Survey report Kitui, Kenya

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IVM Institute for Environmental Studies

SURVEY REPORT KITUI

Results of a questionnaire regarding subsistence farmers' drought risk and adaptation behaviour

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VERSIE: 1

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VERSPREIDING

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VERSIENUMMER	DATUM	AUTEUR	OPMERKING

1. INTRODUCTION

This survey was set up in the framework of the PhD research of Marthe Wens, aiming to simulate the role of adaptation behaviour in agricultural drought risk models. The research disentangles the role of human adaptation decisions on the evolution of drought risk through time. Therefore, the crop water production model AQUACROP is linked with behavioural models. Various adaptive behaviour scenarios will be simulated using a dynamic and heterogeneous agent-based decision model. As such, the effect of assumptions about this adaptive behaviour can be investigated.
As part of the evaluation of the adoption behaviour of smallholder households in semi-arid rural areas in Eastern Africa, her thesis depicts a case study in Kenya within the Kitui district about 150 km's east of Nairobi, where the different agricultural and water management measures to mitigate and cope with drought among mixed small scale mixed crop-livestock farmers will be investigated. The main objective of the mission to Kenya was to pilot and execute an in-depth questionnaire among 250 smallholder farmers in Kitui Central: Kisasi district , Ituki, Kisavi, Kwa kethi, Mulili, Kwakya tene areas. Therefore, three steps were taken:

Using KOBO-Toolbox an online free survey application which enables the collection of survey answers, a questionnaire was established that consisted of 85 questions in the following categories: Drought experiences, adaptation measures, drivers and challenges for adoption, current water sources and household characteristics. A disclaimer at the start of the survey was added: *This survey is done in collaboration with SEKU and SASOL for the VU University of Amsterdam in the Netherlands, purely in the interest of learning about how residents of this area deal with droughts. We have no affiliation with decision-makers, politicians or companies and we will treat your data confidentially and anonymously. The results from this survey will allow researchers to advise policy makers on how to effectively combat the impacts of droughts. With droughts we mean prolonged periods of rain deficiency and/or streamflow deficiency that might affect peoples' water supply. Your participation in this survey is voluntary. This means that you may refuse to take part in this interview or stop the interview at any moment without any consequences. Thank you in advance for your time and: Feel free.*

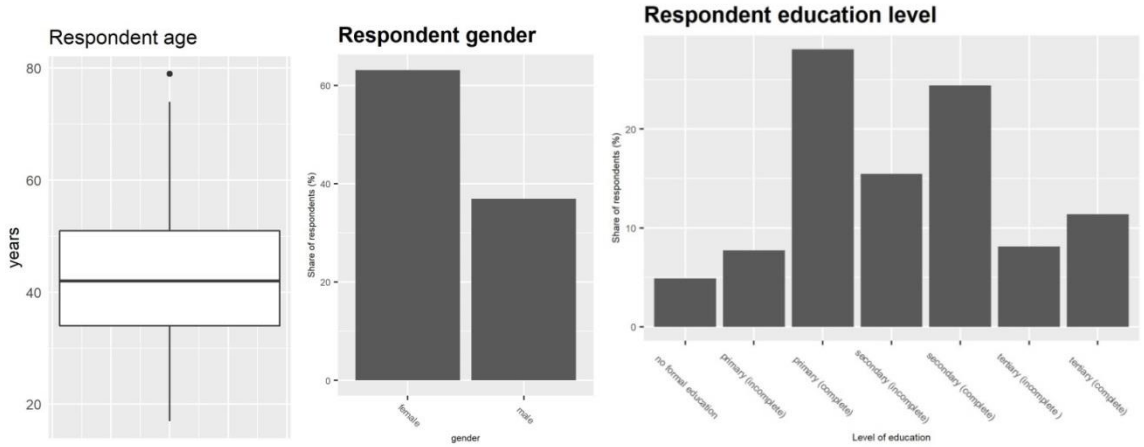
With the help of Dr. Moses Mwangi from SEKU University, multiple surveyors (research assistants) were contacted to discuss the TOR for surveying one month (August 2019). Emmanuel, Nicholas and Stella worked with SEKU before on data collection and proved to be reliable surveyors. A full day of discussing all survey questions – explaining the reasoning behind the question and adjusting questions to the local context where necessary while ensuring similar translation to Kikamba and phrasing among the surveyors preceded the start of data collection

After three days of piloting (30 completed surveys), a new meeting among the surveyors was organised, so as to improve the questionnaire based on their experiences. A few questions were added, removed or changed in order to guarantee clarity and usefulness while avoiding sensitive topics. An updated survey was added to KOBOToolbox, which marked the start of one month of surveying. The surveyors were asked to target farm households (mixed crop livestock) outside the town centres, and adopt a snowball sample technique, which proved to be the most efficient way of finding suitable respondents while not having to travel too far. Every day, the surveyors – which each had a certain area assigned: around Kitui town, around Nthwani town and around Mutitu town – started on another location in Kitui central.

2. RESULTS

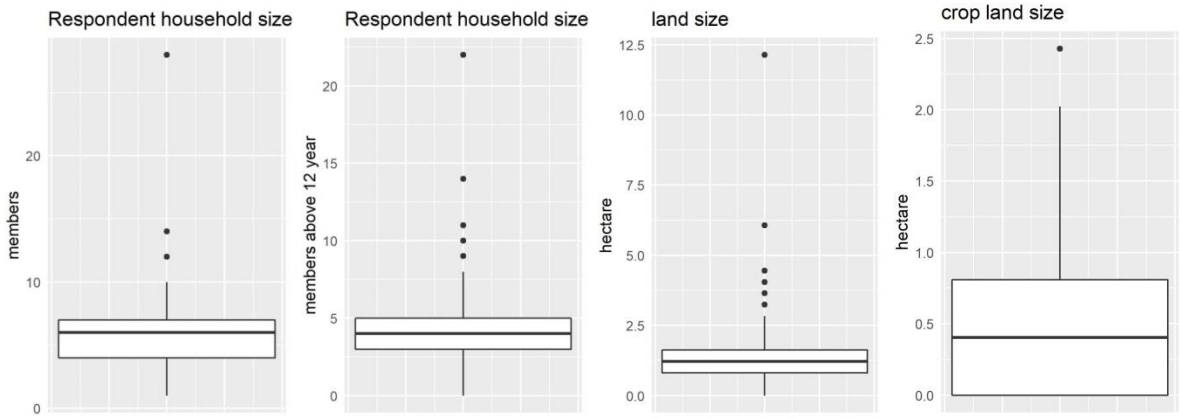
2.1. RESPONDENT CHARACTERISTICS

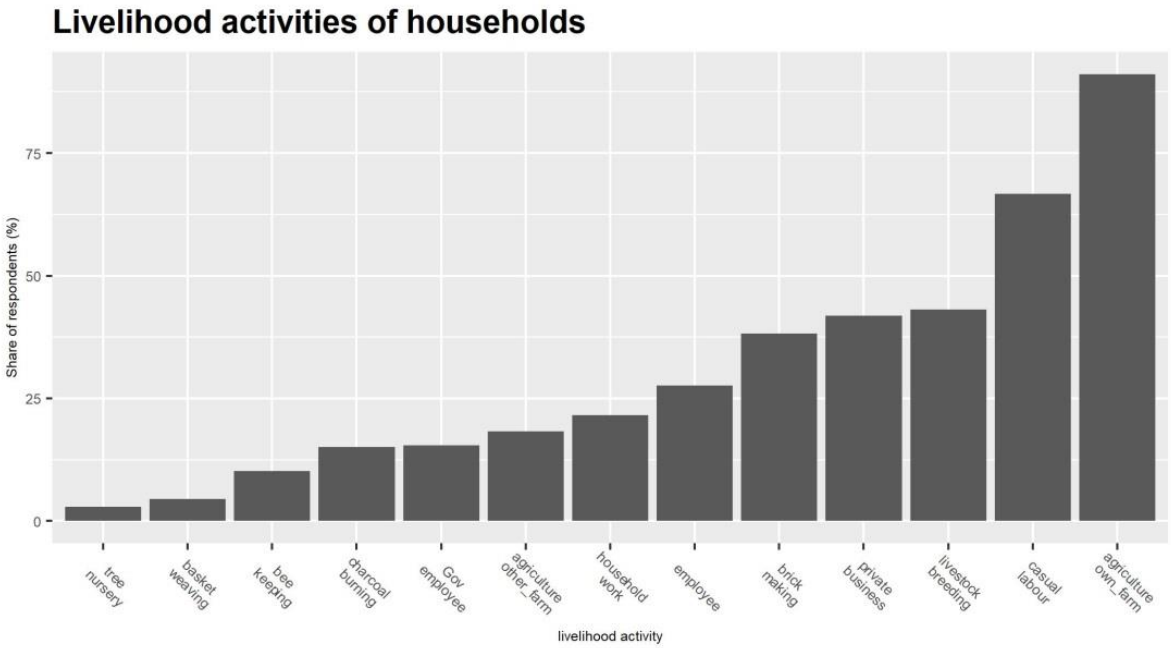
260 respondents were reached. The average age of the respondents is 42 years, while the majority is female. This large share of female respondents is a result of the sampling technique whereby not the household head but one of the senior household members with available time, was asked to participate in the (long, not compensated) survey. The majority of the respondents has had secondary education or more, only 5 percent did not receive any eduction. According to the surveyors, the majority of the respondents were taking the survey serious and gave the best information they could (but often replied they didn't know the answer). Ofcourse, there were respondents (especially the rich) who thought it was a waste of time and that made the interview session a bit difficult. Those who hadn't installed the adaptation mesasures in their farms would struggle to estimate the cost of each measure. On the other hand, very enthousiastic respondets had a lot of information to offer but also many own questions to ask. The average time of the interview was about one hour up to two hoursm depending on the concentration of the respondent and willingness of the interviewee to answer questions.



2.2. HOUSEHOLD CHARACTERISTICS

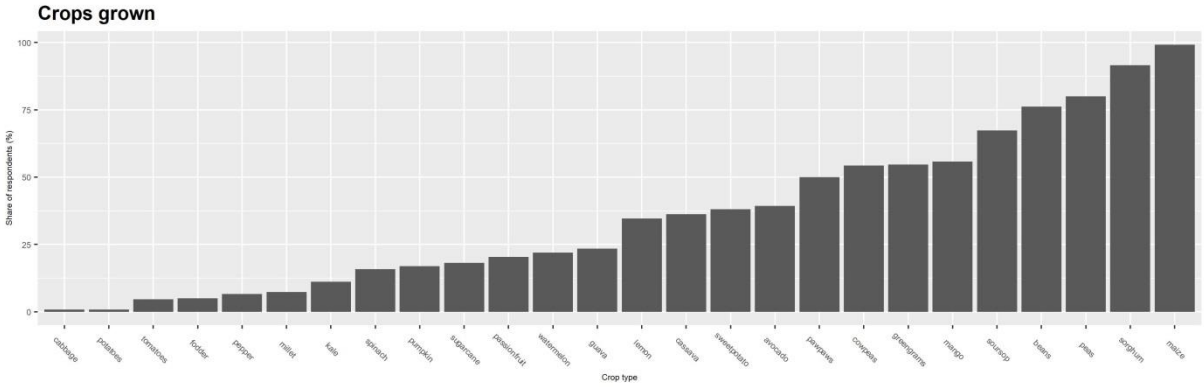
Of the 260 farm households reached, the average household size is 5.9 (+-2.6) with on average 4.3 (+-2.4) members above 12 years old. The average land size owned by these households is 1.25 (+-1.23) hectare, while the average acreage (land used for crop production) is 0.46 (+-0.41) hectare. Indeed, a significant share of the responents does not own agricultural land – rather rends or lends it. Not all respondetns were able to give a reliable numbers of their land size (woman who were not household head), in which cases the translator helped them estimating it). 97% of the surveyed households listed agricultural production on own farm as (one of) the household's livelihood activities, 19% listed agricultural production on another farm. 46% of the respondents take part in mixed crop-livestock farming, 43% has a family member who owns a private business and 40% sometimes sells charcoal to ensure income. While 71% somethimes engages in 46% of the households has a member that is permanent (Government) employee hence has a more fixed source of income. Other livelihood activities were Pastor and traditional brew making

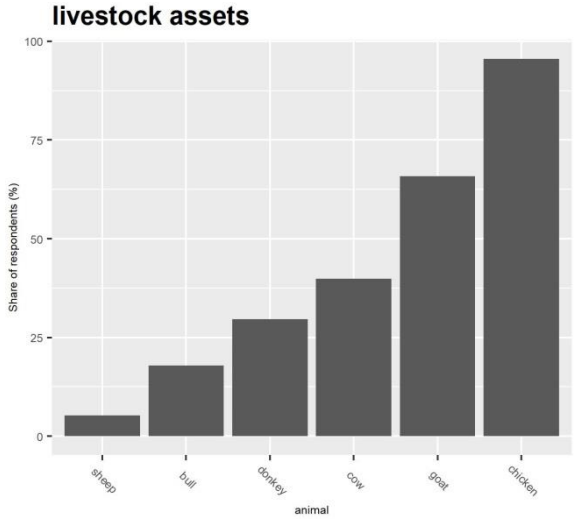


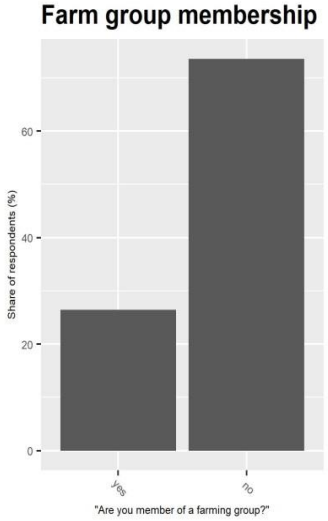


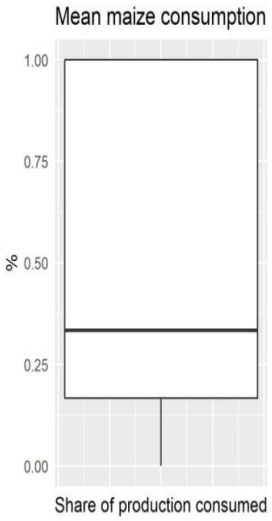
2.3. AGRICULTURAL CHARACTERISTICS

All but one of the farm households surveyed, produced maize on their (rented) crop land. Peas and beans are the second most popular crop, grown by 80% and 76% of the surveyed farm households, respectively. Two other legumes, greengrams and cowpeas are adopted by about 55% of the farm households while 55% and 50% has respectively mango and pawpaw fruits on its fields. The second most popular cereal is sorghum, only adopted by 15% of the respondents, while cassava is grown by 36%. Only 25% is member or a farm group (cooperative, discussion group etc.). 30% of the farm households consumes 100% of their harvest, the other 70% are food selfsufficient.



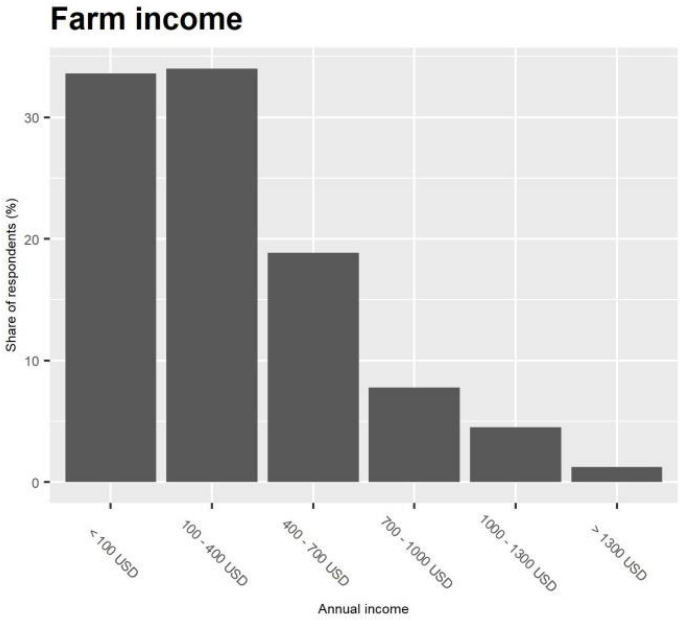


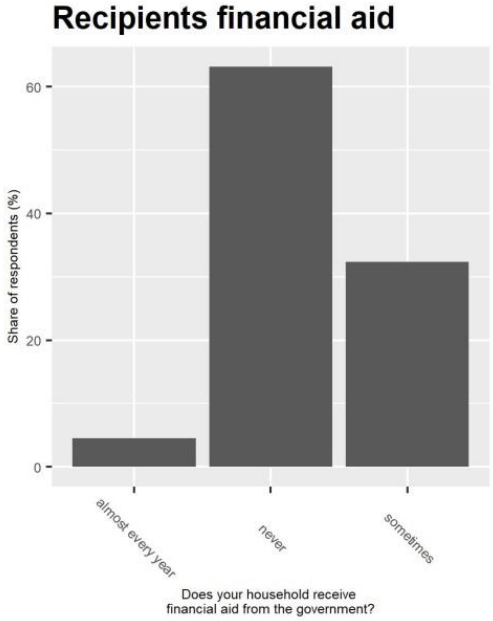


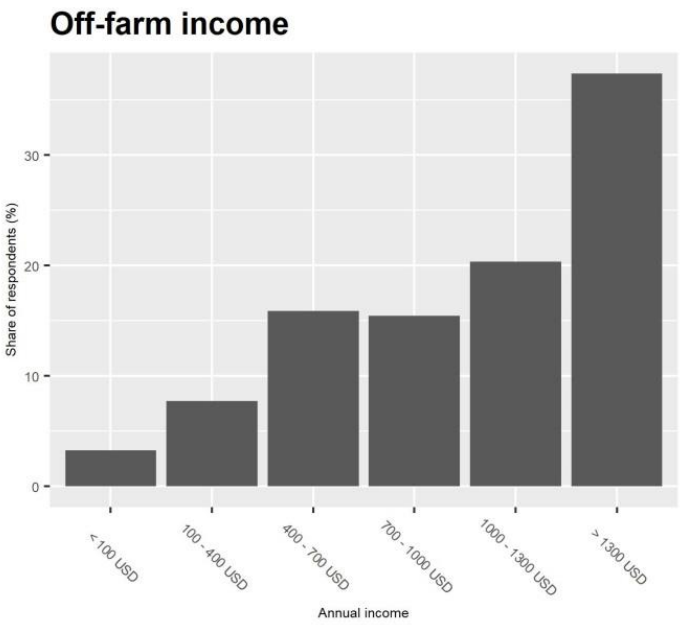


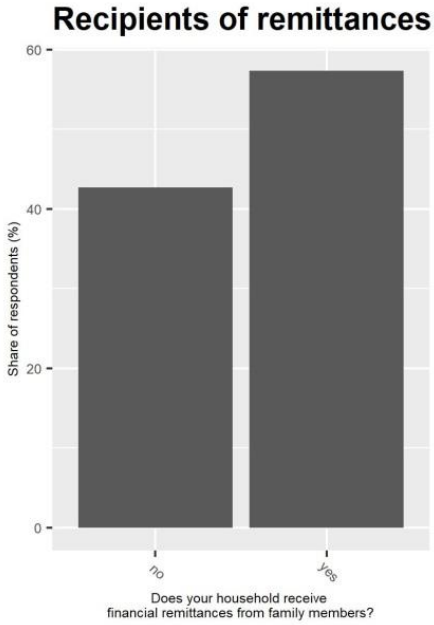
2.3.1. ECONOMIC CHARACTRISITCS

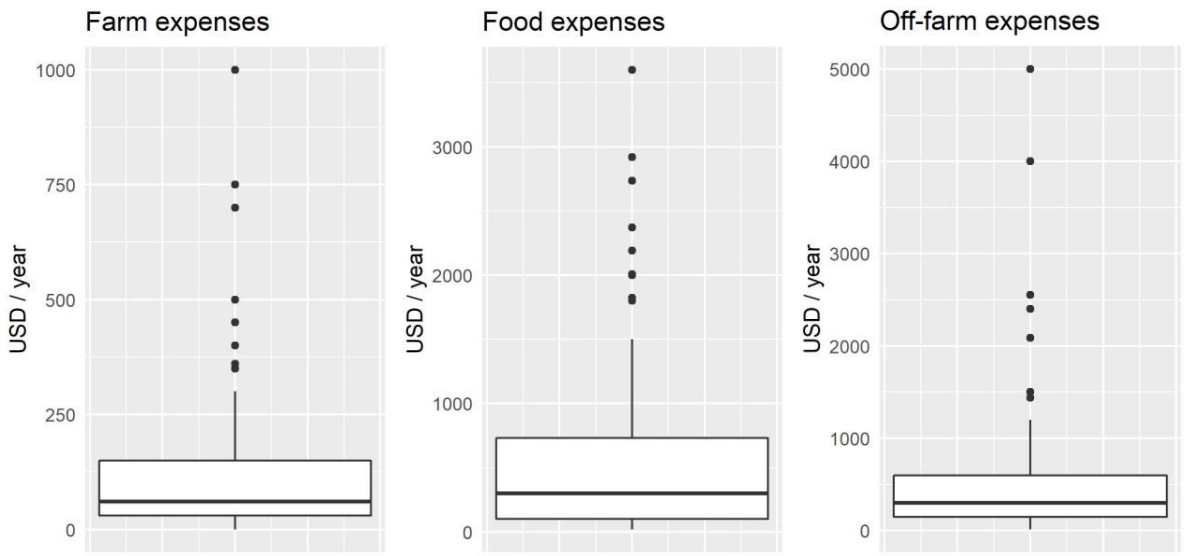
Asked to estimate their annual income (in KSh, converted to USD), 37% respondents receives less than 100USD per year from selling extra yields – indeed a large share of the households is subsistence farmer, mainly producing for own consumption. Less than one third of the farm households surveyed, received more than 400 USD per year income from farm production – hence we were indeed able to capture smallholder farmers rather than market-oriented large farms. 40% of the respondents does receive more than 1300USD from off-farm employments, while only 10% reveives less than 400USD. These results need to be interpreted with care, since many households join casual labour with daily contracts and daily, differing, wages. This makes their yearly estimate biased. Most respondents never reveived any financial aid (62%) while 58% does receive remittances, i.e. has an external source of financial assets. Talking about expenses, while the average farm household spends 118 (+- 146) USD on farm input and management annualy, the median value is only 50USD. Also for annual food expenses, the average value (567 (+-655) USD) differs a lot from the median value (300USD) of all farm households. Regarding off-farm expensenses, average annual dollars spend on clothes, house, … equals 446 (+- 536 USD), while the median value is 300USD. The total annual farm household expenses average 1132 (+- 1097) USD, while the median household spends about 800USD annualy. The lowest total mentioned is 45 USD, while the highest value equals 7525 USD





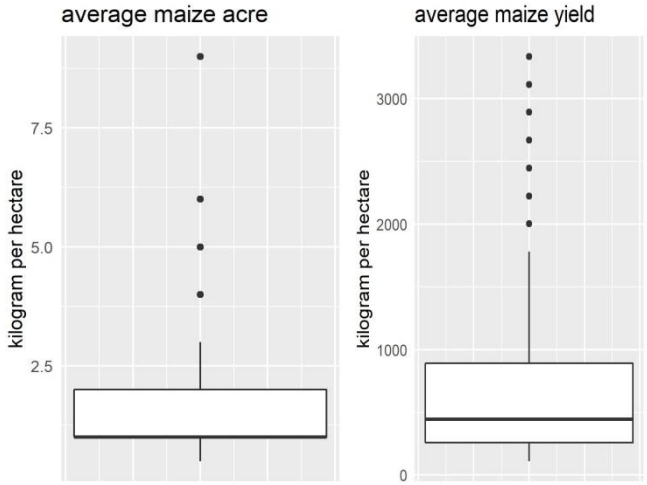






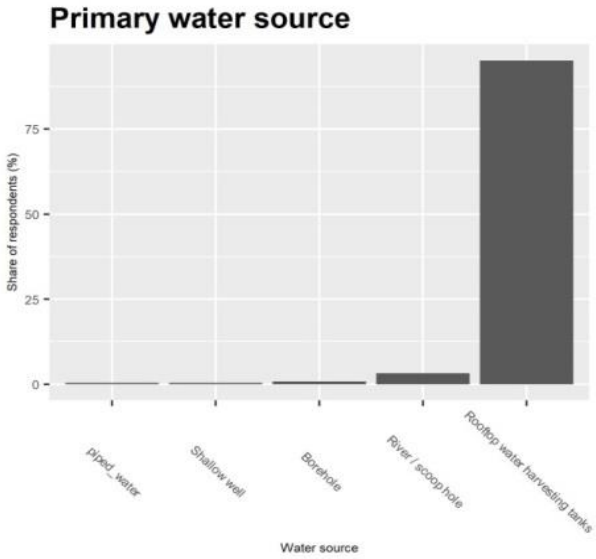
2.3.2. MAIZE CHARACTERISTICS

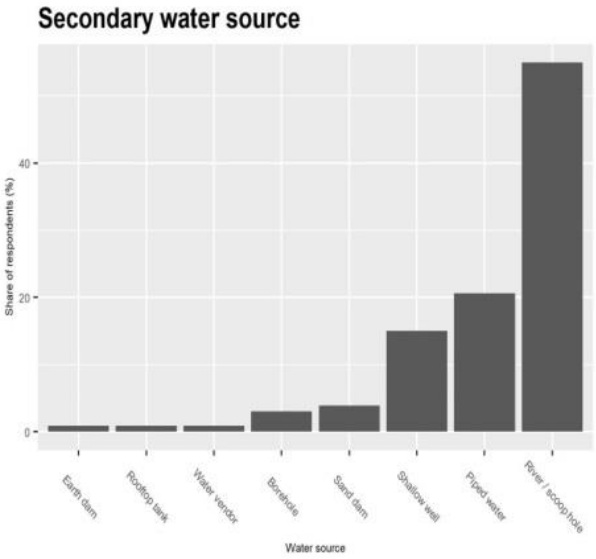
While all but one farm households grow maize, 79 % says it it their most important food crop. 96% ranks it among the three most important crops. The average acreage (average of two seasons) used to plant maize is 0.71 (+- 0.71)ha, while the median acreage is 0.60 hectare. 6% of the respondents allocates over 2ha to grow maize. Mean maize yield (averaged over the seasons) is 679 (+-568) kg/ha, while the median yield is 444 kg/ha. Average annual harvest (sum of two seasons) consist of 1975 (+- 2016)kg maize, while the median farm household only harvests 6 bags of 90kg maize. The percentage of this production that is consumed by the household, ranges from 100% to 20% (average 57%), supporting our assumption that many households product maize largely for own consumption.

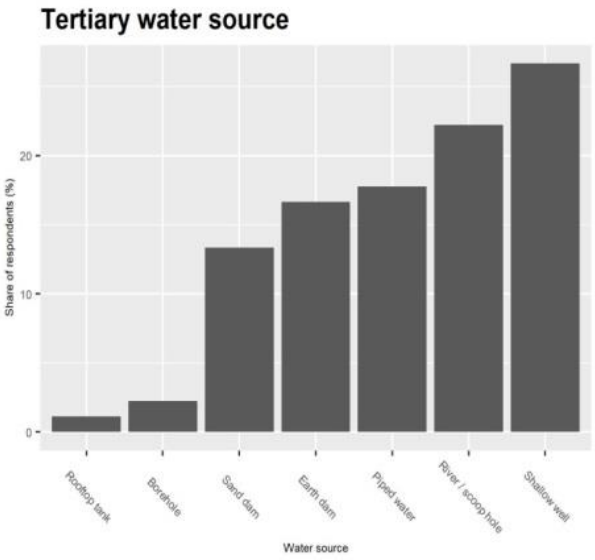


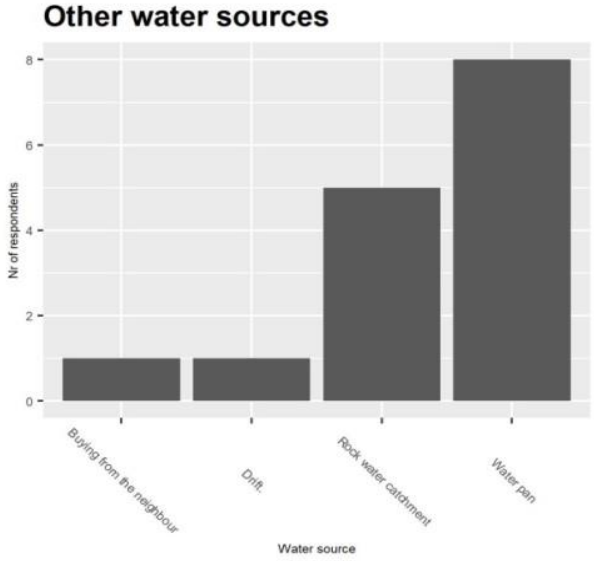
2.3.3. WATER SOURCES

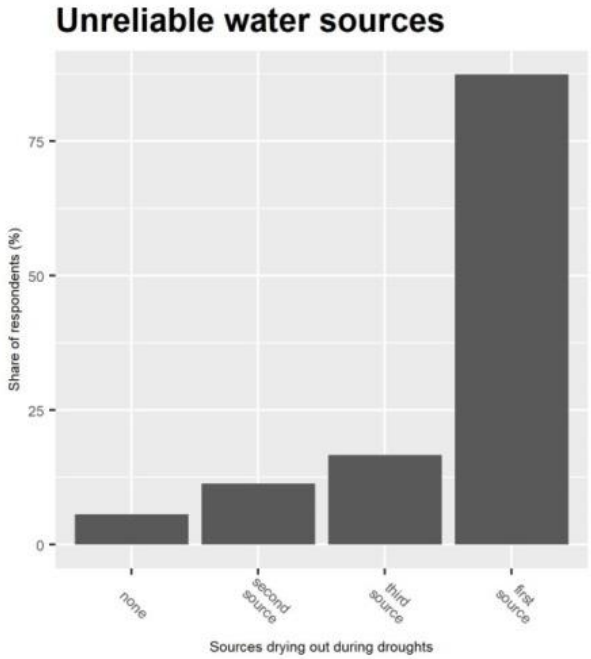
Rooftop water harvesting tanks are the most common primary water ource, but are also marked as unreliable during dry spells (they dry up during the dry season). The river, scoop holes, are the second most popular water source, and for many households this is their secondary water source; less than 10% marks this source as unreliable. Piped water, shallow wells, and eart or sand dams on the river are also common water sources, but serve most frequently as tertiary water source. Typically the dry months of August, September and October are water shortage months (requiring water rationing in household water use). Most respondets (almost 60%) thinks that there will be a lot less water available in the future.

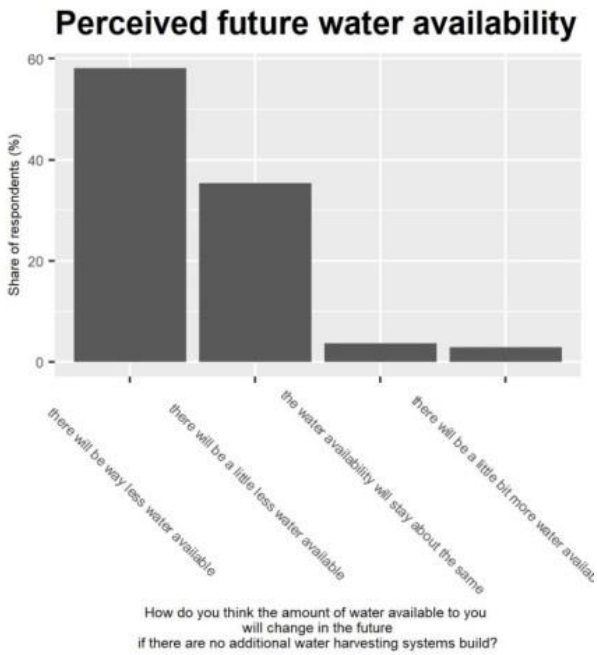

Primary water source
Share of respondents (%)
75
50
25
0
piped_water
Shallow well
Borehole
River / scoop hole
Rooftop water harvesting tanks
Water source

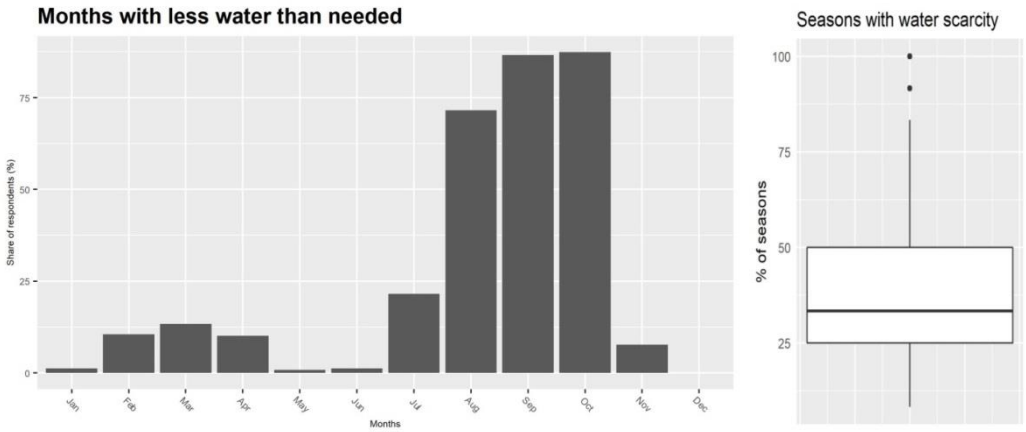

Secondary water source
Share of respondents (%)
40
20
0
Earth dam
Rooftop tank
Water vendor
Borehole
Sand dam
Shallow well
Piped water
River / scoop hole
Water source


Tertiary water source
Share of respondents (%)
20
10
0
Rooftop tank
Borehole
Sand dam
Earth dam
Piped water
River / scoop hole
Shallow well
Water source


Other water sources
Nr of respondents
8
6
4
2
0
Buying from the neighbour
Drift
Rock water catchment
Water pan
Water source

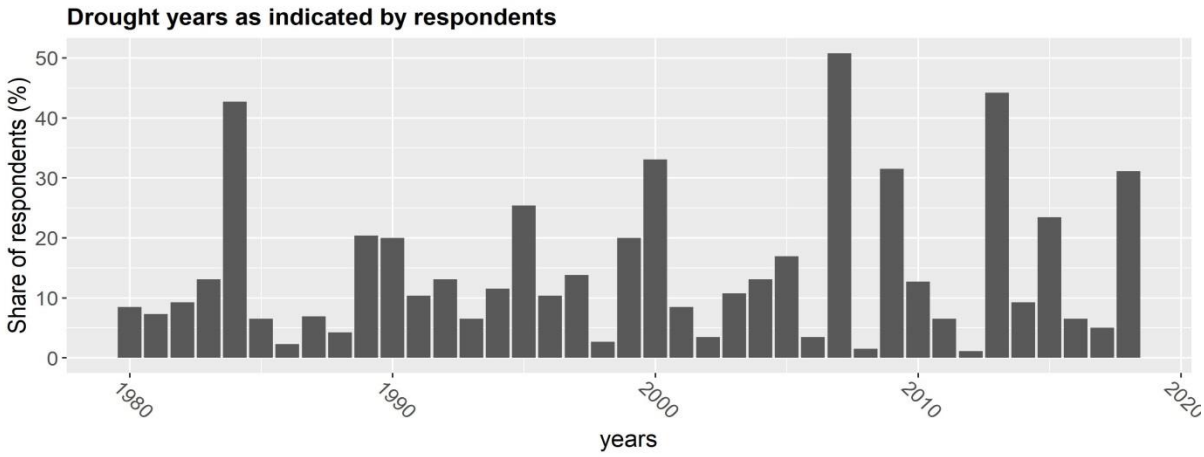

Unreliable water sources
Share of respondents (%)
75
50
25
0
none
second source
third source
first source
Sources drying out during droughts

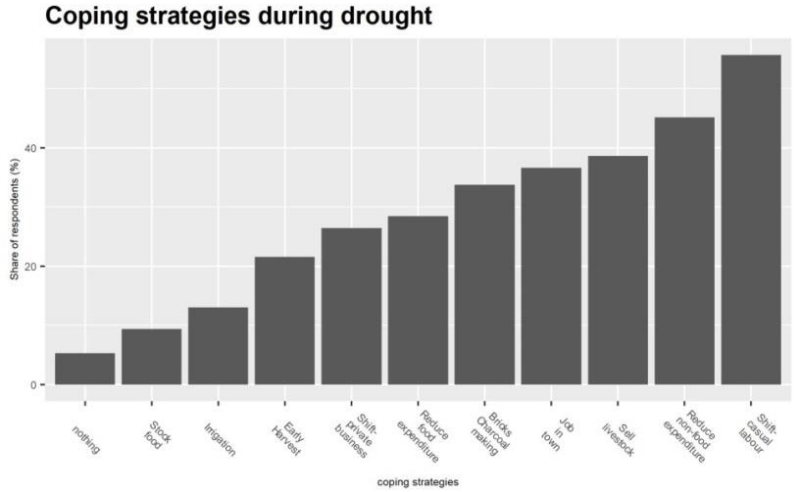

Perceived future water availability
Share of respondents (%)
60
40
20
0
there will be way less water available
there will be a little less water available
the water availability will stay about the same
there will be a little bit more water availa
How do you think the amount of water available to you
will change in the future
if there are no additional water harvesting systems build?

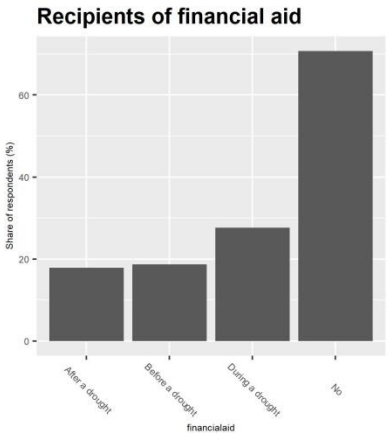


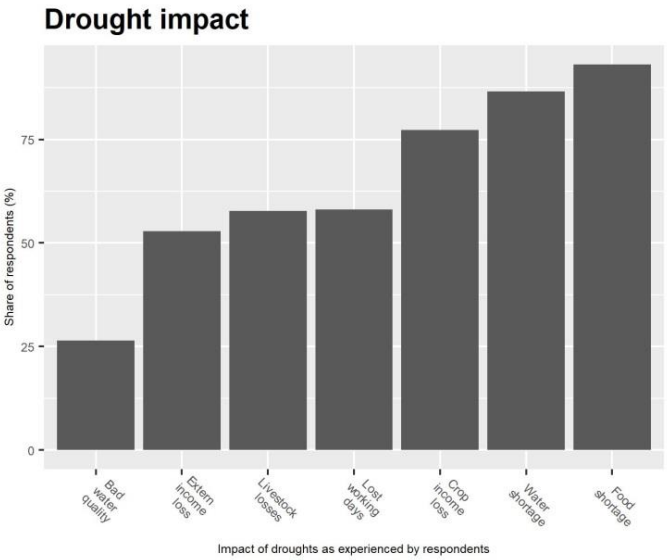
2.4. DROUGHT DISASTER EXPERIENCES

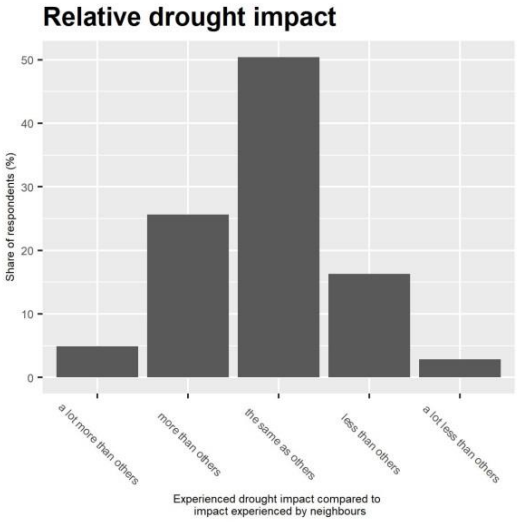
For farmers, a drought simply means dry days when there actually should be more rain; that includes dry spells, late onset of rain, little rainfall, few rainy days and a short season. Respondents acknowledged that in the last decade, 40% (+-19%) of the crop growing seasons were water scarce (average over all households) – less water than expected and needed. Severe drought years as remembered by 20% the households, were 1984, 1989-1990, 1995, 1999-2000, 2007, 2009, 2013, 2015 and 2017. One person remarks that there is a trend in droughts in the years 00, 5 and 7. Another person claims to recall droughts up to the '20s : Years of drought are 1953, 1955, 1961, 1979,1975 , 1942, 1935, 1939, 1945,1976,1921,1927,1950. Two thirds of the respondents experience a slight to mayor increase in the frequency of droughts due to recent climate change. Food shortage is most often answered as main drought impact experienced in the past (93% of respondents), while water shortages and crop income loss are felt by respectively 87% and 78% of the surveyed farm households. Focussing on impacts on agricultural production, three quarter of the respondents answered to have disrupted farm activities during droughts; low (65%) or no (50) crop production. Respectively 25% and 30% reported more specific low or even no maize yield during droughts. Other impacts mentioned were: lost a job, quitting to venture in farming (or shift focus away from farming, lost hope) increased conflict and crime rate (food, irrigation infrastructure stolen), loss of livestock pasture, need for milk to feed young cattle, children leaving school to work in twon (fees not paid), changing livestyle, divorce (2), loss of life (mentioned 10 times) due to malnutrition, bad water quality, also due to Chinese dumping. More than 70% never received emergency food aid before, during or after a drought. Those who did, spent it onw on consumption (as aid is often in the form of maize and beans or rice) or on their farm (when it is in the form of seeds). Some sold the emergency food and bought other things with it (2) or gave it to more needy people (11).About two thirds of the respondents reported to find the impact of droughts extremely severe; and most of the respondents (+-80%) (strongly) agrees that they are very vulnerable to droughts. To cope with droughts, 60% of the surveyed farm households would shift to casual labour, 50% would reduce non-food expenditures and 40% would sell livestock and/or search for a job in the town. Many relied on their (grand)children to work in town and send money. Other activities to cope with droughts were: selling murram for road construction, bee keeping, posho mill, traditional brew making (illegal), selling land ("I use most of the farm to construct rental buildings. Our soil is so poor, it hardly supports crops. Sorghum and millet can work well but we don't have that time of looking after birds. Its selling price too is usually lower"), lease land from areas where there is no drought, or borrowing money from friends or relatives.

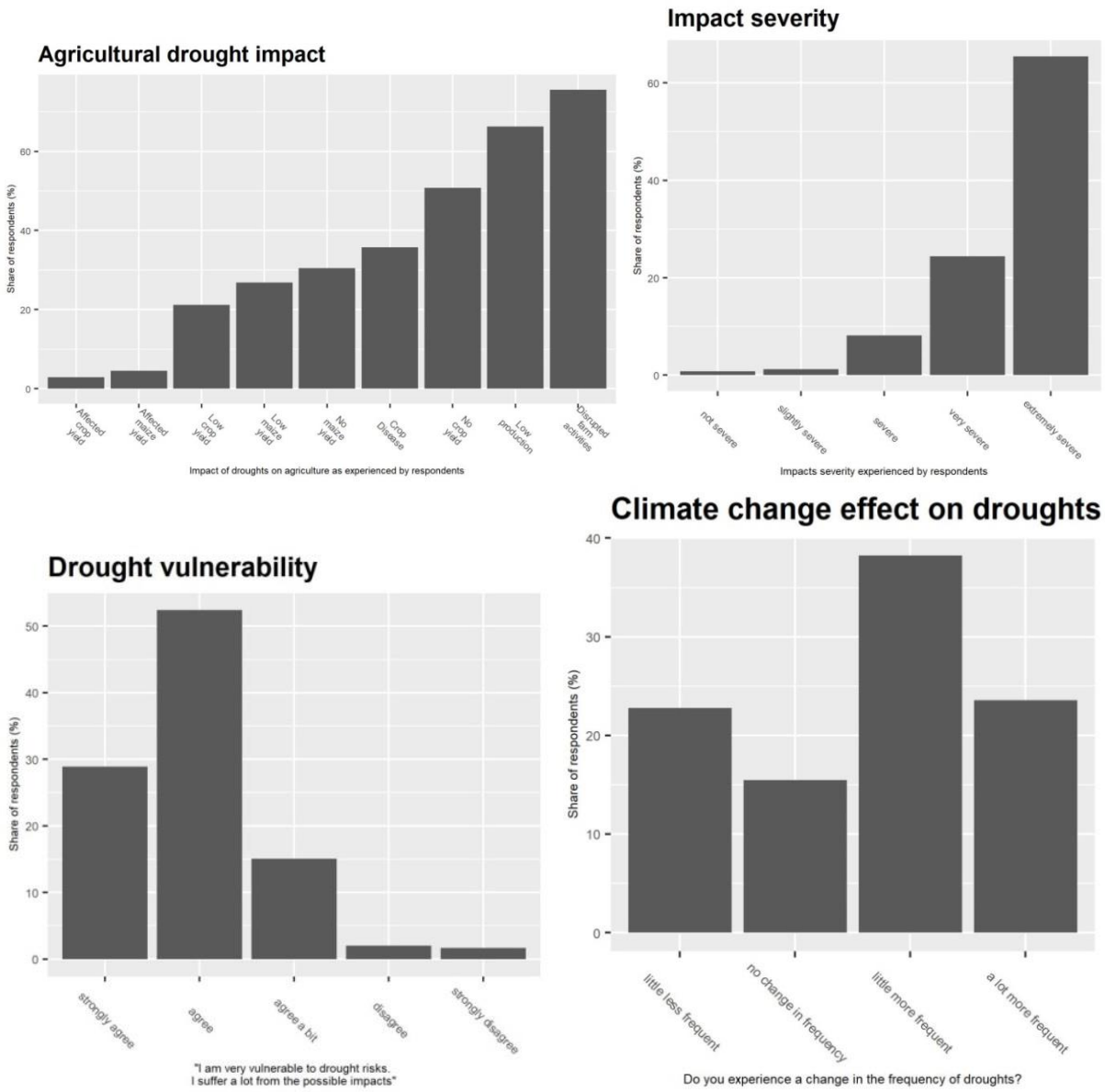

Drought years as indicated by respondents
Share of respondents (%)
0
10
20
30
40
50
1980
1990
2000
2010
2020
years


Coping strategies during drought
Share of respondents (%)
0
20
40
nothing
Stock food
Irrigation
Early Harvest
Shift- private business
Reduce food expenditure
Bricks Charcoal making
Job in town
Sell livestock
Reduce non-food expenditure
Shift- casual labour
coping strategies


Recipients of financial aid
Share of respondents (%)
0
20
40
60
After a drought
Before a drought
During a drought
No
financialaid


Drought impact
Share of respondents (%)
0
25
50
75
Bad water quality
Extern income loss
Livestock losses
Lost working days
Crop income loss
Water shortage
Food shortage
Impact of droughts as experienced by respondents


Relative drought impact
Share of respondents (%)
0
10
20
30
40
50
a lot more than others
more than others
the same as others
less than others
a lot less than others
Experienced drought impact compared to impact experienced by neighbours

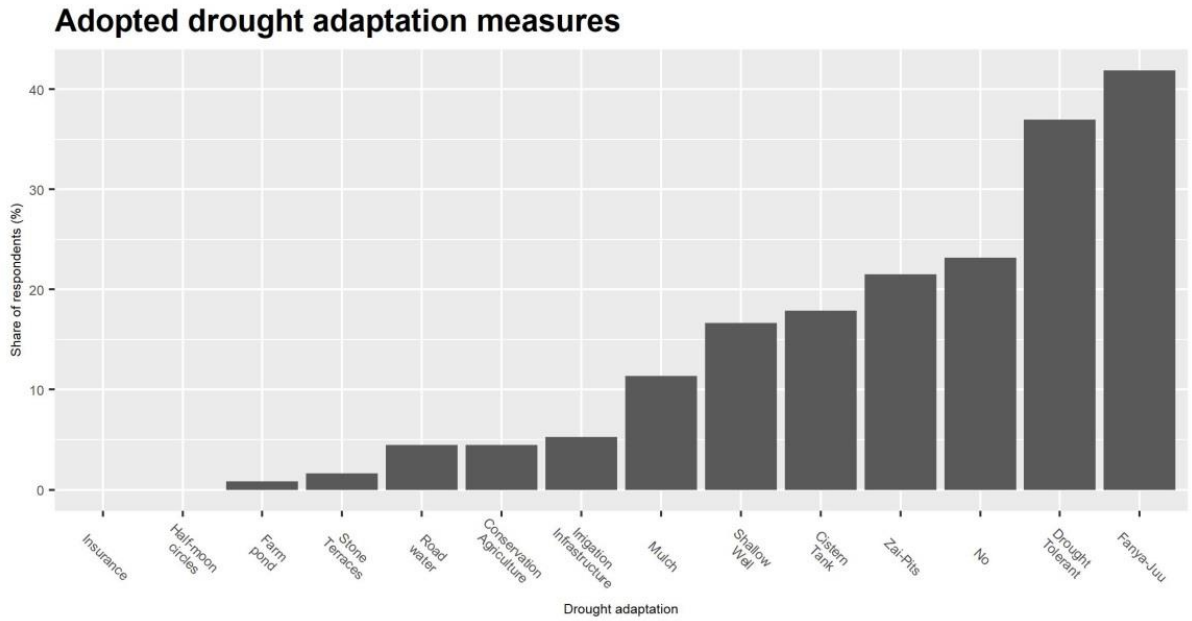


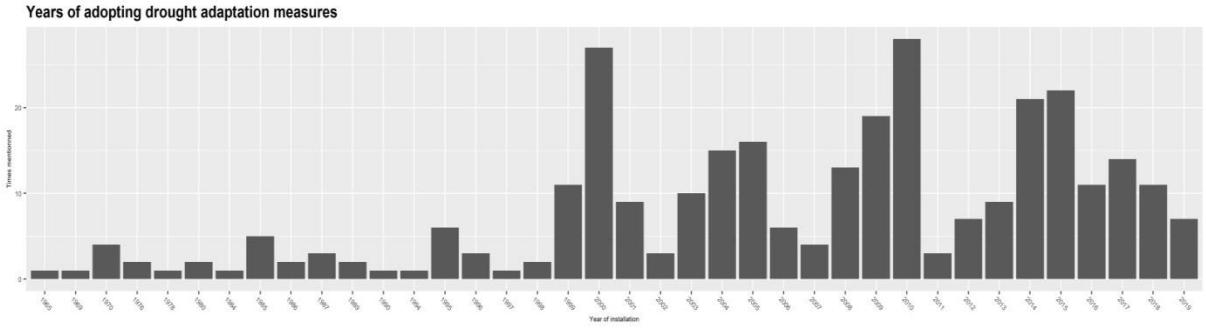
2.5. DROUGHT ADAPTATION

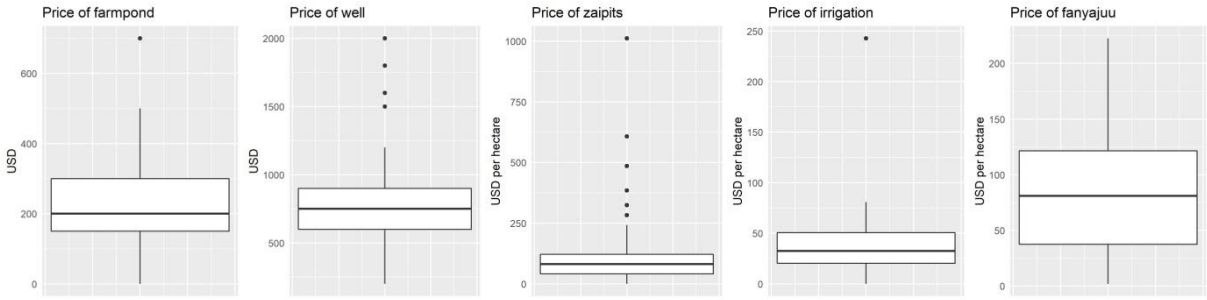
2.5.1. ADOPTED MEASURES

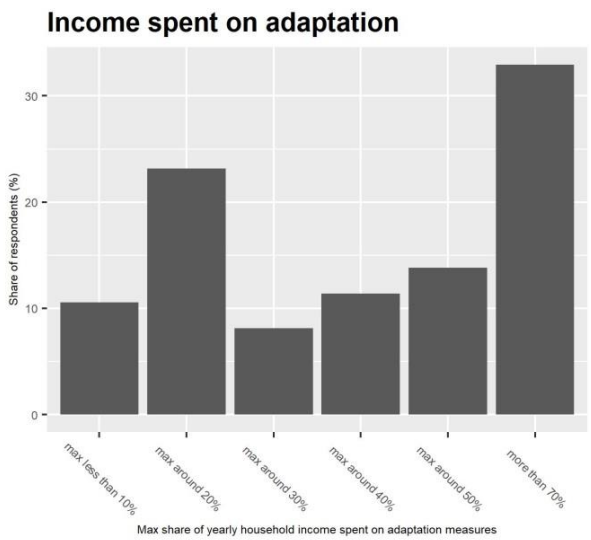
Drought adaptation measures are adopted by three quarter of the surveyed farm households. 45% has fanya juu terraces, while 38% used drought tolerant seeds. Zai pits, cisterns, shallow wells and mulch are implemented by respectively 22%, 18%, 17% and 11% of the interviewed households. Peaks in the adoption of these drought adaptation measures occurred in 2000, 2004-2005, 2009-2010, 2014-2015, 2017 – years that coincidence the droughts experienced in this area (see before). Fanya Juu terraces and Zai pits are estimated to cost respectively 80 (+- 50) USD / ha, and 146(+-194) USD/ha, Farm ponds cost around 250(+-145) USD per piece and irrigation infrastructure is perceived to costs 40 (+-50) USD / ha (which is a large underestimation given expert numbers or WOCAT estimations). Asked how much of their annual income they would spend on the implementation of drought adaptation measures, the mayority of the respondents answered around or more than 50% of their annual income – most of the respondents (>80%) never received any funding for their drought adaptation measures. Other sources of funding mentioned by respondents were relatives (often children) and church

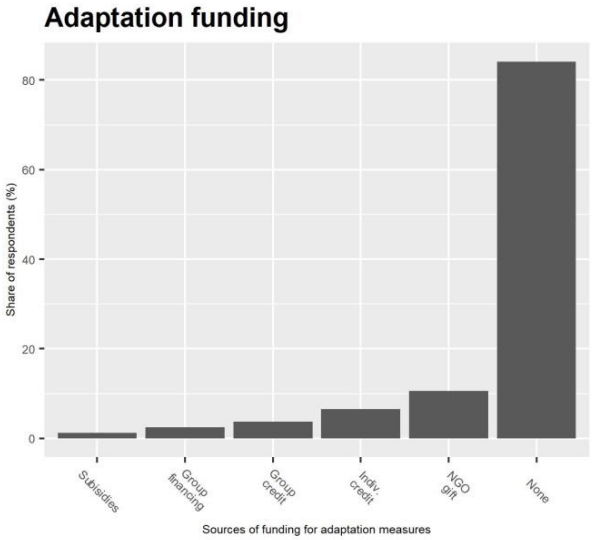
Tallking about collecting measures, households team together and dig deep scoop holes for drinking water and another for their cattle. A person fetching water from the well but never dug is charged a fine. Either money or is told to dig deep when the water level drops. The wells for cattle have to be checked regularly mostly after two weeks. Also shallow well are often constructed collectively.


Adopted drought adaptation measures
Share of respondents (%)
0
10
20
30
40
Insurance
Half-moon circles
Farm pond
Stone Terraces
Road water
Conservation Agriculture
Irrigation Infrastructure
Mulch
Shallow Well
Cistern Tank
Zai-Pits
No
Drought Tolerant
Fanya-Juu
Drought adaptation

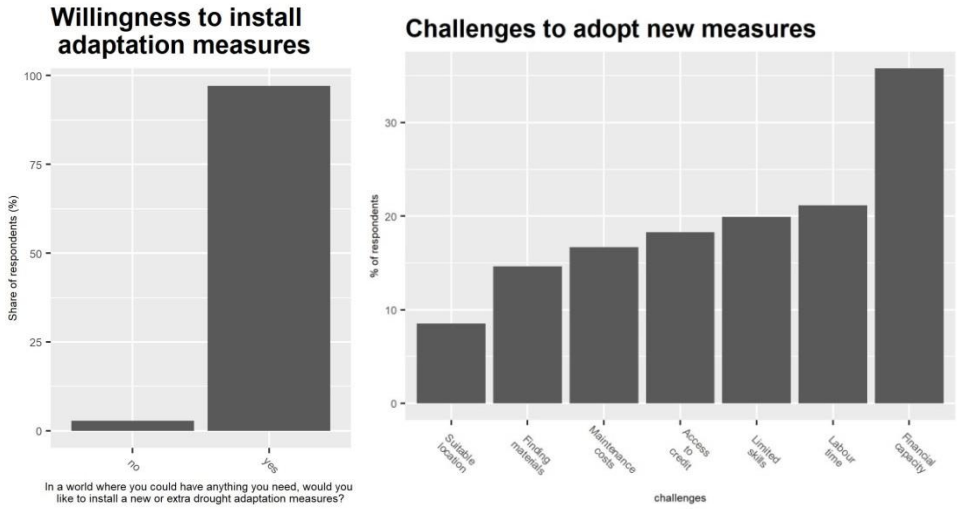

Years of adopting drought adaptation measures
Year of installation


Price of farmpond
USD
Price of well
USD
Price of zaipits
USD per hectare
Price of irrigation
USD per hectare
Price of fanyajuu
USD per hectare

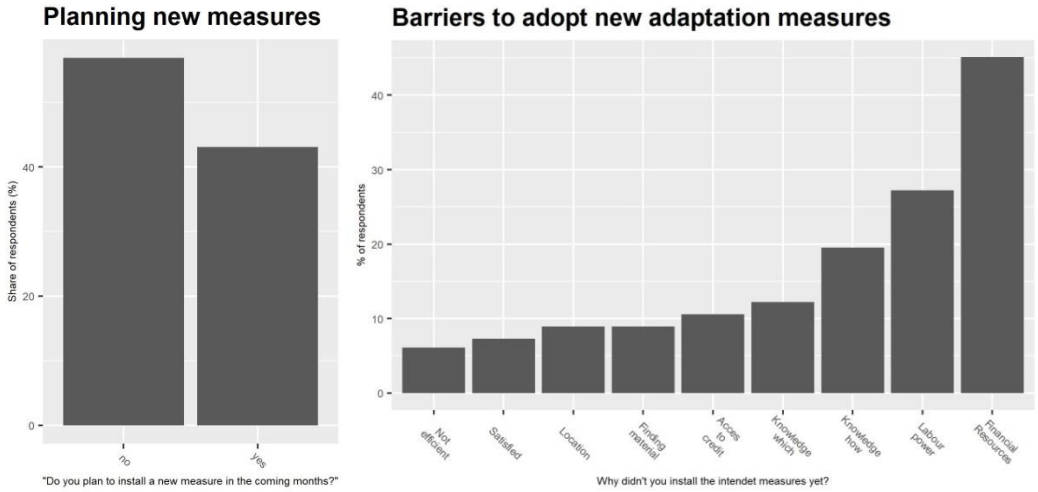

Income spent on adaptation
Share of respondents (%)
0
10
20
30
max less than 10%
max around 20%
max around 30%
max around 40%
max around 50%
more than 70%
Max share of yearly household income spent on adaptation measures


Adaptation funding
Share of respondents (%)
0
20
40
60
80
Subsidies
Group financing
Group credit
Indiv. credit
NGO gift
None
Sources of funding for adaptation measures

2.5.2. BARRIERS TO ADOPTION



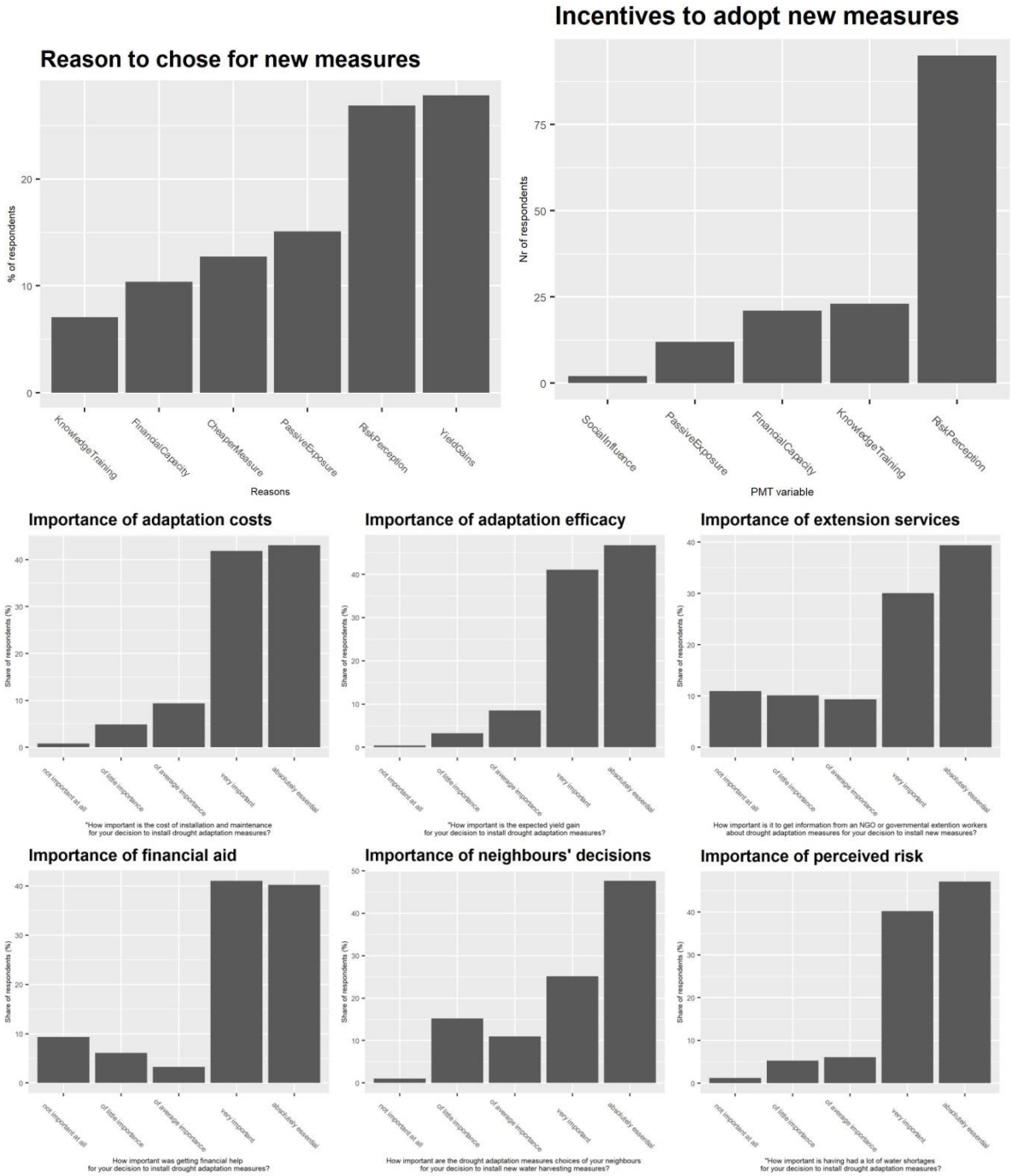
While almost all of the respondents would like to install extra drought adaptation measures, only slightly over 40% is planning to do so. This proves the existence of barriers to the adoption of new measures, identified to be: readiliy available financial resources (50%), knowledge on which and how to install measures (22% + 13%) and labour power (30%) among others. This human, financial and technical capacity also appears to be the main challenges overcome when installing measures in the past – which confirms that these are the most important drivers for adoption. Other barriers mentioned are the land size (too small), age (health, strength to install is lacking), the availability of rain (not enough, so rainwater harvesting is becoming useless), hope in farming is lost (waste of time). Other reasons to actually plan the installation of new measures where the following: finally having the time and network to help, joined a group to get a loan, having kids graduating that can help, the promises of the MP to help farmers (elections are coming), a stream has formed next to the farm, so the opportunity to get the water is there.



2.6. PROTECTION MOTIVATION THEORY VARIABLES

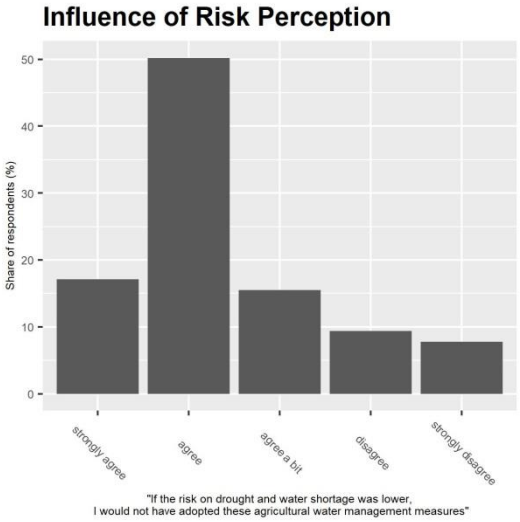
Asked to indicate the most important reason why the farm household adopted drought adaptation measures in the past, both “expected yield gains” and “fear for next drought”are answered by more than 25%. Surprisingly, the reception of a training about a certain measure was chosen to be the most important driver by less than 10% of the respondents (ranked lowest). When questioning the incentives to adopt new measures, fear for increased drought risk is placed as most important by 62% of the respondents, Gaining extra knowledge would incentivise 15% of the respondents the most, while having extra financial capacity is ranked as third most important driver. These results are slightly surprising as they do not support the ranking of the barriers to adopt. Other drivers / incentives mentioned where: “we learnt it from our parents” (x3) and “I had a leaking cement tank so I bought a plastic one”, Then, the

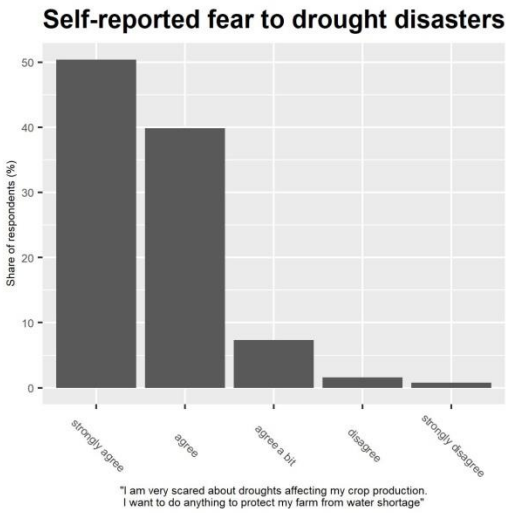
importance of each of these incentives was questioned. Here, adaptation efficiacy, risk perception, adaptation costs, receiving financial aid , receiving extension services and observing neighbours' adaptation decisions are found to be very important or even absolutely essential by respectively 94%, 93%, 91%, 86%, 74% and 73% of the respondents.

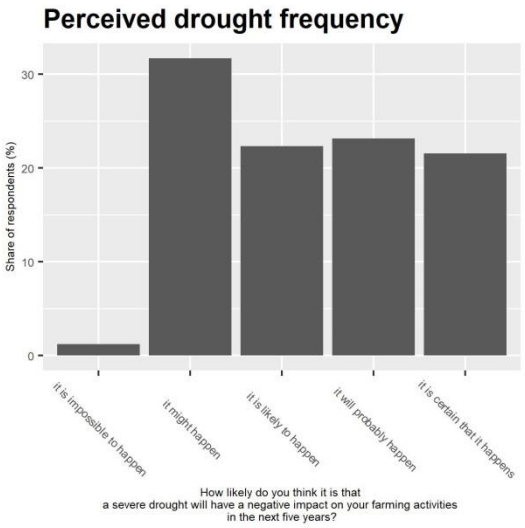


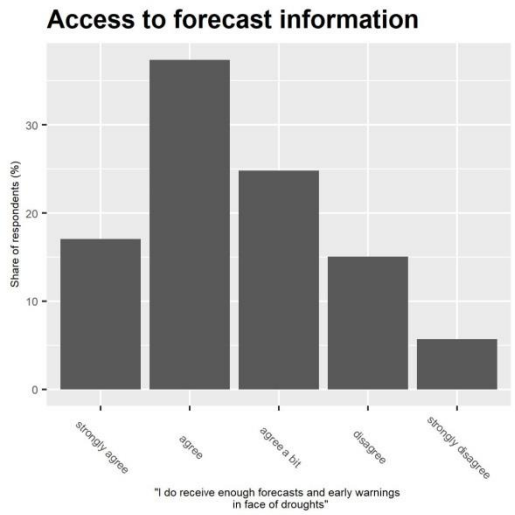
2.6.1. RISK APPRAISAL

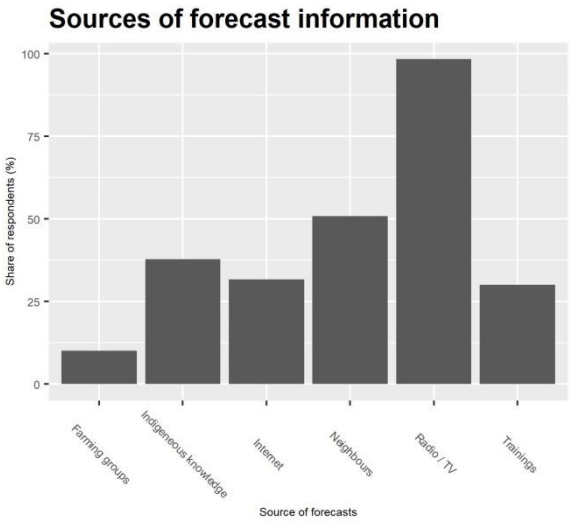
Two thirds of the respondents (strongly) agree that the perceived drought and water shortage risk, drives their decision to adopt new drought adaptation measures. Most respondents indeed are scared about droughts causing harmfull consequences to their crop production. About half of the respondets find that they receive enough forecast and early warning information, mostly from radio/tv, neighbours and indigenous sources (rainmaker). There is a spread in the opionion about the thrustwortyness of these sources (almost 45% does not thrust the forecasts).

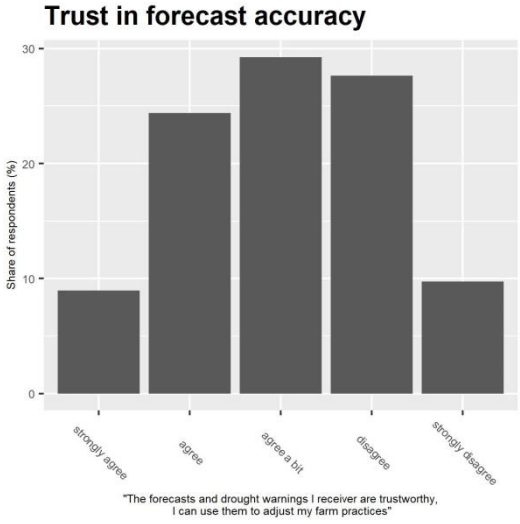








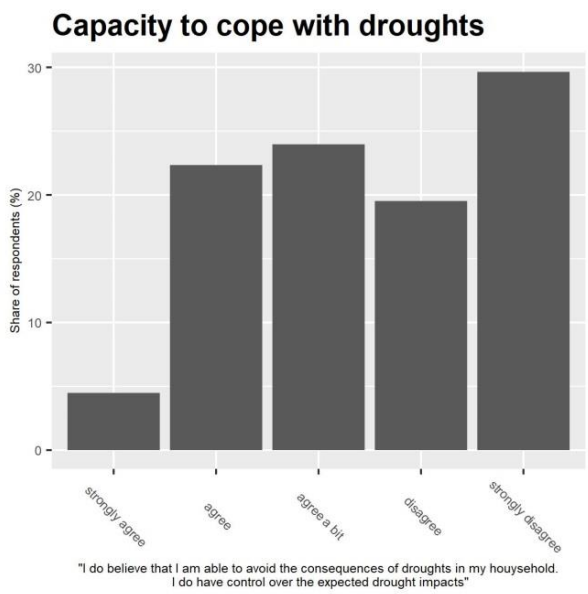


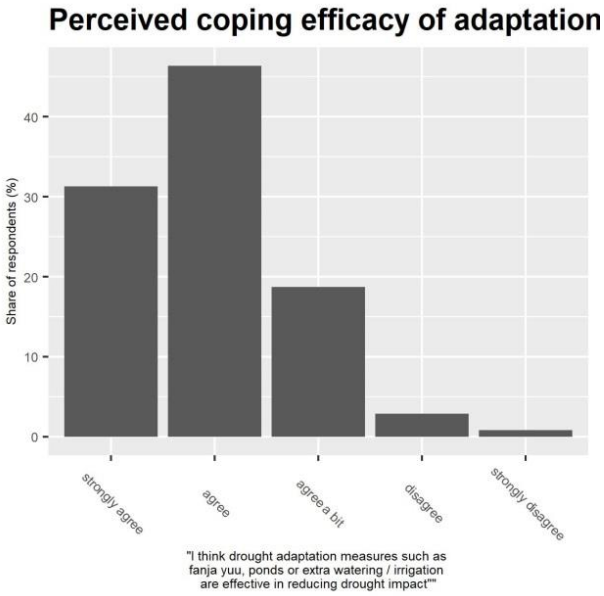


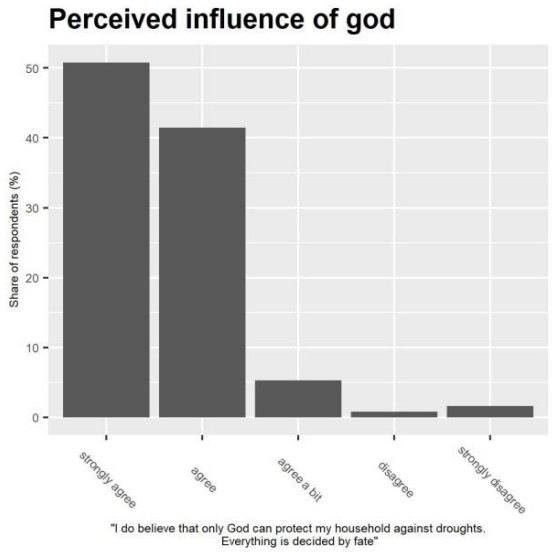
2.6.2. COPING APPRAISAL

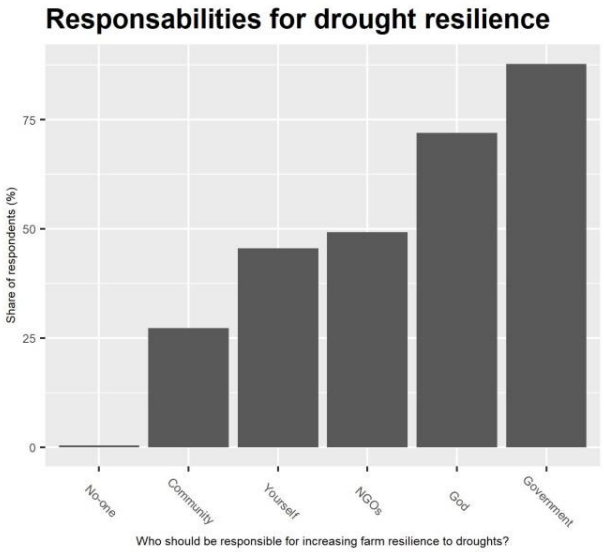
Almost half of the respondents believe that they are not capable to avoid the consequences of droughts, while more than two thirds thinks that drought adaptation measures are indeed effective to reduce drought impacts. A large majority answered that “only god can protect their household form drought impact”, which might implicate they are not thinking of themselves as influencial actors in the reduction of drought risk. Indeed, 77% believes that God – among others - is responsible for their farm resilience.

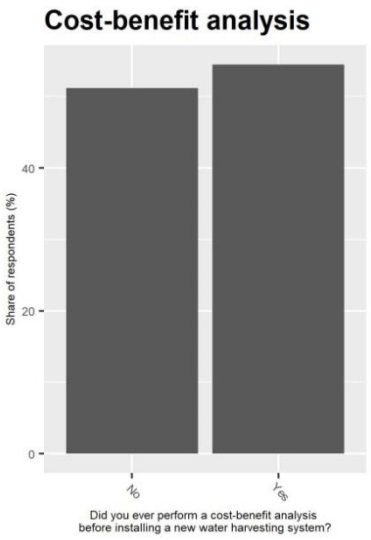
93% of the surveyed farm households find that also the government has a responsibility to increase their farm resilience, while less than half of the respondents (48%) see themselves responsible for this. Asked if they performed a cost-benefit analysis before adopting a drought adaptation measure, slightly more than 50% or the respondents answered they did so. Most of the information needed for such CBA, comes from radio and TV (almost for 100% of the respondents), neighbours are the second most important source of data about drought adaptation (> 50% of the respondents), while trainings by NGOs or the government only rank respectively third (source for 40%) and fourth (35%). More than 50% actively looks at their neighbours'decisions when deciding wheter or not and which measure to adopt, while only 21% says their neighbours decisions do not influence them at all. The average size of social networks among farmers is 18, while the median is reported to be 8. 50% of the respondents (strongly) agree that they get enough information about drought adaptation measures from governmental and other trainings. Only 61% ever went to such trainings, but those who go, go often frequent (87% attend a training (more than) once per year). There is a split in opinion regarding the usefulness of such training: only two thirds of the respondents have the feeling that the followed trainings were relevant.

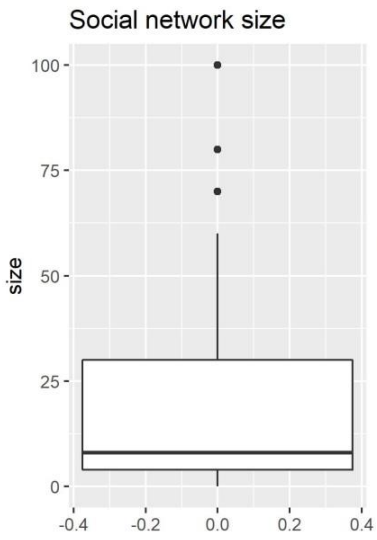


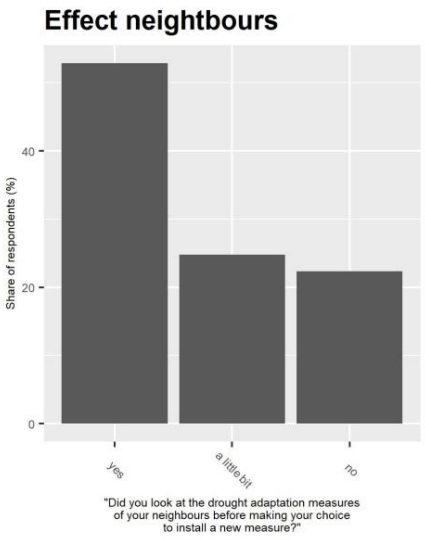


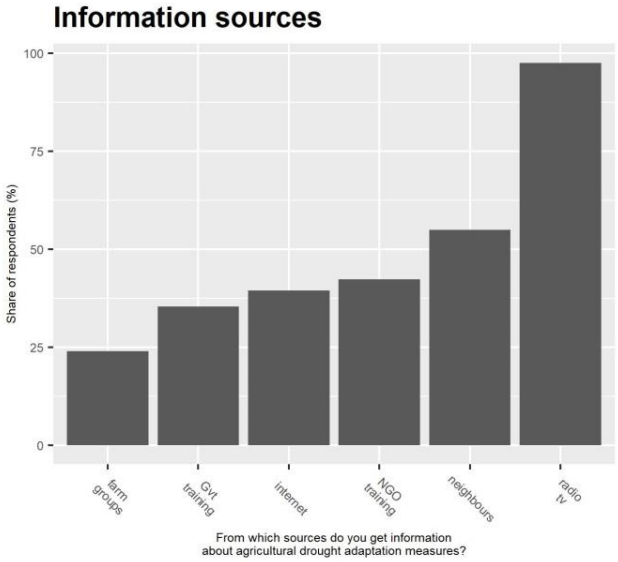


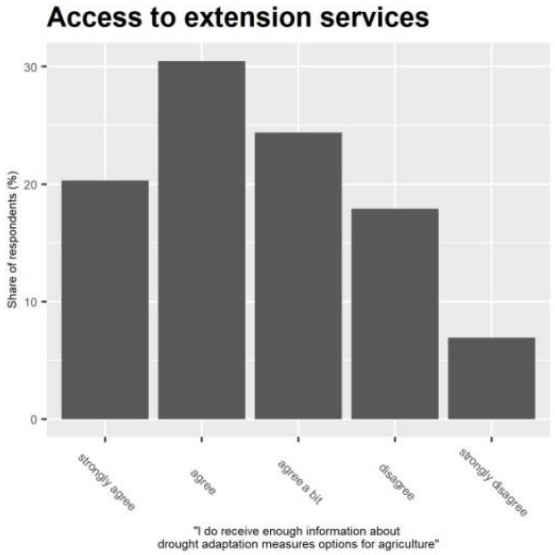


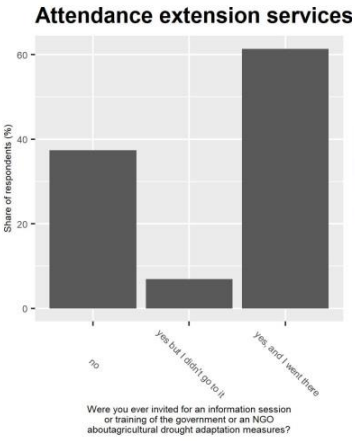

Cost-benefit analysis
Share of respondents (%)
0
20
40
No
Yes
Did you ever perform a cost-benefit analysis
before installing a new water harvesting system?

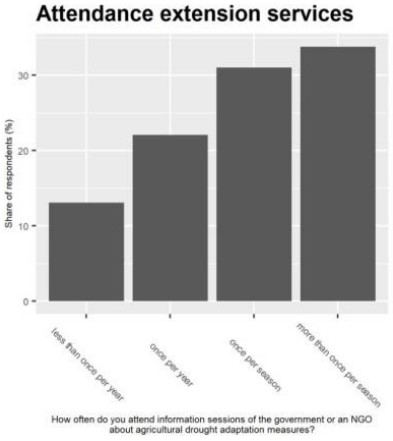

Social network size
size
0
25
50
75
100
-0.4
-0.2
0.0
0.2
0.4

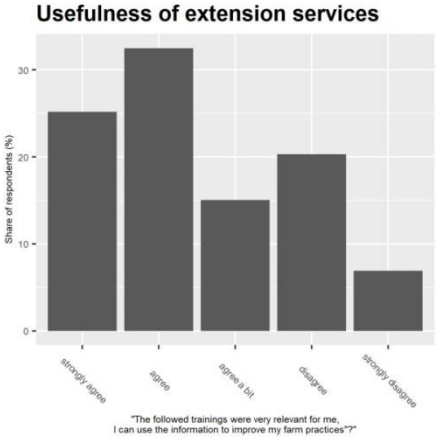

Effect neightbours
Share of respondents (%)
0
20
40
yes
a little bit
no
"Did you look at the drought adaptation measures
of your neighbours before making your choice
to install a new measure?"


Information sources
Share of respondents (%)
0
25
50
75
100
farm groups
Gvt training
internet
NGO training
neighbours
radio tv
From which sources do you get information
about agricultural drought adaptation measures?


Access to extension services
Share of respondents (%)
0
10
20
30
strongly agree
agree
agree a bit
disagree
strongly disagree
"I do receive enough information about
drought adaptation measures options for agriculture"


Attendance extension services
Share of respondents (%)
0
20
40
60
no
yes but I didn't go to it
yes, and I went there
Were you ever invited for an information session
or training of the government or an NGO
aboutagricultural drought adaptation measures?


Attendance extension services
Share of respondents (%)
0
10
20
30
less than once per year
once per year
once per season
more than once per season
How often do you attend information sessions of the government or an NGO
about agricultural drought adaptation measures?


Usefulness of extension services
Share of respondents (%)
0
10
20
30
strongly agree
agree
agree a bit
disagree
strongly disagree
"The followed trainings were very relevant for me,
I can use the information to improve my farm practices"?"

3. DISCUSSION

3.1. FARM CHARACTERISTICS

The main crops grown in the area included maize, beans, cow peas, green grams, pigeon peas, sorghum and millet. However, in some households, green grams, pigeon peas, millet and sorghum were being harvested in minimal amounts. Fruits included mangoes, oranges, lemons, water melon, soursop, pumpkin, papayas. A large limitation in this are is that there is no market for the harvested crops. The crop pruction and farming type is thus focused on self subsitence (supported by the county government).

3.2. SOURCES OF WATER

Scooped wells was the major source for most households since it was free and easy to get water . The other sources of water are shallow wells, boreholes, sand dams, harvested water from roofs, and ponds. The national governments and Non-Governmental Organization have invested large sums of money over years developing community water projects to address the problem of accessibility of water, but the aspect of sustainability of the water projects is left in the hands of the community resulting to high failure rates of these projects. A good example is shown in the figure below left.

A concrete tank that was to harvest rainwater from rooftop is turned to a staffroom , in Kitui. It was easier to change its use than renovate it. According to me, this could also relate to problem of dependency where unless we are funded, we cant solve our problems. Many water projects have failed due to poor maintenance and cooperation between the contractor and the beneficiaries. Shallow wells have gone dry while poorly constructed sand dams have been swept away leaving the residents get water from the dry river beds. Those with money or getting loans go ahead and buy tanks other constructing wells and boreholes to have water.

3.3. DROUGHT EXPERIENCE AND COPING STRATEGIES

Aged respondents gave remarkable stories too about the droughts such as ‘nikwa ngweete drought’ (I die as I hold) - a severe drought in 1982 whereby one had money but there was no food to buy so they had to travel for long distances to buy food and sometimes spend days as queue at the shop. Another drought was in 1989 when the only food availablewas wheat flour so they were eating ‘chapatis’ every day.

Most people claimed that 2018 rainfall was very poor. Getting water is still hectic for the people, they still spend more time to fetch water than usual. The poor performance of rainfall caused pasture stress and wilting of crops was reported is reported across the livelihood zones due to moisture shortages. The last harvest was minimal. Due to the need for income to purchase food as well as school fees, and out of fear for lievestock diseases and water shortages, farmers are doing distress sales of livestock (the animals would never survive the drought). This has led to upsurge of traded volumes in the markets.

As a result a sharp decrease in livestock prices was recorded, thus reducing household purchasing power and access to food. At the same time, domestic staple food prices have been high in recent months (due to low food availability). Most households had to look for a way to cope with drought to get money for food and other expenses. A lot of people fetched water more than three times a day with averagely 8 jerricans of 20 litres. To cope with this water insecurity, some households; relied on less preferred and or less expensive food, others borrowing food or relying on help from a friend or relative. Many respondents took the risk to look for other sources of living other than farming. In Kisasi, every household was making bricks (see pictures). However, making of bricks reduces vegetation that would be consumed by cattle (Vegetation is cleared to get soil and bricks are burnt using thick cut-down trees (leads to deforestation).

Others reduce the number of meals eaten per day or reduced the portion size of meals or reduce the quantity of food consumed by adults to ensure that children had enough to eat. On utilization, households relied on less preferred food and dietary diversity comprised of maize, beans and legumes. Food security in the future is likely to be a huge problem to Kitui residents if action is not taken.

The governor thought that the reason as to why Kitui ever created an endless cycle of poverty was because of being demeaned by the aid we got from WFP who earlier were also handing out cash to villagers at Kisasi area and other parts of Kitui to buy food. Therefore, the governor mobilized the locals to drop farming of the ever failing maize and beans and start small-scale irrigation project where farmers would grow horticultural produce such as green grams. Last year the governor in conjunction with Red Cross targeted 184,000 households to produce about 50 million kilograms of green grams. Most farmers got 2kg the green grams and they were harvested and sold to the government, who wanted to sel lit to the Indian government restricted green grams importation. However, this resulted in more problems to arise like water provision, acquiring seeds, fertilizers and market. Most of the residents are poor and can't start the new farming unless they are funded. Only those living near or have their farms near rivers can irrigate.

3.4. DROUGHT ADAPTATION MEASURES

The adaptation measures farmers installed worked well for them regarding the problems they were solving. People with tanks wanted to quit the time they took going to fetch water. Farmers who opted to do irrigation and drilling boreholes were retired men and women who their only hope was farming and others were young men who their parents had farms near rivers and had no other job to do apart from irrigation. It went well for them since they were satisfied with the measure and saw no effect of drought in their household. Many replied that going to town was their only solution to evade drought and its impact instead of dwelling farming that reaped nothing.

- Fanya juu terrace is the common measure adopted by many people in kitui central (mainly by those with land on steeper slopes), because it is easy to install, protects soil erosion and cost of installation is low. The slopy terrain and soils also provide an enabling environment for this kind of terraces. The cost of installing fanya juu terraces is about kshs 750 for 5 feet length and 3 feet depth; per acre this is stimated to be ksh 32000. Depending on interval between the terraces and depth cost can be higher or lower (one dug a fanya juu for kshs 2500 for 10 feet length and 5 feet depth). Deep terraces - 'cut offs' called by residents - are dug at ksh 500 per 4 feet length, 5feet depth and 2 feet width
- Zai pits have been adopted by a fewer people as they are used mostly to plant bananas (there is a certain banana species which does well when is planted in zai pits thus people to use that species), or other trees, and is only sometimes used for irrigated crops (using very small pits). Zai pits usually go for kshs 250 for 2 feet depth and length usually either between 1 or 2 feet and width of 2 feet. Those digging pits for irrigating crops charge according to the size of the farm, +- kshs 300 for 17 by 17 feet. Thus, the cost of installing zai pits is ksh 172,000 per acre.


Figure fanya juu terrace


Figure bananas planted in Zai pits

- Irrigation by use of watering cans is a common measure adopted, many people have positive attitude towards the measure but still want adopt use of generators since use of cans is a bit tiresome and time consuming.. However, drip irrigation in kitui central has not been adopted by many people. A farmer starting irrigation on a land that has not been ploughed would have to pay around kshs 1000 for the 17 by 17 feet piece of land. On drip irrigation, the lowest average estimation cost on a small farm of 50 by 50 feet went for kshs 200,000 excluding a water tank.


Figure shallow well used to irrigate kales


Figure: dried up shallow well

- The lack of water is a problem to those who perform mannual irrigation especially those have settled on the hills (Farmers who irrigate often using the mwewe river water, only a few have been dug boreholes)/ The use of shallow wells to provide water for irrigation has been adopted by multiple of the more wealthy people, as the water table of kitui central is near therefore it is easy to get ground water. People who had installed shallow wells were positive towards the measure To install shallow well of average depth of 30 feet (10M) one needs a total of ksh 80000 (usually +-kshs 1000 per feet with the diameter being not more than 3feet), but the price varies depending on the soils formation. For instance, a rocky layer goes for kshs 2500 per feet. When the well is build using bricks, sand and gravel, the average cost goes for kshs 85000. However, water shortage also has an impact to those who use shallow wells water since during months of August, September and October the water available decreases, one of the respondent said that during these months he has to reduce the size of land under irrigation.



Figure use of cans and generators for irrigation

- Roof water harvesting structures are mainly for domestic water - not for irrigation. Tanks of 10000lrs were owned by the richest respondents while the other 5000ltyrs to 120ltrs were owned by most people (acquired through loans of the FSA Itoleka).
- Mulching was also practiced by few farmers who irrigate and those having small farms near their homes, (kitchen garden.)
- Seeds that require less water is another measure which has been adopted by many people with majority of those who use the measure been positive towards the measure. The yellow maize (Katumani) requires less rain just like, millet, sorghum, cassava, pumpkin, butternut.
- Another common practice in kitui central is use of alluvial aquifers (scope hole water) for manual irrigation especially those who have land bordering the river Nzeu. Water from scope holes is taken by use of cans and water pump generators. This strategy is very prone to prolognued dry spells and scoop hole water is often not available during the dry period since the river dries up.

Figure Irrigated vegetables

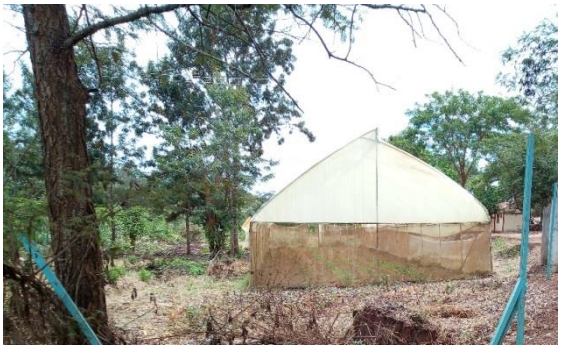


Figure use of greenhouse to grow vegetables

3.5. DRIVERS FOR ADAPTATION DECISIONS

Every rumour of technology has a successful story behind it, and they are not afraid of implementing it in Kitui. Most people are ready to do what they can and make Kitui Canaan but without any help , this will continue to be a wish to every farmer in Kitui. What strengthens the farmers are that in case they fail to work hard on the adaptation measures they have installed, they are sure to face the harsh impacts of drought most hunger and poverty

Respondents want to install new measures next year because of the following reasons: (I) they are ready to take loans and install any measure they have wished of; (II) they want to try other crops or trees and see its results; (III) they have migrated to wetlands and tend to irrigate; (IV) they have gotten more financially stable; (V) To avoid the shame when a neighbor installs a measure. You would also want to have something like his in your compound. This was seen with tanks and solars.

Financial reasons like a person getting a loan and installing a measure, are important to the adoption of drought adaptation measures. The main factor affecting the adoption of new measures is financial capital: many households have a plan to install new measures but investment costs are the greatest challenge. Richer farmers can use their salaries to buy tanks, the others depend on savings or donations.

Also **access and ownership of land** play s a role. Small size of land owned by households limits types of the measure they can install, example some people wants to install shallow wells and water pump generators but due to small land size it becomes non economical to spend more input than low output.

Another reason for adoption is “being tired of famine” – their **perceived risk** motivates them to act accordingly. Fluctuation of rainfall has forced some of the people to shift from agricultural activities to other economic activities therefore they have no adopted measures which can increase crop yields.
The **impact of past droughts** has made household to invest in new measures which can improve their crop yield such as use of seeds that requires little rainfall, crop irrigation, installation of shallow wells and use of green housing technology for to grow vegetables. Drought experiences has also made households to join farming cooperatives to learn about farming technology.

In terms of **training**, specific people are known to attend since they never reveal to other people .The reason they gave out is for them to enjoy the allowance themselves. What we call PRIDE. Unless the chief addresses about a training or a meeting, few people will know and live to believe that the government does not help nor held meeting for them to address their problems.

Also **external influence** plays a role: For example, the Kitui county governor mobilized farmers to drop farming of the ever failing maize, beans and start small-scale irrigation projects where farmers would grow horticultural crops. Another example is efforts of the county government, in partnership with Red Cross, to distributed green grams seeds to all farmers to plant and sell the harvest to the Indian marke. (However later the Indian government restricted the green grams importation).

However, other factors also play a role: one woman shares her drivers for vegetable growing and brick making using scope hole water and shallow well: "agriculture and self-employment is the only thing I values since I have freedom to work at my own convenient time" and with the scoop hole and shallow well, she perceives to have enough control over drought impacts.
Some of the households had no measures because of the rainfall regime which makes them reluctant to investe in agricultural activities, they rater venture in business activities in towns. One of the respondent said that the cost of input is higher than what he gets from the output because if rains fail he almost nothing after spending a lot in buying farm inputs (risk adversity).

3.6. FOOD SECURITY IN KITUI

People queue for the demeaning (d, mwolio in KiKamba), food aid in the Kamba tribe every time a dry season occurs.
For you to get relief food, your name has to be forwarded by the (Mutui) Village elder of your location. The names will also indicate that those are the only poor people in that area. Most of households I have surveyed say that once the village elder has a bad attitude with you, never will you get the aid. Also some cases like Chiefs selling the relief food occur or force you to bribe him so that you can get help.
The food aid consist of maize (yellow maize Kamba call it Katumani), and can be used for human consumption and also for plantation. Many farmers grow this maize in their farm because it succumbs to drought. It requires less rain. Other aids include beans, rice, French peas etc. The portioning is determined by the number of people and the available food.
Recommendations from government officials is the organizations essential for aiding Kitui residents with food should in turn help recipients build their own capacity to grow food. The food aid spoils the Kitui poor farmer's future. Oxfam recommended that food aid should only be provided in response to calls from national governments.
Picture shows the County Women representative Dr. Irene Kasalu helping chiefs giving relief food to Kisasi residents.

3.7. WATER SECURITY IN KITUI

To help solve the residents major problems, business oriented organizations like FSA what they call (ITOLEKA), Uwezofund , KENYA WOMEN FINANCE TRUST (KWFT) and much more have chipped in the areas to help people but with an aim of making profit. Women are the largest group who have joined them to get assets like tanks, solars, construct houses and modernized jikos, give loans, water pumps and many more. They give you what you want but agree on the terms. Failure to which they take all valuable you have that fits their money.
For one to become a member of the organizations, what you need to do is have shares whereby when you will be attending the trainings they offer, you deposit some cash which they call savings. The many savings you have, the much items and help you can acquire. I majorly focused with the Itoleka FSA since we have met a couple of households having tanks from them as shown in the figure above (right). We inquired of how one can get a 5000ml tank from the FSA. The members in such organizations form a

group of about 5 people and above according to how much you rate yourselves financially, since everyone has her own savings, they all get the items they want. For a tank, the minimum savings you should have is kshs 5000. The normal price for such a tank is kshs 42,000. Since you need the tank but can't afford to buy at once, the FSA officials will give but at an interest based on your agreement. Your guarantors have to be some of your group members. Incase I need a tank and I am a guarantor of a member who hasn't settled his debt, I wont get help.

The negative side of these organizations are that once a member fails to settle the debt, your group members together with the FSA official who was responsible during that time will pick any valuable item in your household that fit their money. The valuable items carried include roof tops, mattresses, cattle, window and door frames or panes and stored food.

3.8. FUTURE PERSPECTIVE

The main threat to food security for the people living in Kitui central is drought (rainfall regime) little and unpredictable rainfall which cannot be relied on. The severity of a drought's impact is determined by the interaction between levels of exposure and vulnerability. Food security and livelihoods are being undermined by a number of factors, including insecurity and conflict, high population growth, weakening community institutions, limited education opportunities, past poor governance and corruption and the shortcomings of contingency planning and response. In addition, people own only small plots of land thus cannot carry out agricultural activities at large scale, a situation which will be worsened by population increase. If the areas's isolation, insecurity, and weak integration persist, then vulnerability will deepen. The overall challenge is to sustain livelihoods in an environment that is becoming more unpredictable, and where people's access to and control over critical livelihood resources such as land is insecure.

Moreover, respondents suggested that, in future, there may be longer and more frequent dry periods interspersed with intense but shorter and less predictable periods of rainfall. Even the rainmakers in the area and people who can forecast weather through nature, said that the weather patterns were unusual. In ASAL like Kitui area, the poor rainfall weather patterns are likely to intensify water stress, reduce crop yields, exacerbate flooding, increase the incidence of human and livestock disease, accelerate desertification, reduce biodiversity, deplete water and, and intensify resource-based conflicts. The open water sources are likely to diminish exacerbated with over usage by livestock and people and higher-than-normal temperatures. Due to that reason, livestock will drink water 3 days a week occasionally, further reducing the water available.

Also soil fertility has an impact to food security. The prolonged cultivation on the same piece of land has rendered soil nonproductive forcing farmers to use fertilizers to increase land productivity. This makes agriculture more expensive and to some point farmers inputs exceeds output. As a result of degrading soil and erratic rains, food production will become less predictable and food security and poverty reduction efforts will be undermined. The low harvested experienced in most households will lead to over relliance of the food market hence food price rising creating a negative impact on households purchasing power. Competition over the limited resources is likely to lead to resource- based conflict between households, people and livestock.

Besides, the construction of road infrastructure (such as the recent Kitui – Kibwezi road development) causes a lot of land degradation. The Chinese need murrum for construction, they give farmers some cash and excavate the murrum on their land, leaving behind a depression as shown below; The murram when selling to someone costs ksh 1500 per tractor. After ful lexcavation, the person owning the area is left with an option of selling boulders for construction. A tractor full of boulders costs kshs 2500.
The water source of these construction workers is the dry river beds, water from aquifers. All shallow wells, wells dug across rivers, boreholes become dry when the road construction workers start pumping the water. Some of the respondents say it is a common behavior for the Chinese to deposit their waste at rivers leaving people with less water, which results in polluted water not healthy to drink from.

These 5 photos show a farm that has been mined to get murram for construction , that whole land that was used, she just got ksh 250,000 of which still she is to vacate that land since she is near the road.

These five photos show the effect of water extraction for road construction, The Chinese contractors have deeply scooped close to 15 feet in river mwewe to get water for residents. Chinese have scooped wells 50 metre interval along the river. Many aquifers have gone dry. Residents have complained the matter but no success has been achieved. The last picture shows mixture of concrete and cement deposited in the well. The water is clean but can't be consumed by people.

I do not understand the following (it contradicts the many crop failures and water shortages):

One of the most difficulty questions included the question about the number of years in which there was drought since 1980 this was due to the fact that Kitui central is not prone to severe droughts and they don't have remarkable experience of severe droughts, on the same question young interviewee especially those below 25 years had no idea about the droughts which occurred before they were born.