low prices	62	61	1
Less buyers	30	28	2
Cheating (weight, money)	12	12	0
not trustworthy	2	2	0
Delay in payments	1	1	0
Total	308	304	4

**Table 28: Problems in marketing (millet)**



**Figure 17: Activities to overcome marketing problems (millet)**

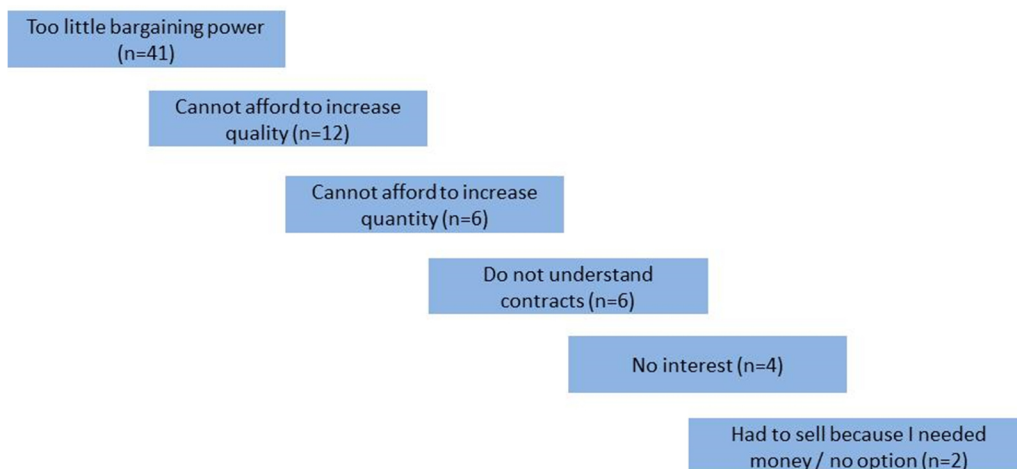


Figure 18: Reasons for inactivity to overcome marketing problems (millet)

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	99	97	2
To search for market information	42	41	1
To look for more buyers	41	41	0
To join a cooperative/farmer group	16	16	0
To increased quantity	8	8	0
To look for more buyers	6	6	0
Sell ist directly to the consumer by myself	3	3	0
To improve quality	3	3	0
Total	411	404	7

Table 29: Plans to change the buyer (millet)

Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford to increase quality	31	30	1
No interest	19	19	0
to little bargaining power	8	7	1
Cannot afford to increase quantity	7	7	0
Don't understand the contracts	4	4	0
Communication constraints	2	1	1
i am now old i can not invest any more in agriculture	1	1	0
Total	75	72	3

Table 30: Reasons for not changing the buyer (millet)



## Farmers' Perceived Problems along the Value Chain for Sunflower

Problems	Total	Dodoma	Morogoro
	N	N	N
insufficient rainfall	78	71	7
No problems	15	12	3
crop pests and diseases	14	10	4
availability of inputs	7	7	0
declining fertility	7	7	0
increasing cost of inputs	7	7	0
increasing costs of inputs	2	1	1
insufficient grazing areas	2	2	0
no access to inputs	2	2	0
heavy rainfall	1	1	0
Other	5	4	1
Total	140	124	16

Table 31: Problems during production (sunflower)

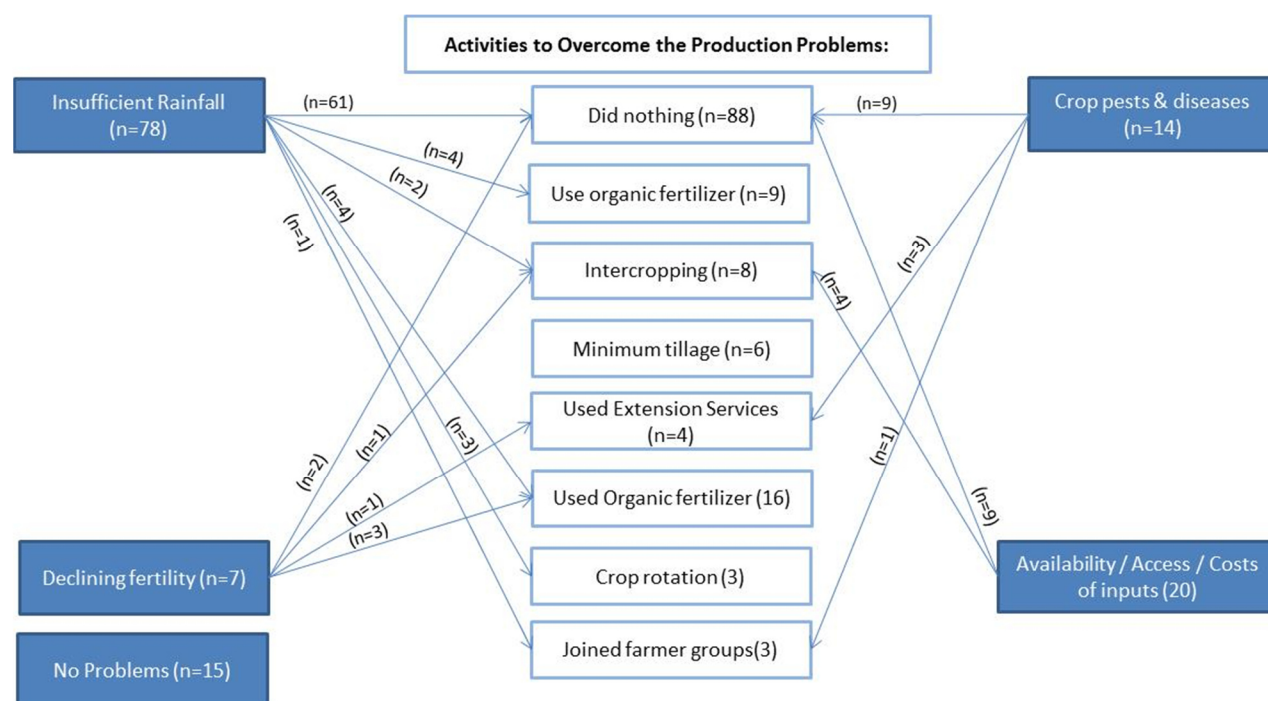


Figure 19: Activities to overcome problems in production (sunflower)





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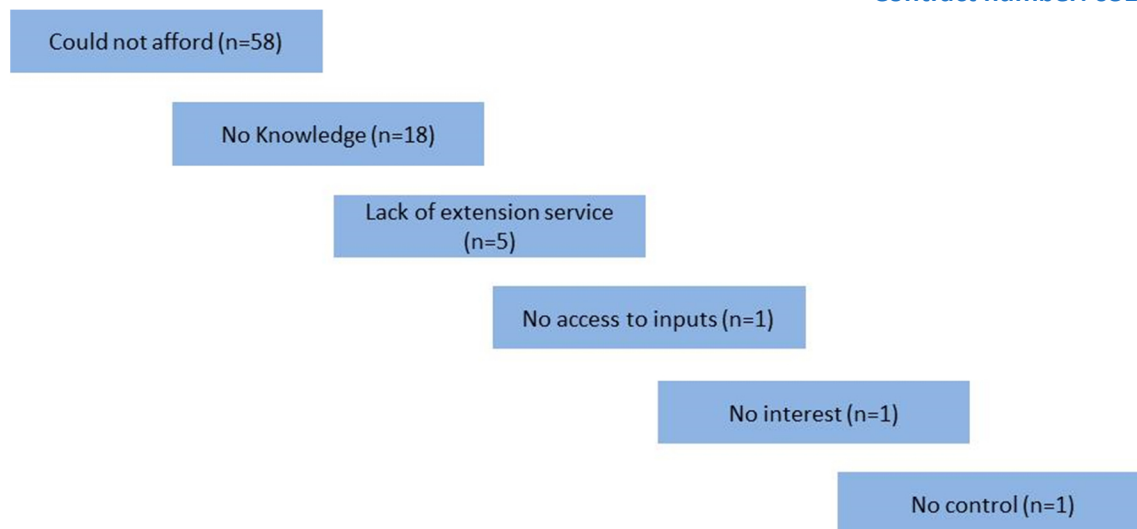


Figure 20: Reasons for inactivity to overcome production problems (sunflower)

Problems	Total	Dodoma	Morogoro
	N	N	N
Increase production area	21	16	5
No plans	19	12	7
use better seeds	19	19	0
use more organic fertilizer	16	16	0
To use extension services	9	8	1
to join farmer groups/ cooperatives	8	7	1
Use better seeds	8	8	0
Take part in agricultural training	6	6	0
To adopt intercropping	4	4	0
to adopt minimum tillage techniques	4	4	0
To adopt irrigation system	3	3	0
to join farmer groups/ cooperatives	3	3	0
Total	140	124	16

Table 32: Investment plans in the next 5 years in production (sunflower)

Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford inputs	17	12	5
No interests to change anything	3	3	0
Cannot afford new breeds	4	3	1
Total	140	124	16

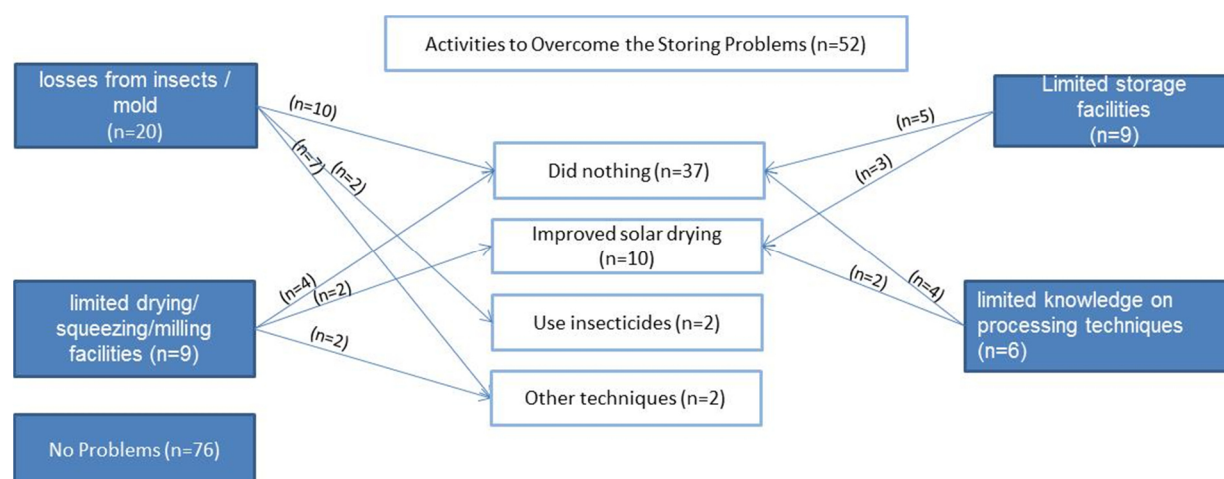
Table 33: Reasons for not investing in agricultural production (sunflower)



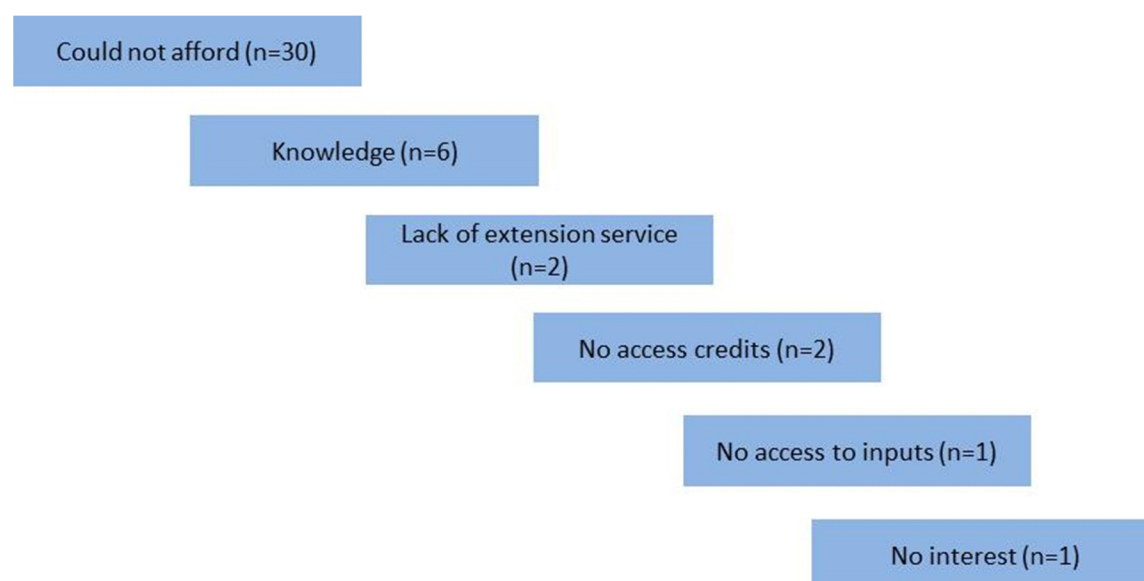


Problems	Total	Dodoma	Morogoro
	N	N	N
no problems	76	62	14
losses from insects / mold	20	20	0
Limited storage facilities	9	8	1
Limited knowledge on processing techniques	9	8	1
Limited drying/ squeezing/milling facilities	19	4	0
Costs of processing	8	2	0
Total	140	124	16

**Table 34: Problems during storing (sunflower)**



**Figure 21: Activities to overcome storing problems (sunflower)**



**Figure 22: Reasons for inactivity to overcome storing problems (sunflower)**



Contract number: 031A249D

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	50	37	13
Learn new conservation techniques	35	34	1
Buy processing equipments	15	15	0
To improve solar drying	7	7	0
Use of plastic drums	1	1	0
Build crop storage room	1	1	0
Total	140	124	16

**Table 35: Investment plans in the next 5 years in storing (sunflower)**

Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford equipments	45	26	9
No interests to change anything	8	4	4
No knowledge of other storage techniques	1	1	0
Total	140	124	16

**Table 36: reasons for not investing in storing (sunflower)**

Problems	Total	Dodoma	Morogoro
	N	N	N
No problems	55	42	13
Low prices	40	39	1
Less buyers	13	12	1
Cheating (weight, money)	8	7	1
Rejection of product	1	1	0
Not trustworthy	1	1	0
Total	512	113	399

**Table 37: Problems in marketing (sunflower)**



**Figure 23: Activities to overcome marketing problems (sunflower)**

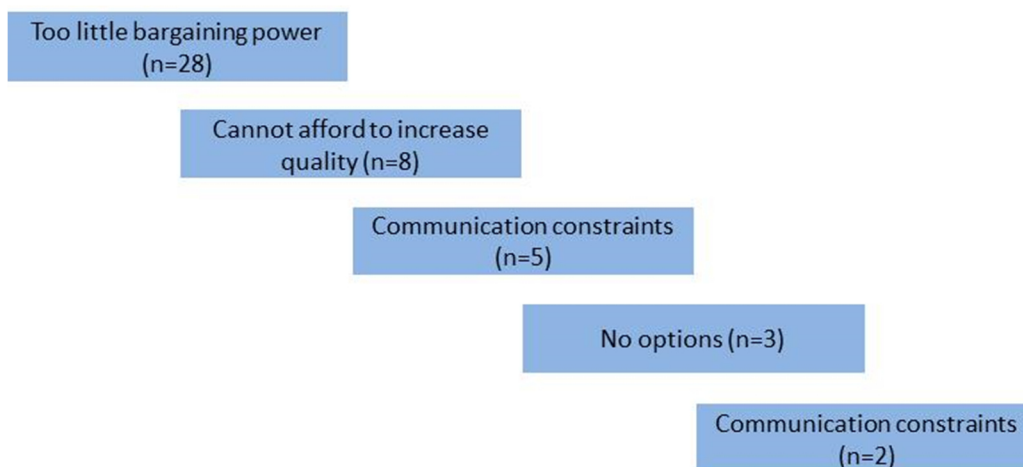


Figure 24: Reasons for inactivity to overcome marketing problems (sunflower)

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	45	35	10
To search for market information	17	16	1
To join a cooperative/farmer group	15	15	0
To look for more buyers	14	14	0
To look for more buyers	3	3	0
To increased quantity	1	1	0
To improve quality	1	1	0
Total	382	78	304

Table 38: Plans to change the buyer (sunflower)

Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford to increase quality	14	11	3
No interest	13	7	6
to little bargaining power	5	5	0
Don't understand the contracts	3	3	0
Communication constraints	2	1	1
Rain is still uncertain so we can't plan for future	1	1	0
Cannot afford to increase quantity	2	1	1
Total	252	126	427

Table 39: Reasons for inactivity to change the buyer (sunflower)



## Farmers' Perceived Problems along the Value Chain for Sesame

Problems	Total	Dodoma	Morogoro
	N	N	N
insufficient rainfall	130	66	64
crop pests and diseases	105	27	78
No problems	36	7	29
no access to inputs	13	3	10
increasing cost of inputs	8	2	6
declining fertility	8	4	4
availability of inputs	6	3	3
lack of agricultural credit	3	1	2
heavy rainfall	3	0	3
insufficient grazing areas	2	1	1
livestock diseases	1	0	1
Total	315	114	201

Table 40: Problems during production (sesame)

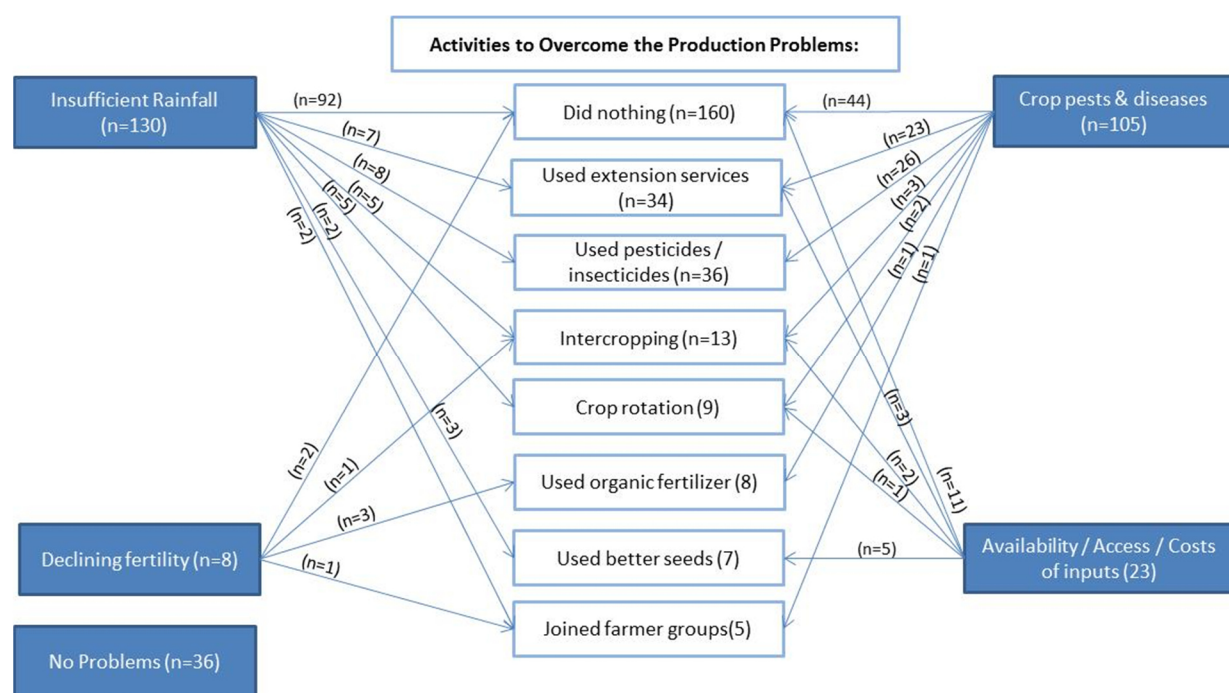


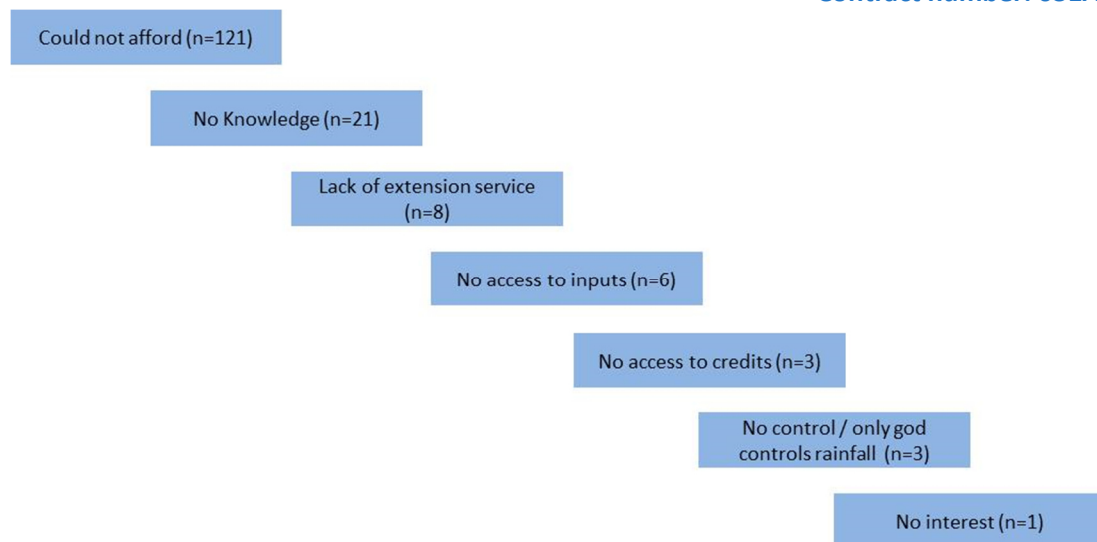
Figure 25: Activities to overcome problems in production (sesame)



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**Figure 26: Reasons for inactivity to overcome problems in production (sesame)**

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	99	15	84
To use extension services	39	14	25
Increase production area	36	15	21
Use better seeds	34	18	16
To join farmer groups/ cooperatives	19	7	12
use more organic fertilizer	14	12	2
Take part in agricultural training	10	5	5
To adopt intercropping	8	4	4
Search credit in informal sources	5	3	2
To adopt crop rotation	5	3	2
Use better seeds	5	4	1
To invest in irrigation system	3	1	2
Total	315	114	201

**Table 41: Investment plans in the next 5 years in production (sesame)**

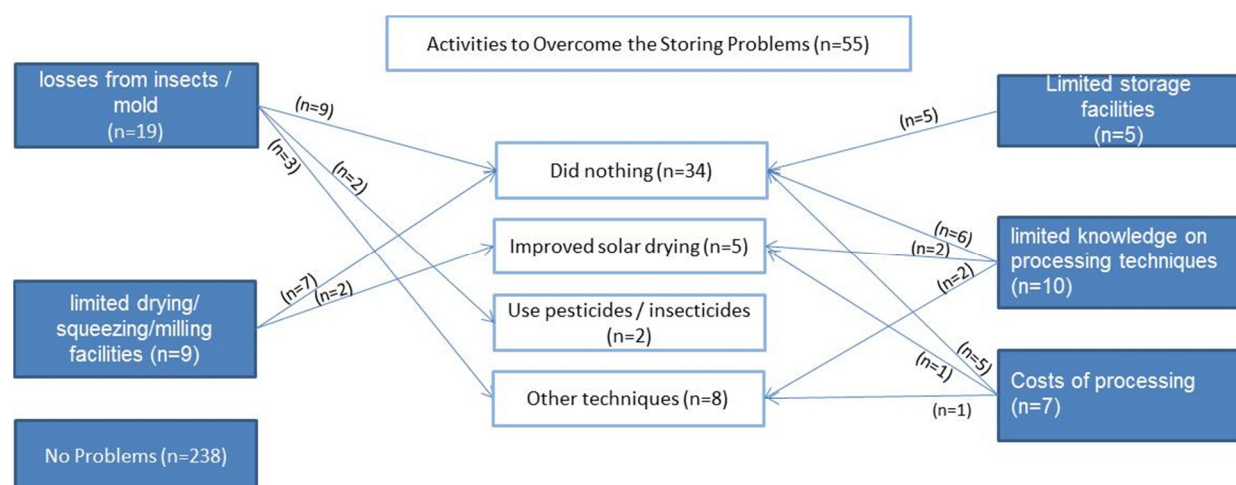
Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford inputs	90	14	76
No interests to change anything	13	3	10
Cannot afford new breeds	4	4	0
Total	315	114	201

**Table 42: Reasons for not investing in agricultural production (sesame)**

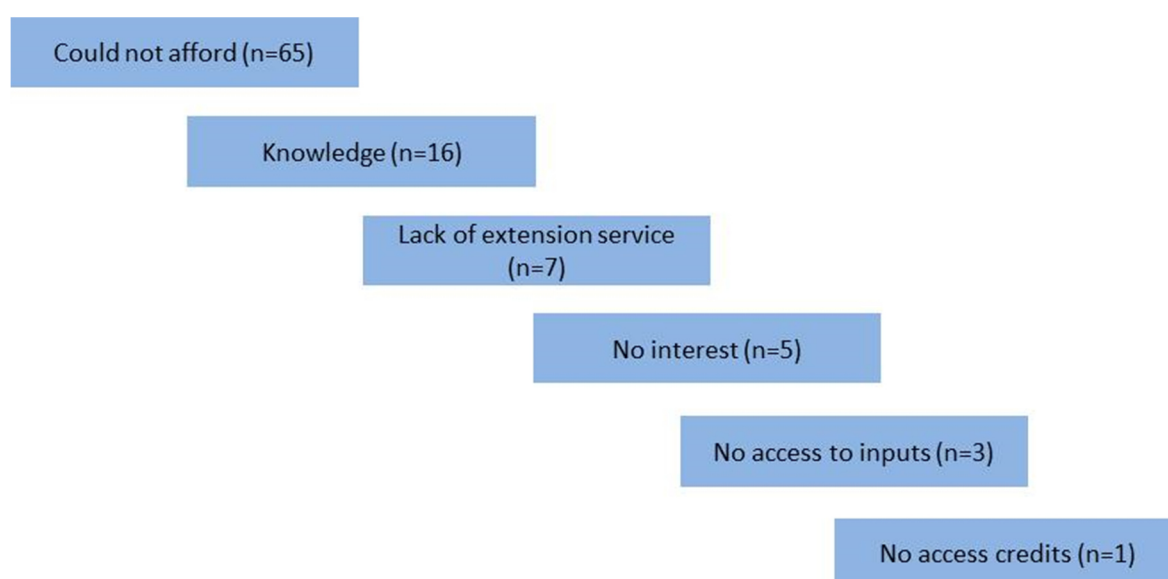


Problems	Total	Dodoma	Morogoro
	N	N	N
no problems	238	71	167
losses from insects/ mold	19	15	4
limited knowledge on processing techniques	10	5	5
limited drying/ squeezing/milling facilities	9	3	6
cost of processing (e.g. rice milling)	7	5	2
limited storage facilities	5	2	3
Total	315	114	201

**Table 43: Problems during storing (sesame)**



**Figure 27: Activities to overcome problems during storage problems (sesame)**



**Figure 28: Reasons for inactivity to overcome storage problems (sesame)**





Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	185	41	144
Learn new conservation techniques	41	30	11
Buy processing equipments	11	7	4
To improve solar drying	7	4	3
Use government storage systems	2	1	1
Build crop storage room	1	1	0
find market with reasonable price	1	1	0
harvesting and threshing should be done on time	2	0	2
Total	179	46	133

**Table 44: Investment plans in the next 5 years in storing (sesame)**

Problems	Total	Dodoma	Morogoro
	N	N	N
Cannot afford equipments	138	41	97
No alternatives	1	0	1
No interests to change anything	39	4	35
No knowledge of other storage techniques	1	1	0
Total	179	46	133

**Table 45: Reasons for not investing in storing (sesame)**

Problems	Total	Dodoma	Morogoro
	N	N	N
no problems	168	38	130
Low prices	73	39	34
Less buyers	22	13	9
Cheating (weight, money)	17	6	11
Many buyers	3	0	3
Rejection of product	3	3	0
Total	288	100	188

**Table 46: Problems in marketing (sunflower)**



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Figure 29: Activities to overcome marketing problems (sesame)

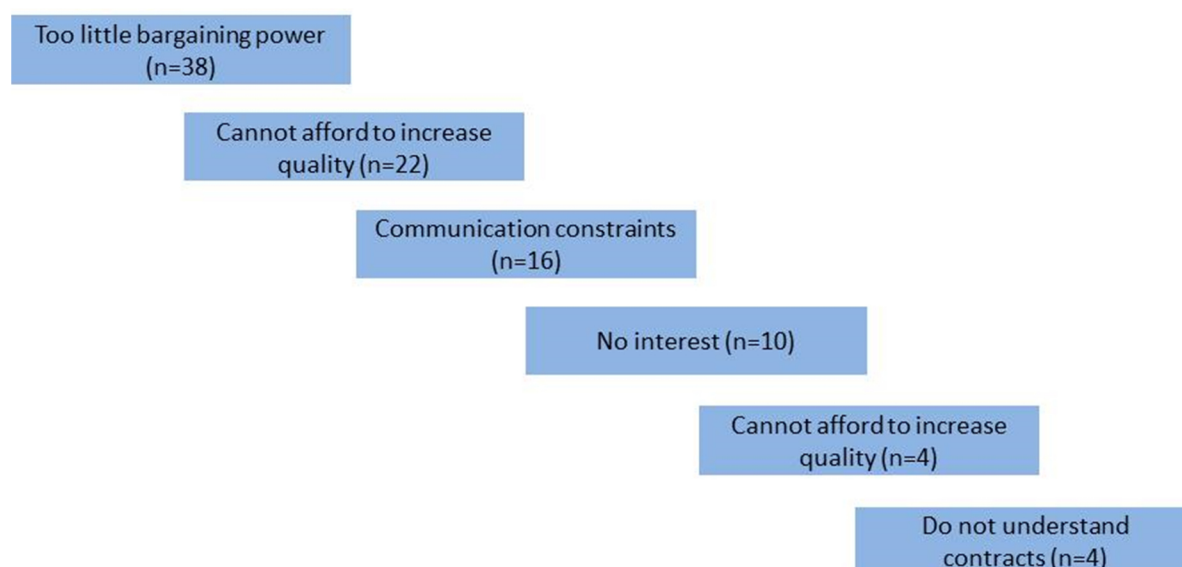


Figure 30: Reasons for inactivity to overcome marketing problems (sesame)

Problems	Total	Dodoma	Morogoro
	N	N	N
No plans	152	32	120
To search for market information	35	20	15
To look for more buyers	24	19	5
To join a cooperative/farmer group	10	8	2
To improve quality	3	3	0
Sell ist directly to the consumer by myself	1	0	1
Total	317	116	201

Table 47: Plans to change the buyer (sesame)



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Problems	Total	Dodoma	Morogoro
	N	N	N
No interest	51	6	45
Cannot afford to increase quality	48	9	39
Communication constraints	15	0	15
to little bargaining power	11	5	6
Cannot afford to increase quantity	4	1	3
Cannot afford cost	1	0	1
Don't understand the contracts	1	1	0
Total	152	32	120

**Table 48: Reasons for not changing the buyer (sesame)**