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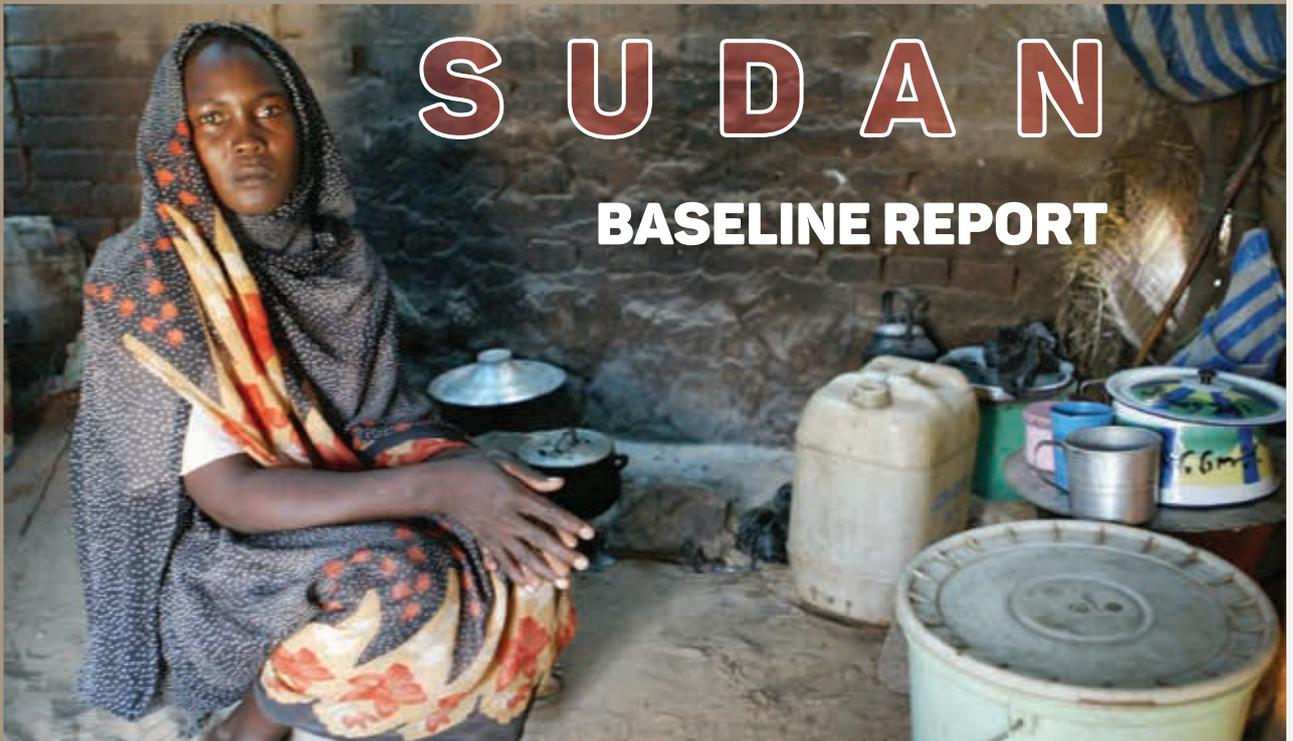
ANALYSING RESILIENCE FOR BETTER TARGETING AND ACTION



**FOOD AND NUTRITION SECURITY
RESILIENCE PROGRAMME IN THE**

S U D A N

BASELINE REPORT



FAO RESILIENCE
ANALYSIS REPORT

RESILIENCE INDEX MEASUREMENT AND ANALYSIS II - RIMA II



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CONTENTS

ACKNOWLEDGEMENTS	vi
ACRONYMS AND ABBREVIATIONS	vii
EXECUTIVE SUMMARY.....	viii
1. INTRODUCTION	1
1.1 Purpose of the baselines in the Food and Nutrition Security Resilience Programme.....	1
1.2 FNS-REPRO contribution to the Sudan's priorities.....	2
1.3 Country background	3
1.4 Objectives of the FNS-REPRO baseline survey.....	4
1.5 Scope of the FNS-REPRO baseline study.....	4
2. BASELINE METHODOLOGY.....	5
2.1 Sampling strategy.....	5
2.2 Main limitations	7
3. BASELINE RESULTS	9
3.1 Demographics.....	9
3.2 Livelihood.....	11
3.3 Assets, social networks and access to basic services.....	17
3.4 Shocks and coping strategies	25
3.5 Food security/nutrition.....	27
3.6 Resilience.....	33
4. BASELINE FINDINGS RELATED TO SPECIFIC INDICATORS OF THE LOGICAL FRAMEWORK.....	39
4.1 Summary of log-frame indicators.....	39
5. DISCUSSION OF LEARNING AGENDA QUESTIONS	41
5.1 Impact-level learning questions	42
5.2 Outcome-level learning questions	44
6. CONCLUSION	47
REFERENCES	48
APPENDICES	
1. Resilience measurement approach	49
2. Summary statistics disaggregated by beneficiary type and gender of household head.....	51

FIGURES

1	Household size by gender of the household head	9
2	Gender of household head.....	11
3	Livelihood sources in the last 12 months.....	11
4	Proportion of household income spent on selected expenses	13
5	Number of income sources by gender of household head.....	14
6	Received training related to gum Arabic production.....	16
7	Gum Arabic production constraints.....	16
8	Social networks and associations.....	17
9	Summary of livestock ownership and average number of livestock owned	19
10	Livestock keeping challenges	20
11	Agricultural tools owned by households.....	20
12	Main purpose of accessing credit.....	22
13	Access to functioning facility and minutes taken (one way).....	23
14	Sources of drinking water	25
15	Shocks experienced by the households in the last 12 months.....	26
16	Number of days in the last seven days that household used a coping strategy.....	26
17	Assistance received in the last 12 months disaggregated by beneficiary type	27
18	FCS categories.....	28
19	Food groups consumed in the household in the last seven days.....	28
20	Food groups consumed in the household in the last 24 hours	29
21	HDDS disaggregated by main livelihoods	30
22	RCI by gender of household head.....	33
23	RCI by beneficiary type	34
24	Average RCI by locality	34
25	Overall contribution of pillars to RCI.....	35
26	Contributing observed variables of Asset pillar	35
27	Contributing observed variables of SSN pillar	36
28	Contributing pillars of RCI by gender of household head.....	36
29	Contributing pillars of RCI by beneficiary type.....	37
30	RIMA-II model structure.....	49

TABLES

1	Sampled households' distribution by states/localities and treatment/ comparison	6
2	Education level by gender of household head.....	10
3	Annual income in USD by gender of household head	12
4	Income source by beneficiary type.....	13
5	Number of income sources by gender of household head and beneficiary type	14
6	Characteristics of gum Arabic production in project area disaggregated by gender of household head	15
7	Crops grown in summer by beneficiary type and gender of household head	18
8	Challenges in crop production disaggregated by beneficiary type and gender of household head.....	18
9	Adaptation practices disaggregated by gender of household head and beneficiary type.....	21
10	Access to transfer, credit, banking services and number of social networks engaged in	22
11	Access to facilities by beneficiary type.	24
12	FCS categories by gender of household head and beneficiary type	27
13	HDDS categories by gender of household head and beneficiary type	29
14	Responses to FIES raw questions.....	31
15	FIES prevalence by beneficiary type	31
16	Determinants of food security.....	31
17	Effect of shocks on RCI.....	37
18	Summary of key log-frame indicators	39
19	Definition of variables used in each pillar for RCI estimation.....	48
20	Summary statistics	50

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ACRONYMS AND ABBREVIATIONS

ABS	Access to basic services
AC	Adaptive capacity
AST	Assets
CA	Conservation Agriculture
CPA	Comprehensive Peace Agreement
CSI	Coping Strategy Index
FAO	Food and Agriculture Organization of the United Nations
FCS	Food consumption score
FIES	Food insecurity experience scale
FNS-REPRO	Food and Nutrition Security Resilience Programme
GAPA	Gum Arabic Production Association
HDDS	Household dietary diversity score
HRP	Humanitarian Response Plan
MEAL	Monitoring, Evaluation, Accountability and Learning
MIMIC	Multiple Indicators Multiple Causes
NRM	Natural Resource Management
RAP	Resilience Analysis and Policies
RCI	Resilience Capacity Index
rCSI	Reduced Coping Strategy Index
RIMA	Resilience Index Measurement and Analysis
RTEA	Resilience Team for Eastern Africa
SMoAAR	State Ministry of Agriculture and Animal Resources
SMoPER	State Ministries of Production and Economic Resources
SSN	Social safety nets
TLU	Tropical livestock units
UN	United Nations
UNAMID	United Nations Mission in Darfur
UNDAF	United Nations Development Assistance Framework
USD	United States Dollar

EXECUTIVE SUMMARY

The Food and Nutrition Security Resilience Programme (FNS-REPRO) of the FAO is a four-year programme of USD 28 million, funded by the Government of the Netherlands, that contributes directly to the operationalization of the United Nations Security Council 2417 by addressing the “cause-effect” relationship between conflict and food insecurity in the Republic of South Sudan, the Republic of the Sudan (Darfur) and Somaliland. The programme, which became operational in October 2019, is designed to foster peace and food security at scale through a multi-year livelihood- and resilience-based approach. The FNS-REPRO component in the Sudan focuses on supporting the production and value chain of gum Arabic. The programme is implemented in the North and East Darfur states.

STUDY APPROACH

This report acts as a baseline for the FNS-REPRO project for the Sudan. The purpose of the current study is two-pronged. The first is to collect baseline values for identified project indicators, which will be tracked over time and used to establish the impact of the project. The second is to identify and document lessons learned that will facilitate the continuous realignment of the current project’s theory of change and assist in defining and designing similar future food security projects in the Sudan as well as in other parts of the world with similar contexts. Overall, the study will employ a panel design with intervention and comparisons.

The study seeks to respond to the following broad questions:

1. To what extent has the Resilience Capacity Index (RCI) of the households in the study area changed because of the FNS-REPRO project?
2. To what extent has the income of the households in the study area changed from the beginning of the FNS-REPRO project to the end of the project?
3. To what extent has the food security status of the households in the study area changed from the beginning of the FNS-REPRO project to the end of the project?
4. Has the FNS-REPRO project supported the production of gum Arabic at household level in the project area?

To respond to the research questions, a baseline study was designed and data were collected from both intervention and non-intervention areas in North and East Darfur states. Data were collected from a total of 662 households, 391 treatment/beneficiary households and 271 comparison/non-beneficiary households. Data collection took place in September 2020. The data were collected by the staff of State Ministry of Agriculture and Animal Resources (SMoAAR) in North Darfur

and State Ministry of Production and Economic Resources (SMoPER) in East Darfur state, as well as Agricultural Planning Units in collaboration with FAO and the Sahari Organization for Development. The staff were trained for three days on mobile data-collection techniques (implemented using KoBo Collect) and the basics of FAO's Resilience Index Measurement and Analysis (RIMA) methodology.

MAIN FINDINGS

- The average Resilience Capacity Index (RCI) is estimated at 56. Male-headed households (RCI=57) are more resilient than female-headed households (RCI=51.7). Households in El Daein (RCI=65.4) and Rural El Fasher (RCI=65.8) have the highest resilience capacity, while households in Tweisha (RCI=50.2) have the lowest.
- Assets (AST) holding and access to social safety nets (SSN) contribute the most to the observed resilience capacity.
- The three main sources of household income in the study area are crop farming (excluding gum Arabic) (77 percent), agricultural labour (43 percent) and non-skilled labour (25 percent). Male-headed households are more dependent on income from crop production, agricultural labour and livestock production, while female-headed households are more dependent on crop production, agricultural labour and trade or petty trade.
- Approximately 22.7 percent of the households were reported to have at least one member of the household involved in gum Arabic production in the last 12 months and most of these households were in North Darfur. Of these households involved in gum Arabic production, 10 percent were female-headed households. The median household land under Hashab or Acacia trees is 10 mukhamas. Among the households involved in gum Arabic production, 44 percent were reported to be combining the production of gum Arabic with other crops. Approximately 21 percent of households accessed gum Arabic market information in the last 12 months. Over 94 percent of the households in the project area involved in gum Arabic production use the Sonki tool to tap gum Arabic and the same proportion do not use protective gear while undertaking the tapping. All the households surveyed in the project area sell the gum Arabic produced as independent traders; none of these households sells through registered cooperative groups.
- Approximately 68 percent of the households have an acceptable Food Consumption Score (FCS). There is a statistically significant difference in FCS by gender of the household head – male-headed households have higher FCS. In terms of the specific foods eaten in the past seven days, oils and fats, cereals, spices and milk are frequently consumed, at least four days a week. Proteins from meat, eggs and pulses are least consumed by the households.
- Wealth index, agricultural assets index, tropical livestock unit holding, size of land cultivated during summer and education of the household head (years) were found to be positively associated with household food security. The main shock that undermines food security in the survey area is reduced household income.



1

INTRODUCTION

1.1 PURPOSE OF THE BASELINES IN THE FOOD AND NUTRITION SECURITY RESILIENCE PROGRAMME

The FNS-REPRO of the FAO is a four-year programme of USD 28 million, funded by the Government of the Netherlands, that contributes directly to the operationalization of the United Nations Security Council 2417 by addressing the “cause-effect” relationship between conflict and food insecurity in Somaliland, South Sudan and the Sudan (Darfur). The programme became operational in October 2019.

FNS-REPRO is the first programme in Eastern Africa specifically designed to foster peace and food security at scale in some of the least stable regions through a multi-year livelihood and resilience-based approach. Until now, interventions in these regions have been of a humanitarian programming nature exclusively. The design of FNS-REPRO allows FAO and partners to set examples of building food system resilience in protracted crises. In this programme, resilience is defined as: “The ability to prevent disasters and crises as well as to anticipate, absorb, accommodate or recover from them in a timely, efficient and sustainable manner. This includes protecting, restoring and improving livelihoods systems in the face of threats that impact agriculture, nutrition, food security and food safety.” (FNS-REPRO proposal 2019; 6).

FNS-REPRO deliberately focuses on unstable regions in the Horn of Africa with a view to address root causes and consequences of protracted crises and food and nutrition insecurity from a conflict-sensitive perspective. The programme contributes to the potential of sustainable, inclusive growth and climate action by working with other actors and stakeholders on the humanitarian-development and peace nexus.

The programme adopts an innovative area- and livelihood-based approach that looks at the multidimensional threats and risks that communities are exposed to, while identifying and utilizing opportunities for improved livelihood resilience. Value chains that can contribute to more resilient food systems resulting in improved food and nutrition security and localized peace dividend were agreed in the proposal. These are Fodder (Somaliland), Gum Arabic (the Sudan – Darfur) and Seeds (South Sudan). FNS-REPRO activities will be built around each of these value chains.

In addition to the analyses undertaken during the development of the proposal and further in-depth context and value chain analysis during FNS-REPRO’s inception phase, a Resilience Index Measurement and Analysis (RIMA) baseline study was conducted, whose design feeds into the overall monitoring, evaluation, accountability and learning agenda of the individual projects. In this regard, the baseline has short-, medium- and long-term objectives.

The RIMA baseline analysis provides a snapshot of the current situation regarding resilience capacity and its determinants of access to basic services and infrastructure, adaptive capacities, income-generating activities, formal and informal social safety nets, social networks and productive and non-productive assets, and shocks. With this information, the programming team can better understand the profiles of the populations with whom they are working and their needs in terms of resilience to food insecurity. This information also equips project/programme managers with evidence to support their decisions about the intervention.

In the short term, the baseline will provide feedback on the project's theory of change – whether it is well conceived in terms of project entry points or if some adjustments or complementary actions are to be considered. From the analysis, the programming team can ascertain if the strategy of the project will address the critical factors for resilience to food insecurity. The baseline also serves to support the targeting strategy of the project to ensure that the criteria for selection are aligned with local profiles and realities of the implementation context.

In the medium term, it sets the thresholds and references for monitoring at activity, output and outcome levels. In this programme, outcome-level food security, livelihood and coping strategy indicators will be tracked to understand fluctuations and to inform any adaptations required.

In the long term, the baseline serves as the reference point for impact assessment at the mid-point or end of the intervention by analysing both changes over time and differences between populations with the same profiles and risk exposure, including between target and comparison groups whenever possible.

In addition, the baseline has been designed with sufficient rigour in terms of sample size and methodology (outlined in more detail below) to allow for the data and findings to be used for four years to inform interventions in the same areas. By gathering a wealth of data on the pillars of resilience, the data and analysis may exceed the scope of the current programme; as such, the baseline can provide evidence for discussion with programming teams and humanitarian, development and peace partners on how to collaborate and coordinate to meet the needs of the affected population most effectively. Therefore, the value of the current baseline does not stop with its initial analysis, but continues as the findings are shared, discussed and reexamined in collaboration with various partners and stakeholders, including the communities profiled in the report.

1.2 FNS-REPRO CONTRIBUTION TO THE SUDAN'S PRIORITIES

FNS-REPRO in the Sudan seeks to build food-system resilience in East and North Darfur through support to their gum Arabic production. Throughout, FAO will develop participatory approaches that especially include women and youth in various links of the gum Arabic value chain.

The FNS-REPRO project in the Sudan is aligned with the Country Programming Framework Government priority 2: Sustainable Agriculture (Crops, Livestock, Fisheries, Forestry) and Natural Resource Management (NRM) and Government priority 3: Disaster Risk Management and Resilience Building.

These priority areas address the challenges of low production and productivity as well as embracing the whole value chain spectrum in a sustainable manner, while adding value to agricultural produce and linkages to domestic and international trade. The priorities are in line with the government objectives to achieve increased agricultural incomes, employment and agricultural exports, and to protect natural resources as well as building resilient agricultural livelihoods.

The project will also contribute to the enhancement of household and community resilience, hence to United Nations Development Assistance Framework (UNDAF) Focus Area 2: Environment, Climate

Resilience and Disaster Risk Management. Adaptive livelihood strategies will be developed and propagated and will focus on improving agricultural and livestock production systems, financing mechanisms and disaster risk reduction. By facilitating the adoption of technologies and practices that increase productivity, promoting community approaches for natural resource management and facilitating multi-stakeholder dialogues to address related issues, the project will contribute to UNDAF Focus Area 1: Economic Development and Poverty Reduction.

The project is fully aligned to the Humanitarian Response Plan (HRP) 2019, which seeks to strengthen the links between humanitarian response and longer-term development by bridging short-term relief and longer-term assistance that require humanitarian and development actors to work within the parameters of the New Way of Working and leverage their comparative advantages. In particular, the project will contribute to the HRP Outcome 2, which targets small-scale farmers for improved agricultural productivity and efficiency across the food value chain.

FAO is renowned for promoting food security, resilient livelihoods, agriculture and rural development; as well as reducing rural poverty and ensuring effective access to social protection. FAO is uniquely positioned to address the challenges of creating the jobs and livelihood opportunities in rural areas that have a strong agricultural and agropastoral vocation, which will generate the conditions for economic diversification, resilience-building and greater stabilization.

1.3 COUNTRY BACKGROUND

The Sudan is located on the Red Sea, a strategic shipping route between two of the world's largest markets – Asia and Europe. The country shares borders with Chad, Egypt, Eritrea, Ethiopia, Libya and South Sudan and faces Saudi Arabia across the Red Sea. According to the World Bank, the Sudan can be classified as a lower middle-income country (gross national income of \$1,740 per capita). The country is classified as “far from world markets”. This means that it faces a three-dimensional geographic challenge compared with other countries – density, distance and division.

The Sudan is the third-largest country in Africa, with a total area of 1,882,000 sq km and an estimated population of 39 million. Sixty-six percent of the population lives in rural areas, of whom 20 percent are largely nomadic. The population is growing rapidly (2.1 percent per year), with an average household size of 5.8 people. The population density is low, with around 46 persons per square kilometre. The country is divided into 18 states, each with its own legislative body and state government. Lower levels of government exist in each state. The names of the states are Blue Nile, Central Darfur, East Darfur, Gedaref, Gezira, Kassala, Khartoum, North Darfur, North Kordofan, Northern, Red Sea, River Nile, Sinnar, South Darfur, South Kordofan, West Darfur, West Kordofan and White Nile. The entire population of the Greater Darfur Region (Central Darfur, East Darfur, North Darfur, South Darfur and West Darfur) is estimated at eight million people (20.5 percent of the country). The Sudan is currently experiencing its most stable period in 15 years. Since the independence gained on 1 January 1956, the country has had alternating forms of democratic and authoritarian government. The Sudan has experienced lengthy periods of conflict – from 1955 to 1972 and again from 1983 to 2005. The latter stands as one of the longest in Africa's post-independence history.

In 2005, the National Congress Party (the party of former President Omar El-Bashir) and the Sudanese People's Liberation Army/Movement signed a Comprehensive Peace Agreement (CPA), formally ending the war between the North and the South. In line with the stipulations of the CPA, a referendum took place in Southern region of the Sudan in 2011 on whether the region should remain as part of the Sudan or become independent. The vast majority of southerners voted for independence. South Sudan officially declared its independence on 9 January 2011. Following the secession of South Sudan, a second republic was declared (replacing the interim constitution that was in place under the CPA).

After 30 years of Omar El-Bashir's dictatorship, the Sudanese people overthrew his regime in April 2019. The self-inflicted economic crisis, characterized by kleptocracy and neglect of productive sectors like agriculture and related food system activities, was the main trigger for the revolution. The country was hit by an economic slowdown, which has worsened since 2017 following the sharp devaluation of the currency, which was linked to the partial removal of international economic sanctions. This prompted high inflationary pressures and particularly an increase in prices of imported goods such as fuel and wheat, which triggered widespread protests from mid-December 2018 onwards. The protests lasted until April 2019, when the former President was ousted. After a temporary transitional military government, the Sudanese militaries and opposition groups established a transitional civilian-led joint-government in August 2019, for a period of three years, with a technocrat cabinet and signed the Constitutional Declaration on 17 August 2019. As a result, the Sudan's relationship with the international community improved.

The military continues to play an important role in the Sudan's politics throughout the forecast period. Moving away from a centralized state, with limited popular oversight on Government actions, to a civilian-led Government that has pledged to remain accountable to the population at large and to address the Sudan's endemic socio-economic problems, creates both opportunities and challenges for structural reforms and United Nations (UN) operations in the country.

The Darfur conflict triggered an unprecedented international humanitarian response that is continuing today. The conflict between the Darfur rebel insurgents and government counterinsurgents was the most severe, with widely reported attacks on civilians across the region from 2003 to 2004.

The underlying factors of the conflict in Darfur are complex, multilevelled and encompass local, national, regional and international dimensions simultaneously. Understanding how each cycle of conflict has led to the dynamics currently at play, requires an understanding and appreciation of the following historical causal factors of the crisis in that region.

From October 2016 onwards, when the National Dialogue for Peace was declared to be over and the 'National Document' was submitted to former President Omar El-Bashir, Darfur has witnessed a reduction in violence. However, the region still faces unacceptable levels of insecurity, particularly in pocket areas in South, Central and North Darfur. This scenario was driven by changing regional dynamics, the strategic defeat of armed opposition groups by the government in Darfur, the willingness of the Government of the Sudan to undertake unilateral ceasefires in Darfur and a reduced public appetite for conflict. In part due to the reduction in violence, the African Union – United Nations Mission in Darfur (UNAMID) was able to withdraw from the Sudan at the end of 2020 (after 14 years).

Despite the reduction in violence, the structural drivers of conflict (poor rule of law, lack of basic services, economic marginalization, land tenure system and unsustainable management of natural resources), coupled with the structural impact of 15 years of active fighting, remain unaddressed.

1.4 OBJECTIVES OF THE FNS-REPRO BASELINE SURVEY

The overall objective of this baseline survey is to determine preliminary baseline values of the project indicators and establish targets for the indicators during the inception phase.

1.5 SCOPE OF THE FNS-REPRO BASELINE STUDY

The FNS-REPRO baseline study covered 662 households in East Darfur and North Darfur, covering 391 treatment/beneficiary households and 271 comparison/non-beneficiary households. It is important to mention that the households selected represent households in the project area and not the two states.

2

BASELINE METHODOLOGY

The baseline uses the RIMA model developed by FAO as its basis. This methodology systematically explores the relationship between selected household-level variables of resilience to construct the RCI based on the four pillars of resilience (assets, social safety nets, adaptive capacity and access to basic services). The RCI measures a household's capacity to withstand stresses and shocks that have long-lasting effects (FAO, 2016b). RCI provides a useful baseline to inform or validate targeting decisions, as it can be used as a ranking tool to identify households that are most at risk and to identify the specific weaknesses that increase vulnerability (FAO, 2016b). In addition, the methodology explains how much each pillar contributes to resilience capacity and how each observed variable contributes to its pillar (FAO, 2016b). It is with this information that the theory of change, targeting and implementation strategy can be examined, and that selected indicators of the project including FCS, household dietary diversity score (HDDS), coping strategy index (CSI) and RCI can be calculated.

2.1 SAMPLING STRATEGY

A two-stage cluster sampling design was used in this study. All the villages in the identified target areas were listed down, categorized by areas receiving project interventions and those that will not receive any proposed interventions. In the first stage of sampling, the clusters (villages) were selected using the probability-proportional-to-size method. Households within each identified village were selected randomly using a systematic random-walk method.

The enumerators that were engaged in the survey were government field officers working for the East and North Darfur State Ministry of Production and Economic Resources and Ministry of Agriculture and Animal Resources respectively. The logistics support was provided by the Sahari Organization for Development. FAO facilitated access to the project beneficiary committee members who acted as community mobilizers in the case or treatment sites. The enumerators were trained in El Fasher for three days on the types of questions in the survey and how to ask them. This was covered in a hard copy questionnaire and through tablets using KoBoCollect software. An important criterion for enumerator selection was their ability to speak English and Arabic. The questionnaire was coded on the tablets using both English and Arabic; the enumerator would select his or her language of choice. Fifteen enumerators were trained and engaged for data-collection purposes. The enumerators were divided into two teams. Each enumerator was expected to complete five interviews in a day.

A random sample of 662 households was drawn from the two states of East Darfur and North Darfur, distributed as shown in Table 1. The survey was conducted in September 2020.

The household questionnaire was designed to capture individual and household well-being parameters or indicators useful for measuring and monitoring progress of the project, while also allowing for analysis of an index for household-resilience capacity using the FAO resilience index measurement and analysis (RIMA-II) tool (FAO, 2016b).

The questionnaire covered the following topics:

- Household location demographics;
- Household assets;
- Household access to basic services;
- Household participation in social networks and training;
- Migration;
- Water, sanitation and hygiene;
- Household livelihoods and sources of income (including livestock production, crop farming and gum Arabic production);
- Remittances and credit;
- Expenditure;
- Food security indicators – FCS, HDDS, Food Insecurity Experience Scale (FIES);
- Shocks and coping strategies;
- Assistance received; and
- Decision-making.

Midway or towards the end of the project, a midline or end-line survey will be conducted on the same households and the results compared with the baseline to evaluate the impact of the project on the target households and locations. This method of panel data collection provides the strongest evidence for attribution of a causal relationship between the implemented interventions and the effect on beneficiaries.

Table 1: Distribution of sampled households by states/localities and treatment/comparison

State	Locality	Sampled households	Beneficiaries	Non-beneficiaries
East Dafur	Abu Karinka	117	63	54
	El Daein	13	13	0
	Adeela	134	71	63
North Dafur	Rural El Fasher	10	10	0
	Umm Keddada	59	10	49
	Kalimando	148	97	51
	Tweisha	111	111	0
	Total	662	391	271

2.2 MAIN LIMITATIONS

The team faced certain challenges during and after the data-collection process. These included training that had to be postponed several times due to travel and gathering restrictions related to Covid-19. It is usually recommended to have a data-validation workshop with the enumerators immediately after data collection has been finalized to check on any inconsistencies in the dataset. This data-validation exercise was not undertaken as physical meetings were not allowed during the Covid-19 pandemic and movement curfews had been imposed. Instead, the data analysts arranged virtual meetings with the data-collection supervisors and FAO field officers and clarified data that appeared to be inconsistent.





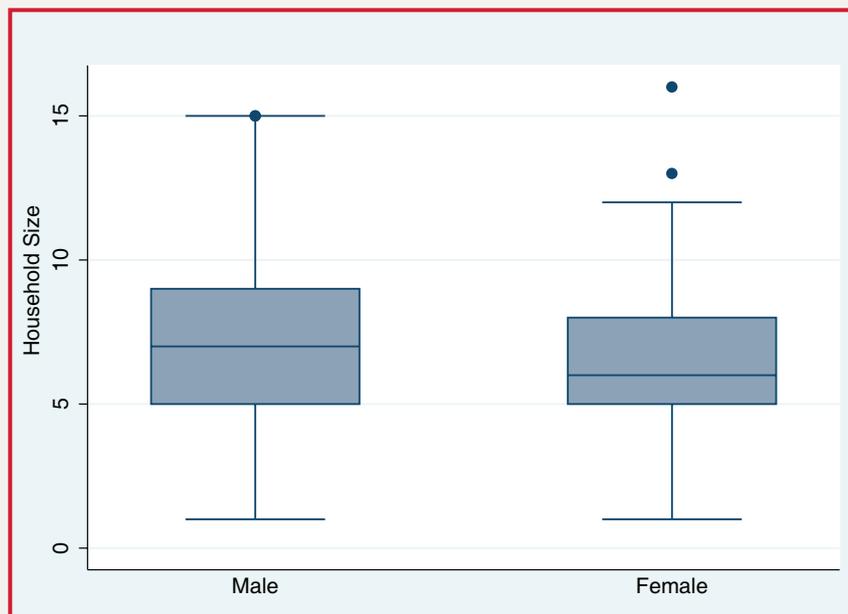
3 BASELINE RESULTS

3.1 DEMOGRAPHICS

3.1.1 HOUSEHOLD SIZE

The median household size in the study area is 7, with male-headed households having a higher median household size of 7 compared with female-headed households at 6 (Figure 1). Both beneficiary and non-beneficiary households have a median household size of 7.

Figure 1: Household size by gender of the household head



3.1.2 DEPENDENCY RATIO

The dependency ratio is the number of dependants in a population divided by the number of working-age people. Dependants are defined as those aged zero to 14 and those aged 65 and older. Working age is between 15 to 64 years. The ratio describes how much pressure an economy faces in supporting its non-productive population. The higher the ratio, the greater the burden carried by working-age people.

From the sampled households, the median age dependency ratio is estimated at 133, suggesting that for every 100 productive/working community members there are 133 dependants. Male-headed households have a higher dependency ratio (150) than female-headed households (122). Beneficiary households have a higher dependency ratio (150) than the non-beneficiary households (100).

3.1.3 LEVEL OF EDUCATION OF HOUSEHOLD HEADS

Table 2 summarizes the level of education of the heads of the sampled households. Approximately 30 percent of household heads did not have any formal education; 20 percent have a secondary and above education level. Disaggregation of education level of household head by gender of the household head reveals that over 50 percent of female household heads did not attend formal education, compared with 25 percent for male household heads. About the same percentages of female and male household heads cannot read and write (54 percent for females and 24 percent for males).

Table 2: Education level by gender of household head

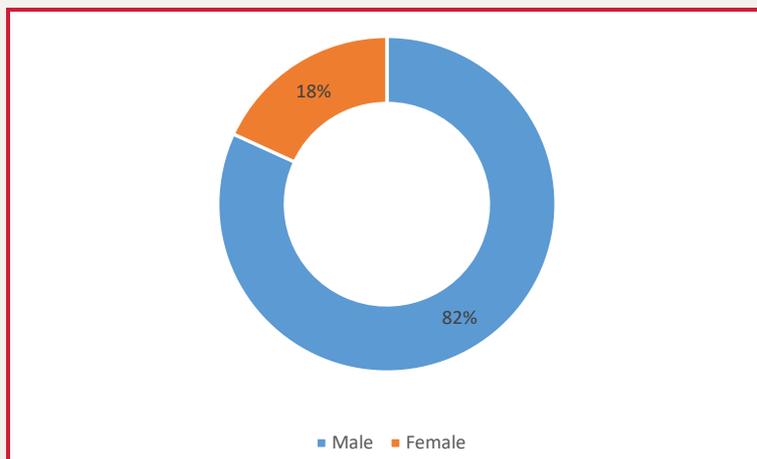
Highest level/household head gender	Male	Female	Total
None/never been to school	25.09	51.67	29.91
Primary incomplete	28.23	20.83	26.89
Primary complete	16.24	14.17	15.86
Secondary school incomplete	7.75	4.17	7.1
Secondary school complete	12.73	4.17	11.18
Higher than secondary	9.96	5.00	9.06
Total	100	100	100



3.1.4 GENDER OF HOUSEHOLD HEAD

Figure 2 presents the gender of household head for the households surveyed. The majority of the households (82 percent) are headed by males.

Figure 2: Gender of household head



3.2 LIVELIHOOD

3.2.1 MAIN SOURCE(S) OF INCOME

The three main sources of income for the households in the 12 months preceding the survey are crop farming, excluding gum Arabic (77 percent), agricultural labour (43 percent) and non-skilled labour (25 percent) as summarized in Figure 3. The same trend is observed for the main source of household income for the last three months.

Figure 3: Livelihood sources in the last 12 months

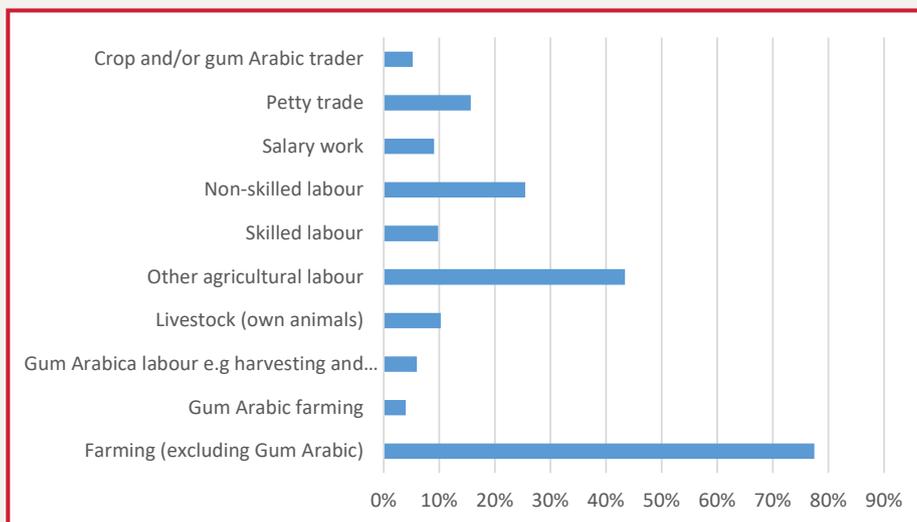


Table 3: Annual income in USD by gender of household head

Income source	Male		Female		Total	
	Median	N	N	Median	Median	N
Crops	521.27	454	89	271.49	543	452.49
Gum Arabic	253.39	135	15	217.19	150	253.39
Livestock sale and livestock products	217.19	167	24	135.75	191	217.19
Agricultural labour	452.49	297	70	361.99	367	434.39
Skilled labour	579.19	43	11	868.78	54	579.19
Non-skilled labour	483.26	132	21	325.79	153	452.49
Trade/petty trade	651.58	94	26	624.43	120	633.48
Sale of firewood	217.19	47	13	173.76	60	217.19
Salary (employment)	841.63	44	10	651.58	54	814.48
Total income	1 208.13	542	120	760.18	622	1 122.17

Note: The income was estimated in Sudanese Pounds (SDG) and converted to USD based on the official exchange rate in December 2020 (1 USD = 55 SDG). At the time there was a significant difference between the official rate and the parallel (black market) rate – with the parallel market approximately five times the official rate (1 USD = 280 SDG). However, on 21 February 2021, the Sudan’s central bank sharply devalued the Sudanese Pound, announcing a new regime to unify official and black market exchange rates in an effort to overcome a crippling economic crisis and access debt relief. As a result, the official central bank rate was changed to 1 SDG = 380 SDG. This should be kept in mind when comparing the income (USD) data from baseline with the midterm and end line data, to avoid drawing incorrect conclusions on project outcomes in the future.

The median annual income of households in the survey area is USD 1 112. Male-headed households’ earnings are higher (USD 1 208) compared with female-headed households (USD 760). There is variation in income generated from the main sources disaggregated by household head gender (see Table 3). Male-headed households are more dependent on income from crop production, agricultural labour and livestock production/sales, while female-headed households are more dependent on crop production, agricultural labour and trade/petty trade. Approximately eight percent of the households reported that they have received remittance from family members, and of these, each household received an average of USD 180 as remittance in a period of 12 months preceding the survey. Only three percent of the households have bank accounts. Approximately 38 percent of the households accessed credit in the last three months, with the only source being friends and relatives; none obtained credit from a bank or formal financial institution.

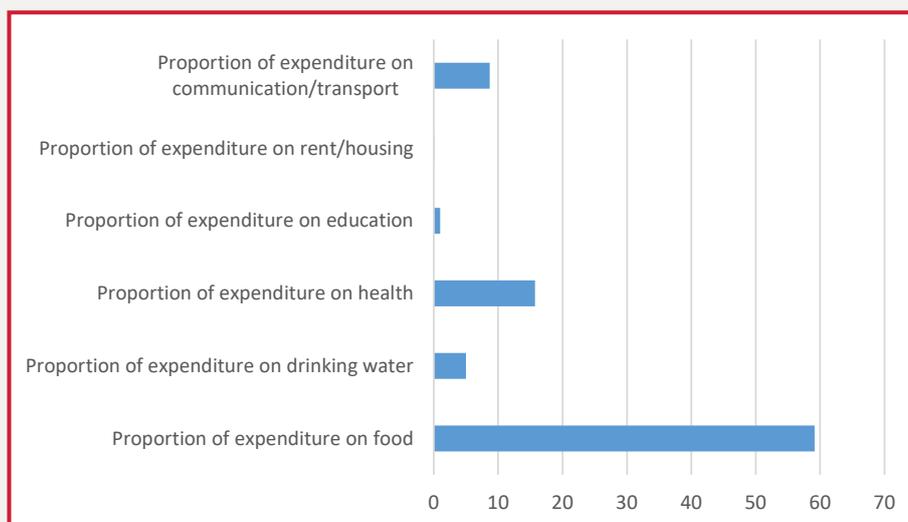


Table 4: Income source by beneficiary type

Income source	Non-beneficiaries		Beneficiaries		Overall	
	N	Median	N	Median	N	Median
Crops	219	452.5	324	434.4	543	452.5
Gum Arabic	25	181.1	125	253.4	150	253.4
Livestock sale and live-stock products	83	181.0	108	221.7	191	217.2
Agricultural labour	150	389.1	217	452.5	367	434.4
Skilled labour	13	868.8	41	543.0	54	579.2
Non-skilled labour	69	452.5	84	457.0	153	452.5
Trade/Petty trade	47	615.4	73	651.6	120	633.5
Sale of firewood	28	217.2	32	193.7	60	217.2
Salary (Employment)	26	746.6	28	841.6	54	814.5
Total income	271	1 066.1	391	1 176.4	662	1 122.2

Table 4 shows the income sources disaggregated by type of beneficiaries. The main income sources are the same for both beneficiary types. There is no significant difference in the amount of income earned between beneficiary and non-beneficiary households. As expected, more households are deriving their livelihood through gum Arabic in beneficiary areas compared with non-beneficiary households.

Figure 4 shows proportion of household income spent on various expenses. The key expenses taking up a large proportion of household income are food (59 percent), health (16 percent), transport/communication (nine percent) and drinking water (five percent).

Figure 4: Proportion of household income spent on selected expenses

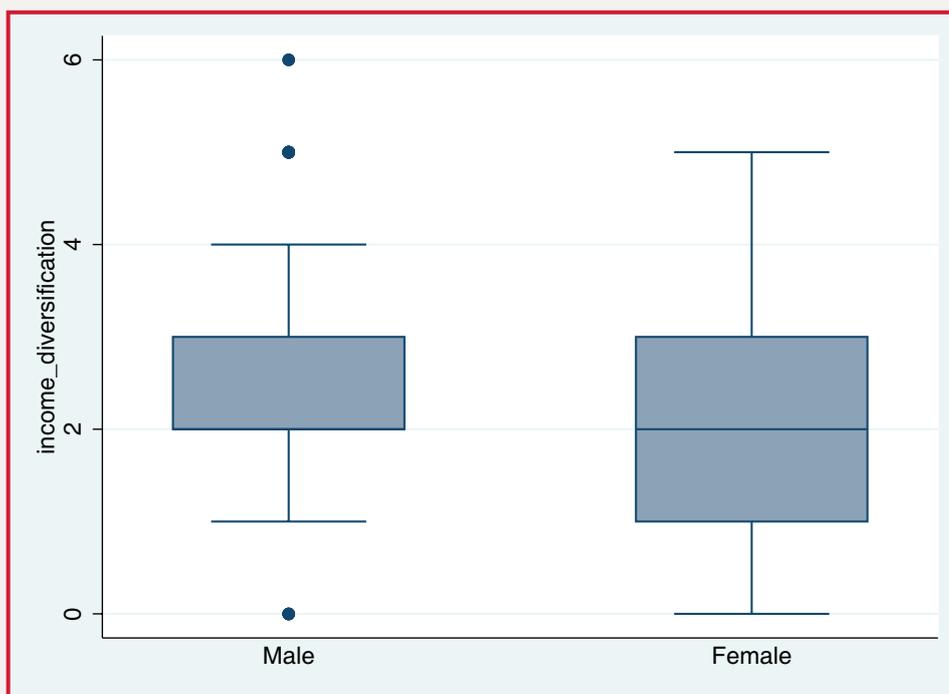
3.2.2 LIVELIHOOD STRATEGIES (DIVERSIFICATION); INCLUDES LIVELIHOOD/ INCOME AND CROP DIVERSIFICATION

Approximately 15 percent of the households rely on one income source and this number is higher for female-headed households (25.8 percent) compared with male-headed households (13 percent). Furthermore, on average, each household has a median of two income sources and there is minimal variation in number of income sources by gender of the household head (Table 5 and Figure 5). There is not much variation in income diversification between beneficiaries and non-beneficiaries.

Table 5: Number of income sources by gender of household head and beneficiary type

Number of income sources	Male (%)	Female (%)	Non-beneficiaries (%)	Beneficiaries (%)	Total
1	13	26	17	15	16
2	37	35	40	35	37
3	34	25	32	32	32
4	13	12	9	15	13
5	2	2.5	2	3	2
6	<1	<1	<1	<1	<1
Total	100	100	100	100	100

Figure 5: Number of income sources by gender of household head



3.2.3 GUM ARABIC PRODUCTION

Approximately 22.7 percent (n=150) of the households were reported to have at least one member of the household involved in gum Arabic production in the last 12 months and most of these households are in North Darfur. Of the households involved in gum Arabic production, 10 percent are female-headed households. The median household land under Hashab or Acacia trees is 10 mukhamas. Among the households involved in gum Arabic production, 44 percent were reported to be combining the production of gum Arabic with other crops. On average, each of the households involved in gum Arabic production owns approximately 165 Hashab or Acacia trees and the average age of each mature gum Arabic tree in the project area is approximately 10 years. These characteristics of gum Arabic production have been summarized by gender of household head and beneficiary type in Table 6.

Approximately 21 percent of households accessed gum Arabic market information in the last 12 months. Over 94 percent of the households in the project area involved in gum Arabic production, use the Sonki tool to tap gum Arabic and the same proportion do not use protective gear while undertaking the tapping. All the households surveyed in the project area sell the gum Arabic produced as independent traders; none sells through registered cooperative groups. However, 42 percent of these households were reported to belong to at least one Gum Arabic Production Association (GAPA). Some of these societies mentioned as GAPAs by the households include *Awlad, Bardany, Bobay, Estafugna, Meiram Darfur, Seyalay, Umsiweek* and *Wad Kota*. The majority of the households (83 percent) did not received any training, while 15 percent received training on improved tapping techniques and seven percent received training in agroforestry (see Figure 6).

Table 6: Characteristics of gum Arabic production in project area disaggregated by gender of household head

Characteristics among the 150 households involved in gum Arabic production	Male-headed household	Female-headed household	Non-beneficiaries	Beneficiaries
% farming gum Arabic	90%	10%	17%	83%
Median land under gum Arabic trees (in mukhamas)	10	6	5	10
Median number of mature gum Arabic trees owned by household	200	50	60	200
Median age of mature gum Arabic trees owned by household	10	12		
Median Kintas of gum Arabic produced in the last 12 months	4	2	4	5
Median gum Arabic seedlings planted by household in the last 12 months	15	15	1	20
Median income from gum Arabic in the last 12 months (in USD)	253	217	181	253

Figure 6: Received training related to gum Arabic production

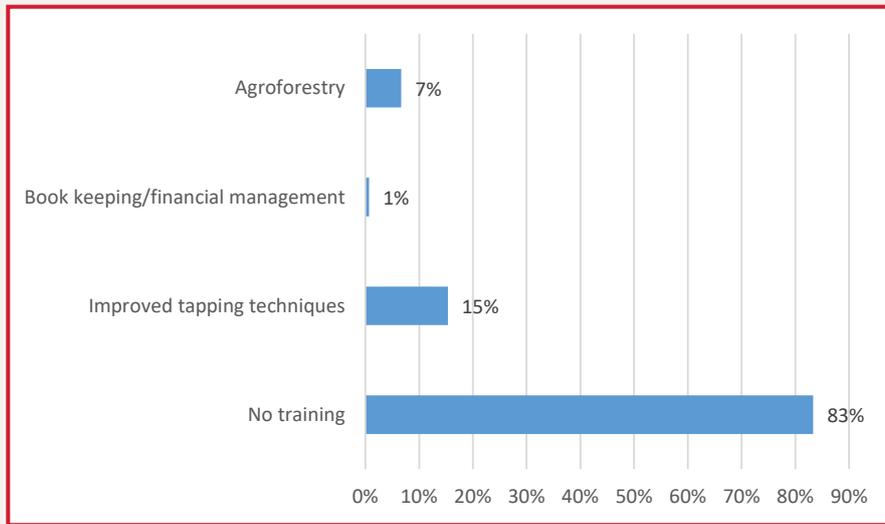
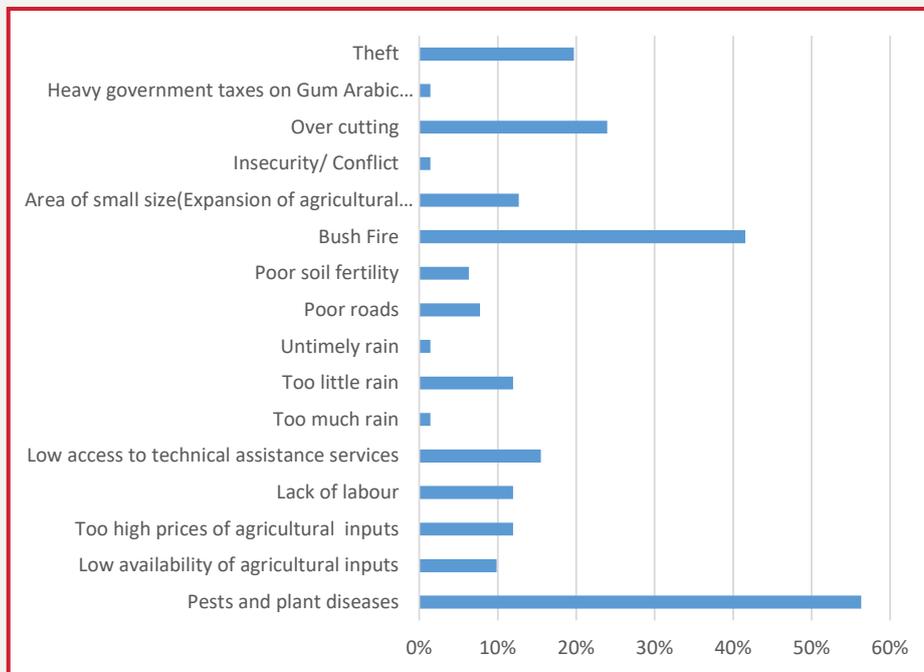


Figure 7 shows the main constraints faced by households involved in gum Arabic production in the last 12 months. The five main constraints are pests and diseases (56 percent), bush fire (42 percent), overcutting (24 percent), theft (20 percent) and limited access to technical assistance (15 percent).

Figure 7: Gum Arabic production constraints

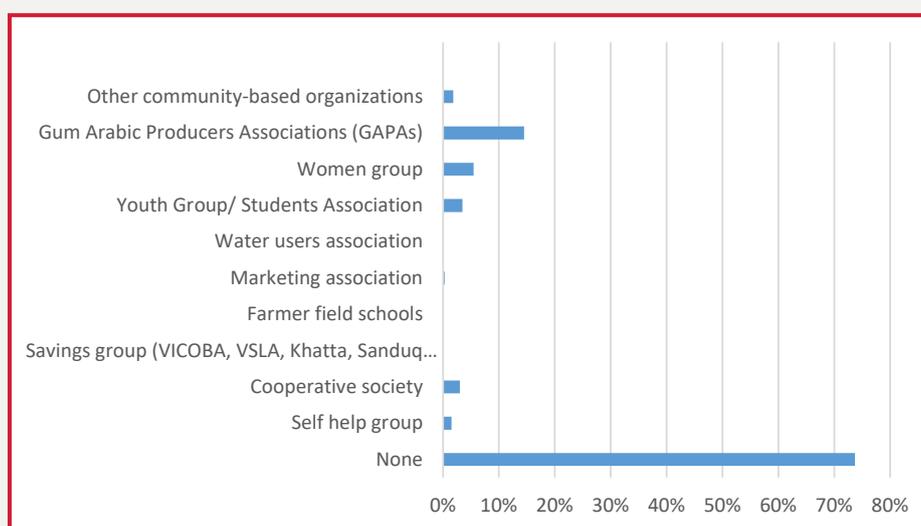


3.3 ASSETS, SOCIAL NETWORKS AND ACCESS TO BASIC SERVICES

3.3.1 SOCIAL CAPITAL: SOCIAL NETWORKS AND ASSETS AVAILABLE TO THE HOUSEHOLD IN TIMES OF DIFFICULTY, SUCH AS ABILITY TO RELY ON FAMILIAL AND COMMUNITY NETWORKS

Approximately 27 percent of the households have a household member belonging to at least one community network or group. The three main networks in the study area are gum Arabic producers' associations (14.5 percent), women groups (5.4 percent) and youth groups (5 percent) (Figure 8).

Figure 8: Social networks and associations



3.3.2 NATURAL CAPITAL: ACCESS TO LAND AND CROP PRODUCTION

Access to sufficient cultivation and grazing land is important in increasing rural household productivity and diversification of income sources. Approximately 93 percent of households in the study have access to arable land and use it for cropping. On average, each household cultivated six mukhamas of land during summer and engaged in minimal planting during winter. Male-headed households on average tilled seven mukhamas during summer and their female counterparts tilled an average of three mukhamas. There is no difference in size of land cultivated during summer for beneficiary and non-beneficiary households; both cultivated seven mukhamas. Approximately 70 percent of the households cultivate land under their ownership, while 30 percent were reported to have rented land for cultivation. The majority (98 percent) of the land ownership is by customary tenure (social legitimacy) and two percent of the households were reported to have legal documents of land ownership. Table 7 presents the main crops grown in the survey area during summer, disaggregated by gender of household head and beneficiary type. The four main crops are groundnuts, millet, sorghum and sesame. Very few households (five percent) undertake crop production in winter and the main crops during that time are millet, sorghum and groundnuts.

Table 7: Crops grown in summer by beneficiary type and gender of household head

	Beneficiary (%)	Non-beneficiary (%)	Male (%)	Female (%)	Overall (%)
None	6	5	4	13	6
Maize	2	1	1	1	1
Sorghum	43	47	45	45	45
Millet	73	66	72	61	70
Rice	1	1	2	0	1
Cowpeas	7	4	5	7	6
Groundnut	82	87	85	81	84
Sesame	45	38	43	37	42
Watermelon	15	8	14	5	12
Vegetables	3	12	6	10	7

Table 8 presents challenges faced by households while undertaking crop production in the survey area. The main challenges are pests and plant diseases, high prices of agricultural inputs, low availability of agricultural inputs and lack of labour.

Table 8: Challenges in crop production disaggregated by beneficiary type and gender of household head

	Beneficiary (%)	Non-beneficiary (%)	Male (%)	Female (%)	Overall (%)
Pests and plant diseases	72	81	76	75	76
Low availability of agricultural inputs	27	29	28	27	28
Too high prices of agricultural inputs	48	50	49	50	49
Lack of labour	28	29	30	22	28
Limited access to technical assistance services	13	9	11	16	12
Too much rain	3	5	3	6	4
Too little rain	13	7	11	9	11
Untimely rain	1	0	1	1	1
Poor roads	1	0	1	1	1
Poor soil fertility	12	10	10	18	11
Bush fire	1	2	1	1	1
Area of small size	7	9	8	9	8
Insecurity/conflict	0	0	0	0	0

3.3.3 PHYSICAL CAPITAL: LIVESTOCK ASSETS, ACCESS TO PRODUCTIVE TOOLS, ETC.

Access to assets increases the household's ability to manage and mitigate against assorted shocks (including drought and conflict) as well as help in smoothing consumption during such periods. Furthermore, access to assets can help such households handle income uncertainties and escape poverty. In this section, two kinds of assets that are important in the survey area are discussed – livestock and productive tools. Figure 9 presents the livestock ownership and average number of livestock species owned per household. Approximately 50 percent of the households own at least one of the livestock species. Approximately 38 percent of the households own goats and each household owns four goats on average. Thirty-four percent of households own donkeys, with an average of one donkey per household, while 15 percent of households own chickens with an average of five chickens per household. Nine percent of households own cattle, with an average of four head of cattle per household. Eight percent of households own sheep, with an average of 10 sheep per household. Six percent of the households own camels, with an average of one camel per household. In terms of per capita tropical livestock units (TLU), each household has a median per capita TLU of 0.13, among the households involved in livestock rearing. Female-headed households have a median per capita TLU of 0.12 compared with male-headed households with a median per capita TLU of 0.13. There is no significant difference in per capita holding between beneficiary households (per capita TLU=0.12) and non-beneficiary households (per capita TLU=0.15)

The main livestock product sold by households in the study area is live animals (68 percent). Fewer than one percent of households are involved in the sale of milk, skin/hides, eggs and honey products. Figure 10 presents the main challenges that households in the survey area experience when rearing livestock; the two main challenges being pests and diseases and lack of veterinary services.

Figure 9: Summary of livestock ownership and average number of livestock owned

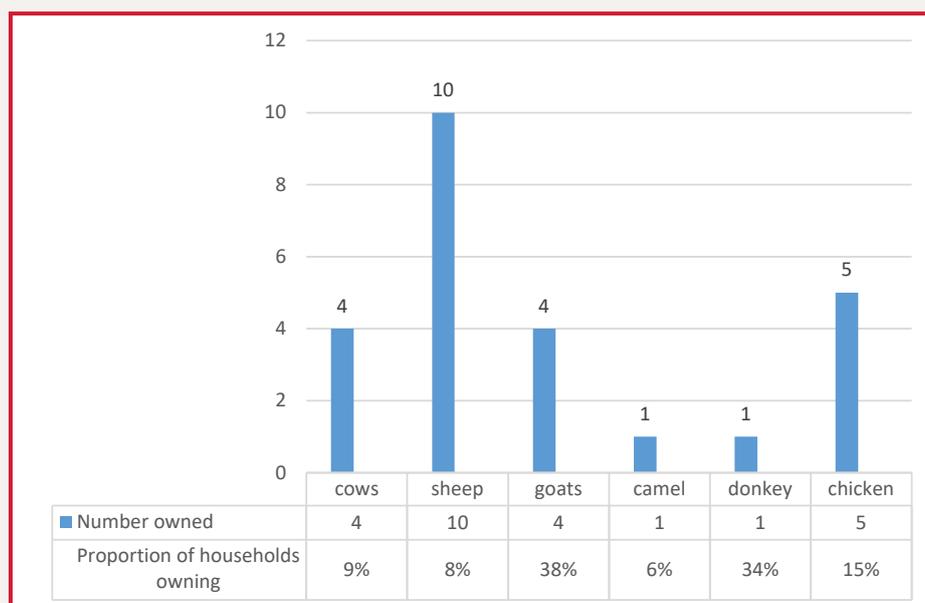
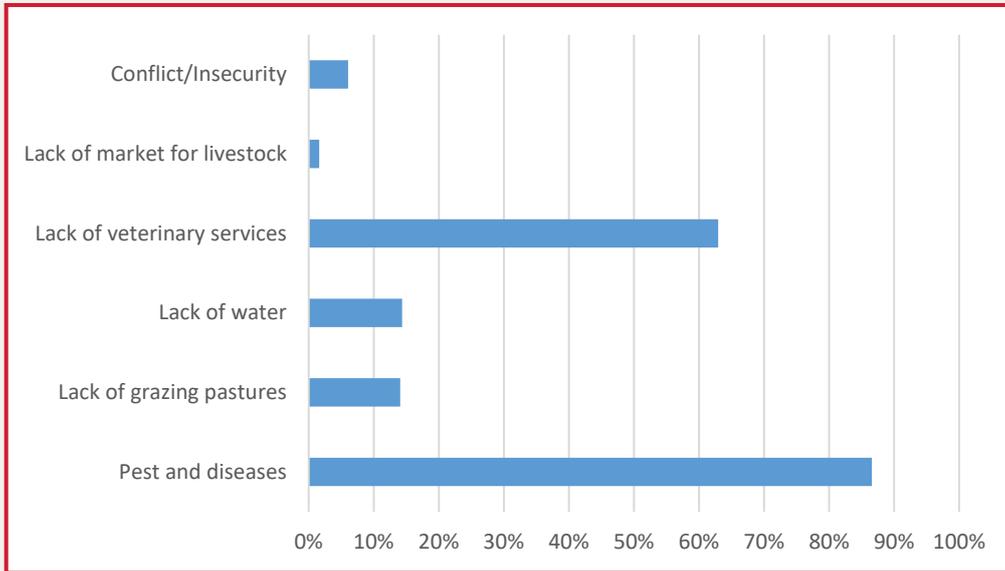


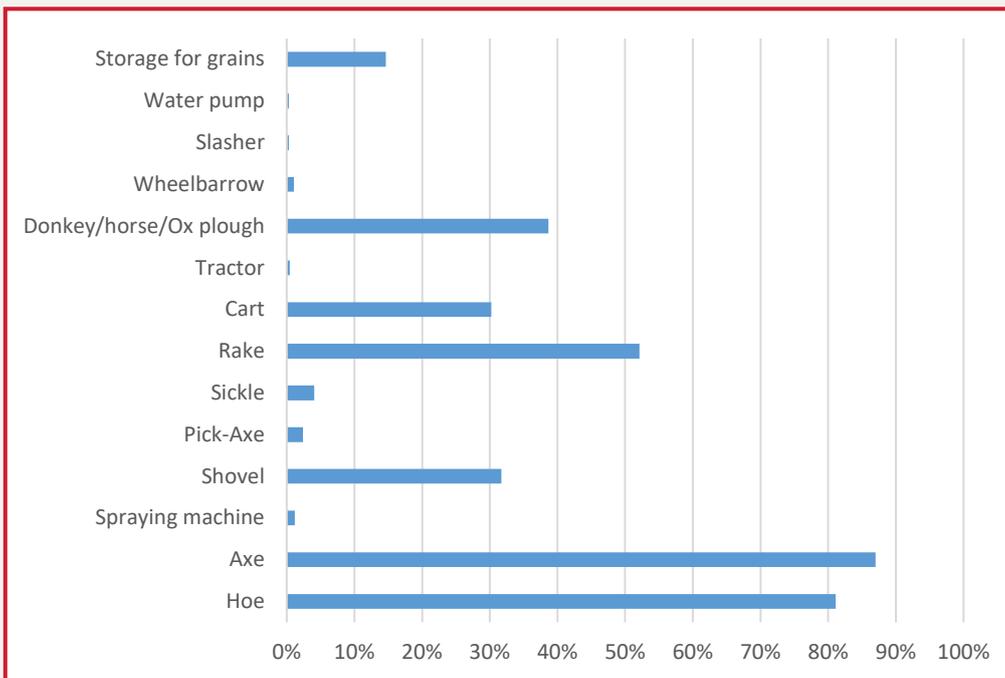
Figure 10: Livestock-keeping challenges



Eight percent of the households reported that they migrated their livestock in search of feed in the survey area.

Figure 11 shows the types of agricultural tools owned by the households in the survey area. The majority owns less productive tools such as hoes (81 percent), axes (87 percent), rakes (52 percent) and donkey or horse ploughs (39 percent).

Figure 11: Agricultural tools owned by households

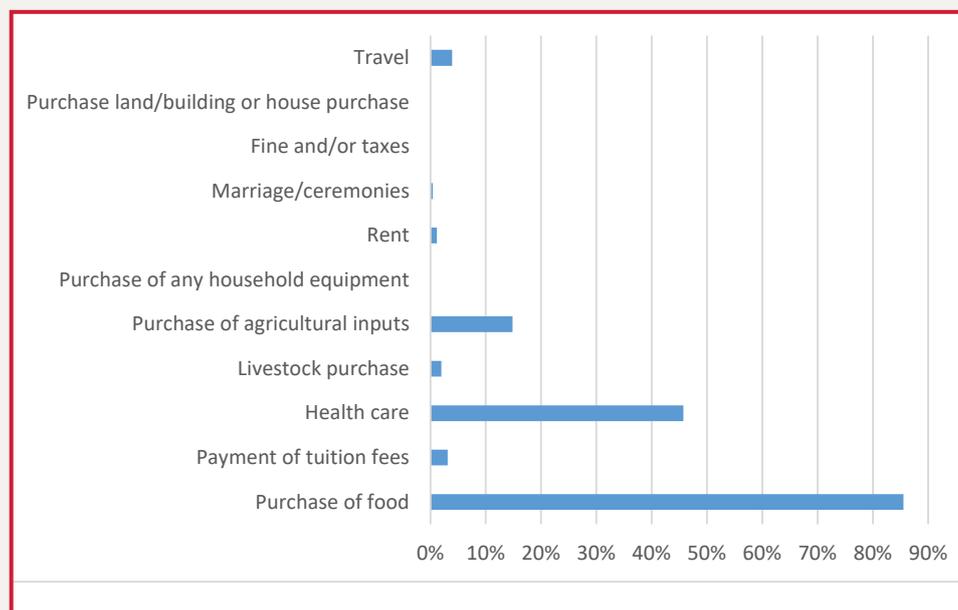


3.3.4 CROPS AND LIVESTOCK ADAPTATION PRACTICES

Table 9 presents the different livestock and crop adaptation practices reported by the households in the survey area disaggregated by gender of household head and beneficiary type. The main adaptation practices are crop diversification, intercropping and minimum tillage.

Table 9: Adaptation practices disaggregated by gender of household head and beneficiary type

Adaptation practice	Beneficiaries (%)	Non-beneficiaries (%)	Male (%)	Female (%)	Overall (%)
Using high-quality seeds/planting materials of adapted varieties	7	4	6	7	6
Crop diversification	63	64	67	47	63
Organic crop farming	10	10	9	15	10
Modification of cropping calendar	2	3	2	4	3
CA practice – mulching (covering the soil with crop residues)	2	6	4	2	4
CA practice – cover cropping/green manuring	1	2	2	1	1
CA practice – crop rotations and associations (intercropping)	39	36	39	32	38
CA practice – minimum tillage/minimum soil disturbance/direct seeding/reduced or improved ploughing	46	50	49	42	48
Water and irrigation management measures (introduction of new and/or improved irrigation methods, introduction of infield water conservation measures)	<1	<1	<1	<1	<1
Nutrient and soil management practices that reduce fertilizer use (microdosing)	5	2	4	2	4
Agroforestry – nitrogen fixing and shade trees (tree planting in or around farms)	19	5	14	11	13
Improving local livestock genetics through crossbreeding or buying and rearing any crossbred/improved breeds of livestock	<1	<1	<1	<1	<1
Taken crop or livestock insurance	<1	<1	<1	<1	<1
Improved post-harvest storage facilities for crop and livestock products	2	2	2	<1	2

Figure 12: Main purposes of accessing credit

3.3.5 FINANCIAL CAPITAL: ACCESS TO CREDIT, MONETARY TRANSFERS, ETC.

Household access to credit plays an important role in improving their daily productivity, increasing their knowledge, improving their well-being and offering an avenue to escape from poverty. Approximately 38 percent of households were reported to have accessed some form of credit in the last three months preceding the survey. Figure 12 presents the main purposes of seeking the credit. The three main purposes are purchase of food (86 percent), access to healthcare (46 percent) and purchase of agricultural inputs (15 percent). Based on these results, little of the accessed credit is used for education and livestock-related expenses. Most of the accessed credit is used for daily food consumption and healthcare needs, which could play a catalytic role in sinking the households into deeper poverty and reducing their creditworthiness in their social circles. The source of the accessed credit was mainly friends, neighbours and relatives (99 percent), which indicates limited access to formal financial services and especially credit.

Table 10 presents a summary of households that accessed several services including access to formal and informal transfers, access to bank and credit and the number of social networks the household members engage in, disaggregated by gender of household head and beneficiary type.

Table 10: Access to transfer, credit, banking services and number of social networks engaged in

	Male-headed (%)	Female-headed (%)	Non-beneficiaries (%)	Beneficiaries (%)	Total (%)
Access to informal transfers	8	13	7	10	9
Access to formal transfers	58	59	31	77	58
Number of associations	32	25	21	37	30
Access to credit	37	48	37	40	39
Access to bank	4	1	4	3	3

3.3.6 ACCESS TO BASIC SERVICES VARIABLES

Significant leaps in alleviating poverty and improving the food security situation in an area are highly dependent on the availability of functioning basic services. Moreover, access to basic services is a key ingredient for economic and social development in rural areas. Improved infrastructure, including transport and electricity connectivity, improves access to other services such as education, health care and access to information and other agricultural extension services. Access to financial services such as mobile money and banking services increases opportunities for doing business. Availability of functioning markets for the purchase of inputs and sale of livestock and agricultural products minimizes exposure to losses emanating from poor prices for smallholder farmers and spoiled perishable products.

In this section, access to basic services is explored by examining distance in terms of minutes it takes a person in the survey area to reach the location where selected services are provided. Figure 13 presents the percentage of households that have access to the selected facility and how long it takes one way (donkey walk time) for someone to reach the point of service. The least accessible facilities are extension services offices, veterinary clinics, farmer field schools, offices that provide weather information, money transfer points and hospitals. The approximate distance to such facilities is two hours. Over 85 percent of households in the study area can access basic schools, secondary schools, health facilities and the various markets.

Figure 13: Access to functioning facility and minutes taken (one way)

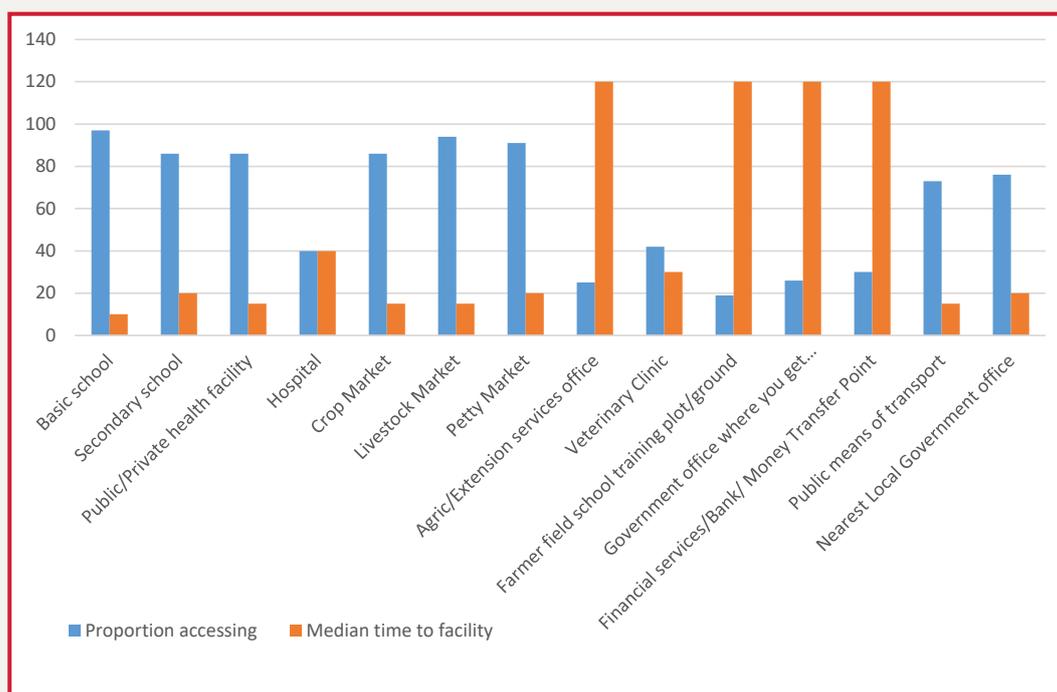


Table 11 presents a summary of households that are able to access the different facilities and the median distance to the selected facilities disaggregated by beneficiary type.

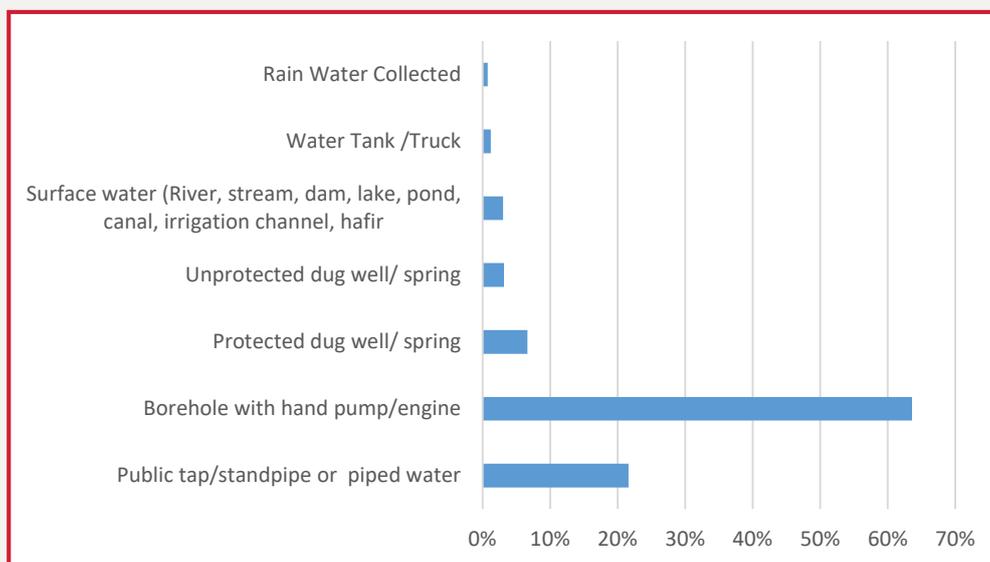
Table 11: Access to facilities by beneficiary type

Facility	Non-beneficiaries		Beneficiaries		Overall	
	% accessing	Median	% accessing	Median	% accessing	Median
Basic school	96	10	97	10	97	10
Secondary school	74	15	95	20	86	20
Public/private health facility	77	20	92	15	86	15
Hospital	42	30	39	40	40	40
Crop market	80	15	91	15	87	15
Livestock market	87	20	99	15	94	15
Petty market	84	20	97	20	92	20
Agricultural extension services office	24	45	26	120	25	120
Veterinary clinic	40	20	43	36	42	30
Farmer field school training plot/ground	15	120	22	120	19	120
Government office where weather/ climate information can be obtained	21	120	29	120	26	120
Financial services/ bank/money transfer point	32	30	28	140	30	120
Means of public transport	65	15	79	17	73	15
Nearest local government office	6	15	86	20	76	20

3.3.7 WATER, HYGIENE AND SANITATION

Figure 14 presents the main sources of drinking water in the survey area. The two main sources are boreholes with a hand pump (64 percent) and a public tap/stand pipe (22 percent). Approximately 92 percent of the sampled households have access to an improved water source. Only 60 percent of the households reported that the mentioned water sources have been functional in the last 12 months. The time spent to collect water (walking from household to main drinking-water collection point, waiting there, filling the container and returning home) was estimated at 30 minutes. Only two percent of the households treat the water that they collect before drinking it. Approximately 93 percent of the households use traditional pit latrines, four percent of the households do open defecation into a bush or stream and three percent use improved pit latrines. Forty-four percent of the households reported that at least one person in the household suffered from diarrhoea in the last three months, while 70 percent reported contracting malaria.

Figure 14: Sources of drinking water



3.4 SHOCKS AND COPING STRATEGIES

3.4.1 RELEVANT SHOCKS REPORTED BY THE HOUSEHOLD, AS WELL AS COPING STRATEGIES TO RESPOND TO - AND OVERCOME - REPORTED SHOCKS

Figure 15 presents the main shocks experienced by households in the survey area in the last 12 months preceding the survey. The main shocks were high food prices, high cost of transport/fuel, reduced income/employment, serious illness and epidemic.

Approximately 31 percent of the households in the survey area reported that in the past seven days there had been times when they did not have enough food or money to buy food. Figure 16 presents food consumption coping strategies undertaken by households in the last seven days preceding the survey. Of the households experiencing a shortage of food or money to buy food, each household reduced the number of meals eaten in a day for approximately 2.5 days, on average, in the last seven days. Similarly, they ate borrowed food or borrowed money to purchase food for two days in the last seven days preceding the survey.



Figure 15: Shocks experienced by the households in the last 12 months

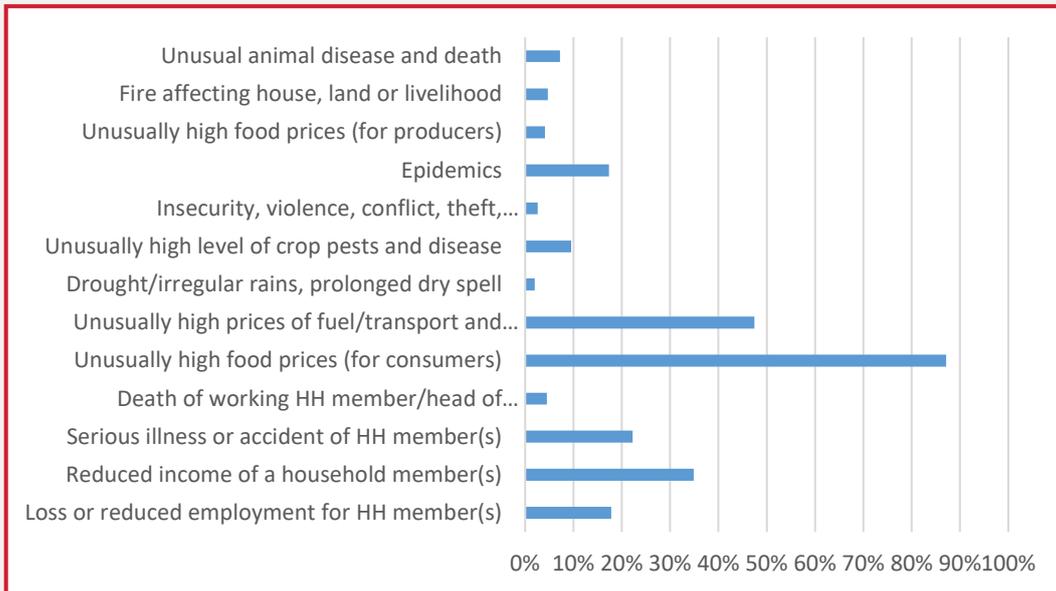
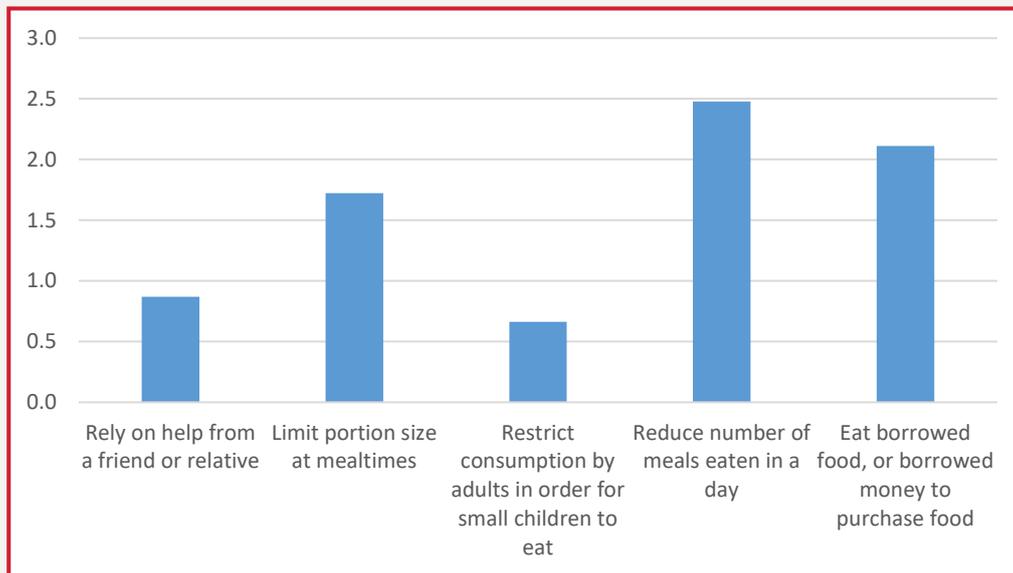


Figure 16: Number of days in the last seven days that households used a coping strategy

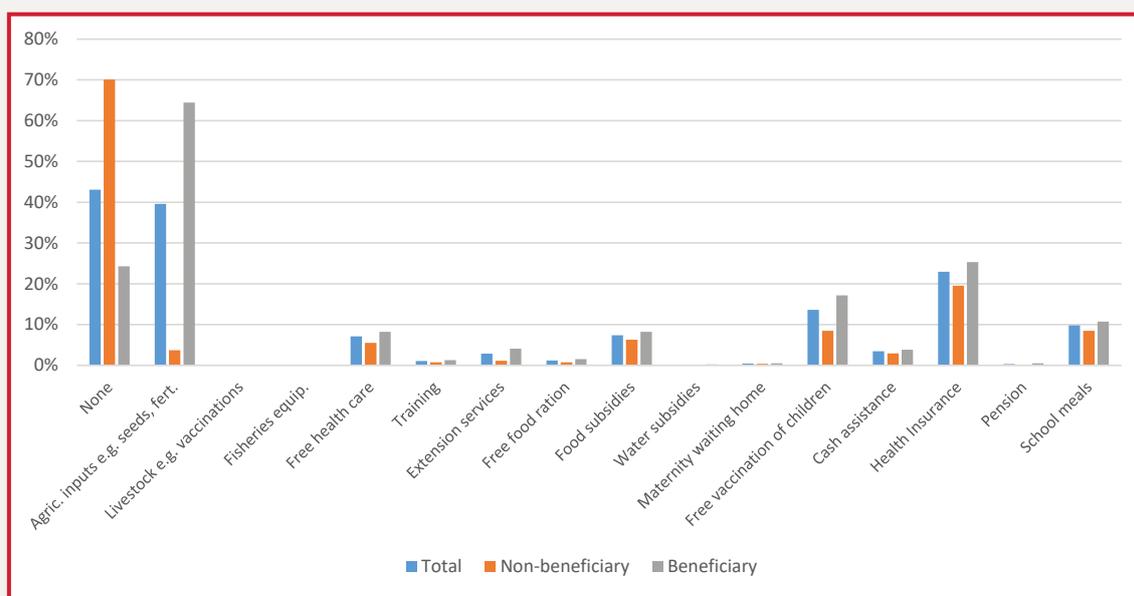


The average reduced coping strategy index (rCSI) in the study area is 3.3, measured on a scale of 0 to 56. This indicates that few households are using coping strategies and those that are, do not employ severe coping strategies.

Approximately 57 percent of the households reported that they had received assorted assistance from various government bodies or partners in the last 12 months. The various types of assistance received by the households are presented in Figure 17. The main forms of assistance include agricultural inputs (40 percent), health insurance (23 percent), free vaccination for children (14

percent) and school meals (10 percent). Disaggregated by beneficiary type, 30 percent of the non-beneficiaries and 76 percent of the beneficiaries received such assistance. The beneficiary households generally received more assistance in terms of agricultural inputs than non-beneficiary households.

Figure 17: Assistance received in the last 12 months disaggregated by beneficiary type



3.5 FOOD SECURITY/NUTRITION

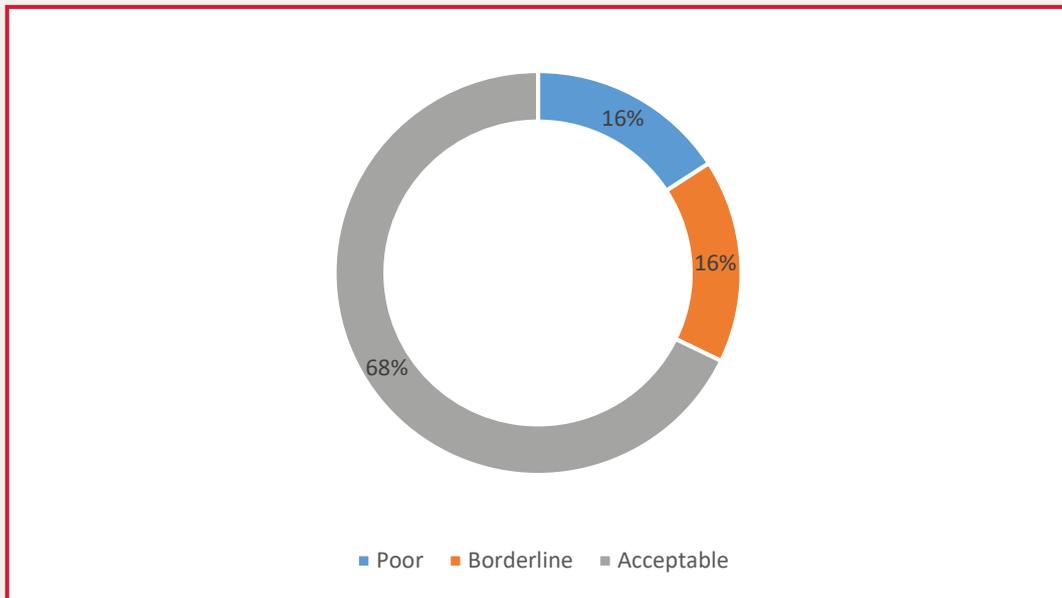
3.5.1 FOOD CONSUMPTION SCORE

Food consumption score (FCS) measures the variety, quality and quantity of food consumed by a household in a period of seven days. The average FCS in the surveyed area is 51. Figure 18 shows the percentage of households in the different FCS categories. Approximately 68 percent of the households have an acceptable FCS. There is a statistically significant difference in FCS by gender of the household head: male-headed households have higher FCS (t-test, p-value=0.001). There is no significant difference in FCS between beneficiary households (FCS=51) and non-beneficiary households (FCS=53). Table 12 presents the FCS categories by gender of household head and beneficiary type.

Table 12: FCS categories by gender of household head and beneficiary type

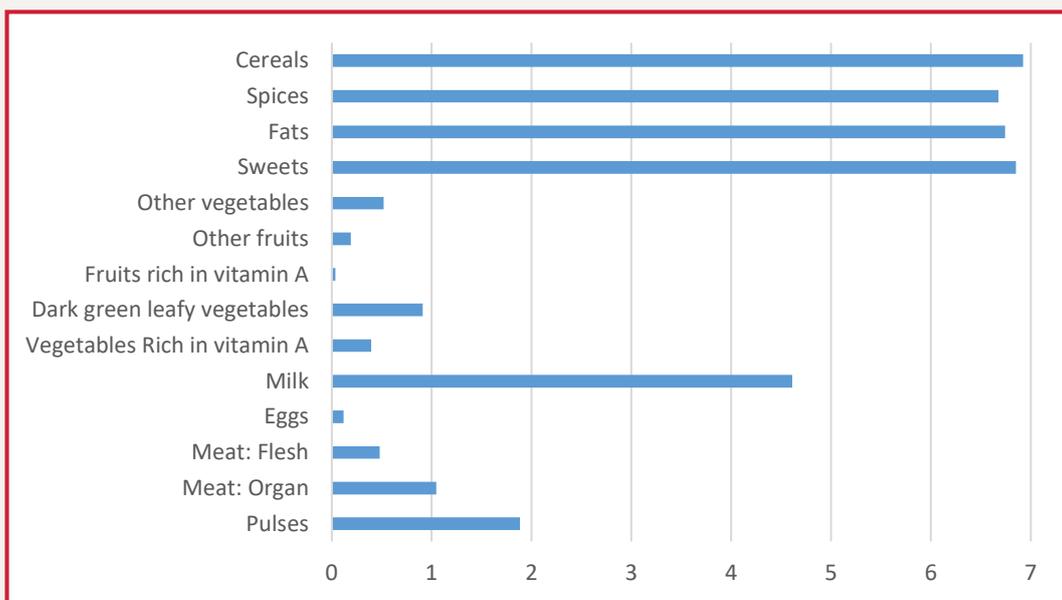
FCS category	Non-beneficiaries (%)	Beneficiaries (%)	Male (%)	Female (%)	Overall (%)
Poor	14	17	13	28	16
Borderline	17	16	17	14	16
Acceptable	69	67	70	58	68

Figure 18: FCS categories



In terms of specific foods eaten in the past seven days, oils and fats, cereals, spices and milk are frequently consumed, at least four days a week. Proteins from meat, eggs and pulses are least consumed by the households. Pulses are consumed approximately two days in a week. Meat is eaten once a week on average (98 percent). Fruits are rarely consumed in the household within a period of seven days.

Figure 19: Food groups consumed in the household in the last seven days



3.5.2 HOUSEHOLD DIETARY DIVERSITY SCORE

Household dietary diversity score (HDDS) measures the diversity of foods consumed in a household. The data for consumption are collected for a recall period of 24 hours. The average HDDS for the households in the survey area is 7. On average, a household in the survey area consumed seven different kinds of food out of the 12 food groups in the 24 hours preceding the survey.

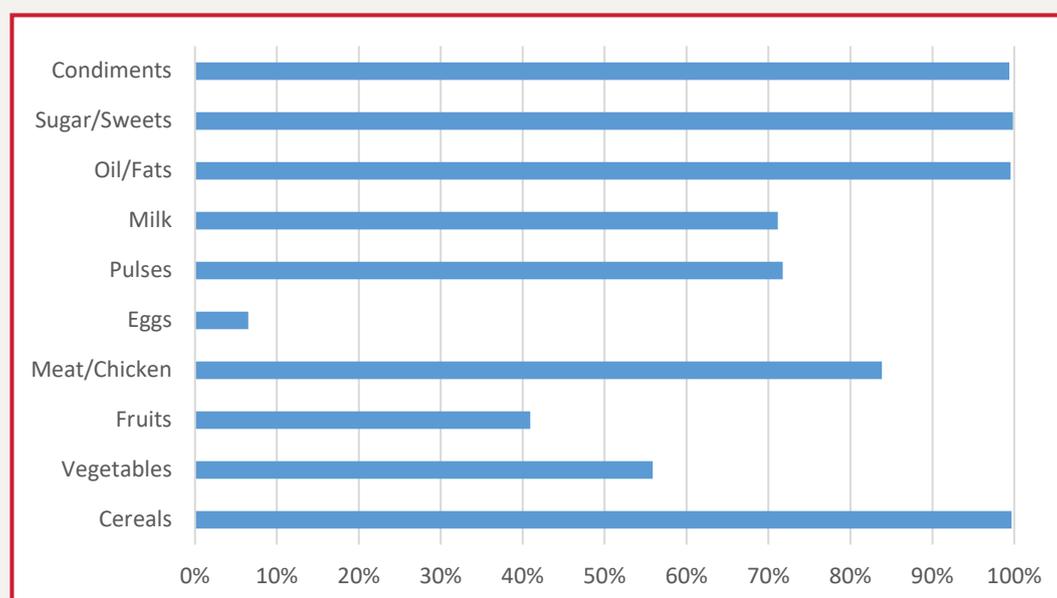
Table 13 summarizes HDDS categories¹ by household head gender and beneficiary type. Male-headed households tend to have higher HDDS than female-headed households. There is not much variation in HDDS between beneficiaries and non-beneficiaries.

Figure 20 presents the proportion of households that consumed specific food groups in the last 24 hours preceding the survey. There is high consumption of cereals, oils and sugar in the survey area. The main source of protein is milk and meat; very few households consume eggs. Approximately 40 percent of the households consumed fruits in the past 24 hours.

Table 13: HDDS categories by gender of household head and beneficiary type

HDDS categories	Male (%)	Female (%)	Non-beneficiaries (%)	Beneficiaries (%)	Overall (%)
Poor	3	3	2	4	3
Medium	27	38	32	27	29
High	70	59	66	69	68

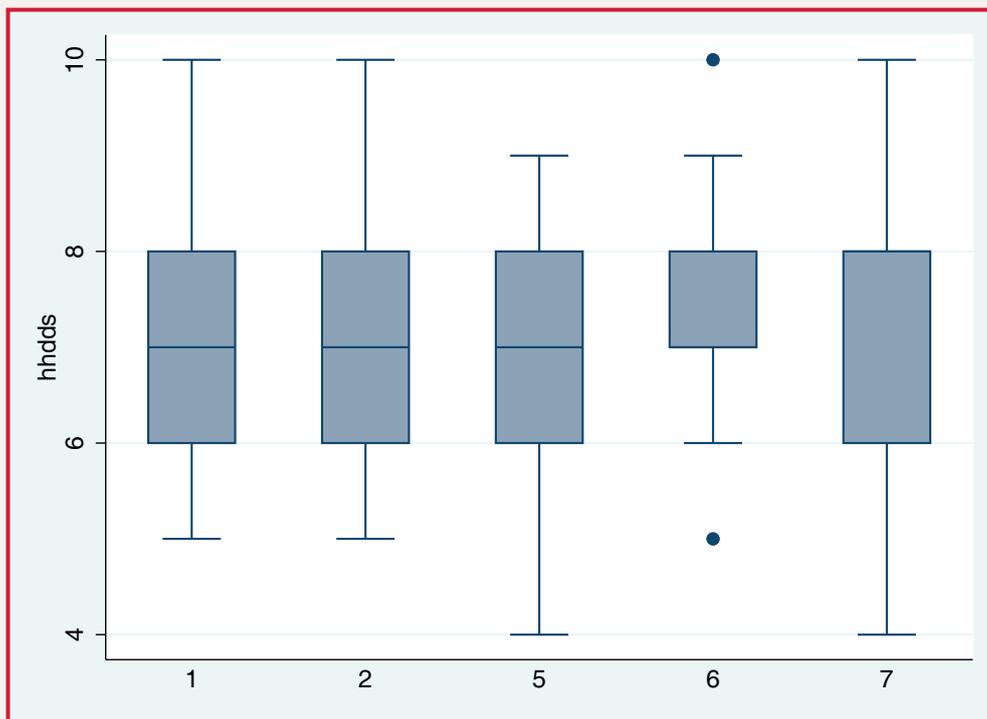
Figure 20: Food groups consumed in the household in the last 24 hours



¹ HDDS categories computation: poor if HDDS ≤ 4 , medium if $4 < \text{HDDS} \leq 6$ and high if HDDS > 6

Figure 21 presents variation of HDDS by main livelihood source. Households engaging in livestock production and non-skilled labour have the least HDDS. While households engaging in skilled labour have low rCSI, they have poor FCS. Households engaging in skilled labour could have access to food and maybe the required resources to purchase food, but have a mismatch in terms of utilization. This could be an indication of a need to conduct mass sensitization on different nutritional aspects and the importance of ensuring that adequate foods across all groups are consumed in the households. There is also a need to document locally available food items for each of the food groups.

Figure 21: HDDS disaggregated by main livelihoods (1 = Crop farming, 2 = Livestock, 5 = Non-skilled labour, 6 = Salaried work)



3.5.3 HOUSEHOLD FOOD INSECURITY EXPERIENCE SCALE (FIES)

Food insecurity experience scale (FIES) is a measure of household food insecurity based on whether or not they experienced certain aspects of food insecurity. The FIES module is made up of eight Yes/No questions asked typically for the reference period of 12 months. Table 14 presents the eight questions together with their raw score for the current study.

In the formulation, questions 5, 7 and 8 contribute to moderate and severe food insecurity, while questions 7 and 8 contribute to severe food insecurity. Based on the FIES global reference scale, the Sudan data were calibrated allowing for production of prevalence of food insecurity. The estimates of moderate and severe food insecurity were computed for both treatment and comparison groups of the sample as presented in Table 15.

Table 14: Responses to FIES raw questions

During the last 12 months, was there a time when, because of lack of money or other resources:	Percentage of households (%)
1. you were worried you would not have enough food to eat?	50
2. you were unable to eat healthy and nutritious food?	50
3. you ate only a few kinds of foods?	50
4. you had to skip a meal?	45
5. you ate less than you thought you should?	47
6. your household ran out of food?	43
7. you were hungry but did not eat?	33
8. you went without eating for a whole day?	29

Table 15: FIES prevalence by beneficiary type

Food insecurity prevalence	Beneficiaries (%)	Non-beneficiaries (%)	Overall (%)
Severe food insecurity	8	13	10
Moderately food insecure	36	33	35

3.5.4 DRIVERS OF FOOD INSECURITY

Table 16 presents the drivers of food insecurity in the survey area. Two food security indicators were used, namely FCS and HDDS. Wealth index, agricultural assets index, tropical livestock unit holding, size of land cultivated during summer and education of the household head (years) were found to be positively associated with both food security indicators. The main shock that undermines food security in the survey area is reduced household income; this is consistent in both FCS and HDDS.

Table 16: Determinants of food security

VARIABLES	(1)	(2)
	FCS	HDDS
Wealth index	33.46*** (10.74)	1.616** (0.806)
Agricultural assets index	18.69** (8.219)	3.221*** (0.617)
Per capita TLU	23.90*** (6.670)	1.451*** (0.500)
Land cultivated during summer	0.260** (0.116)	0.0203** (0.00871)

Access to informal transfers	2.523 (2.217)	0.263 (0.166)
Number of associations	1.643 (1.278)	0.319*** (0.0959)
Access to bank account	-2.523 (3.719)	-0.271 (0.279)
Distance index (inverted)	4.867*** (1.480)	0.117 (0.111)
Distance to water source (inverted)	7.568 (5.381)	-0.323 (0.404)
Improved water (dummy)	0.127 (2.571)	-0.146 (0.193)
Improved toilet (dummy)	-2.348 (3.778)	-0.160 (0.283)
Household head read/write (dummy)	-2.625 (1.675)	-0.203 (0.126)
Household head education (years)	0.954** (0.434)	0.0837** (0.0326)
Income diversification	0.713 (0.706)	0.0653 (0.0529)
Gender of household head: Female	-3.541** (1.646)	0.0872 (0.123)
Shock: Loss of employment	7.465*** (1.723)	-0.217* (0.129)
Shock: Reduced income	-4.576*** (1.422)	-0.238** (0.107)
Shock: Unusually high fuel prices	-1.089 (1.398)	-0.190* (0.105)
Shock: Drought	3.326 (4.293)	0.404 (0.322)
Shock: Epidemic	5.114*** (1.771)	0.108 (0.133)
Shock: Unusually high food prices	3.642 (3.090)	0.686 (0.232)
Shock: Animal disease	0.591 (2.450)	-0.216 (0.184)
Control for locality	Yes	Yes
Control for livelihood	Yes	Yes
Constant	39.93*** (11.85)	4.700*** (0.889)
Observations	658	658
R-squared	0.336	0.282

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

3.6 RESILIENCE

3.6.1 RESILIENCE CAPACITY INDEX

The average resilience capacity in the study area is 56. However, there are variations in the resilience capacity index (RCI) by gender of the household head and administration units (locality). Male-headed households (RCI=57) are more resilient than female-headed households (RCI=51.7) (Figure 22). There is no difference in RCI between beneficiary and non-beneficiary households (Figure 23). El Daein (RCI=65.4) and Rural El Fasher (RCI=65.8) are the most resilient districts, while Tweisha (RCI=50.2) is the least resilient (See Figure 24). However, these are indicative figures as the survey was not intended to produce estimates at locality level.

Figure 22: RCI by gender of household head

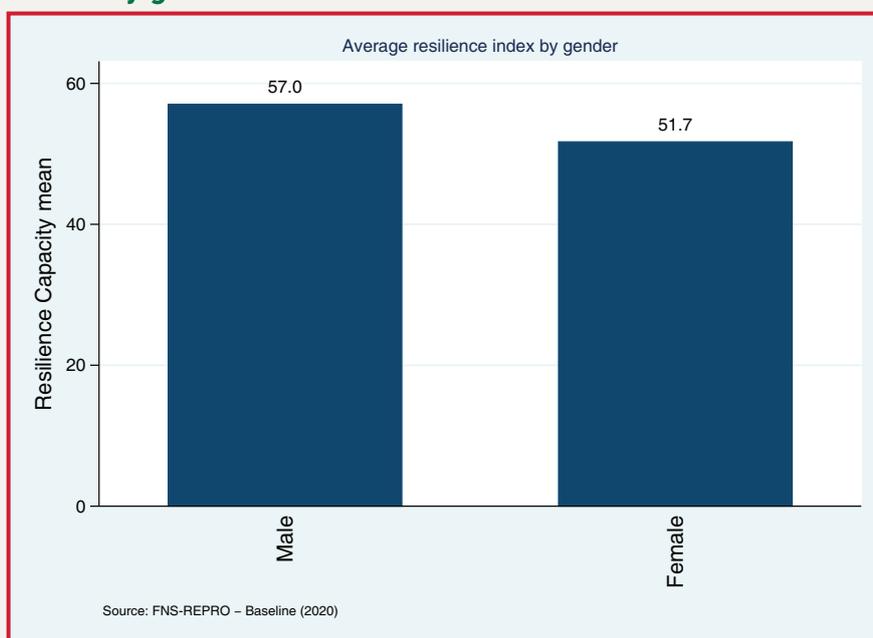


Figure 23: RCI by beneficiary type

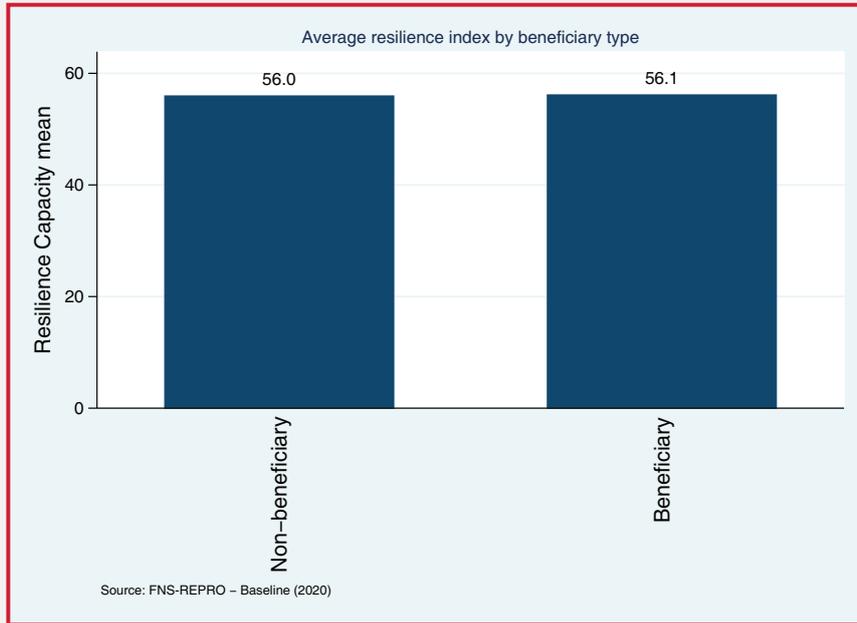
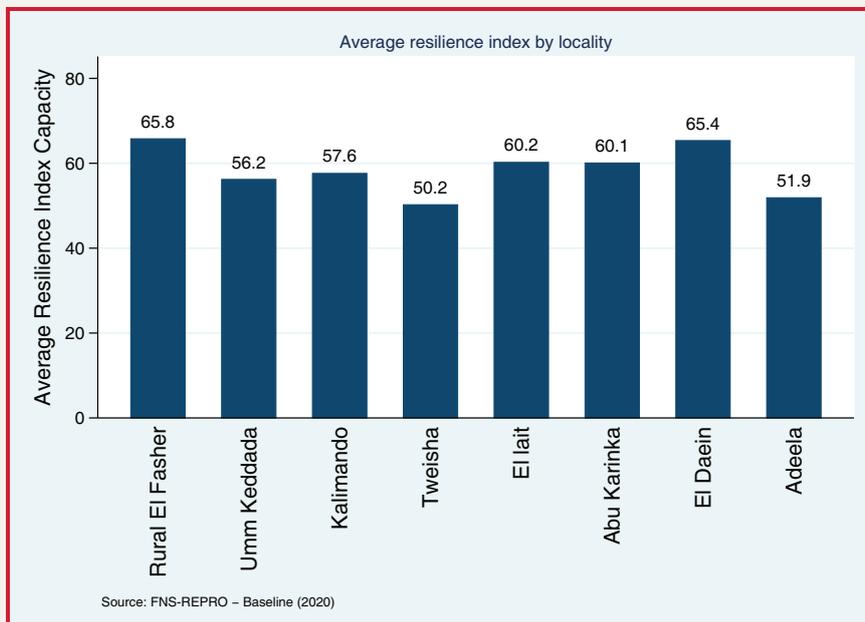


Figure 24: Average RCI by locality



3.6.2 CONTRIBUTION OF KEY VARIABLES TO RELEVANT PILLARS

Of the four pillars of resilience, assets (AST) and social safety nets (SSN) contribute the most to the observed resilience capacity, followed by access to basic services (ABS) (Figure 25). With respect to AST, access to both productive and non-productive assets plays a key role in the observed resilience. On the other hand, for SSN, the number of associations that household

members participate in and access to a bank account are key drivers of resilience. As illustrated by Figure 29, assets and adaptive capacity are the main drivers of resilience among beneficiaries, while assets and social safety nets are the main drivers among non-beneficiaries. With regards to gender of household head, assets and access to basic services play a key role among female-headed households, while assets and social safety nets play a key role for male-headed households (Figure 28).

Figure 25: Overall contribution of pillars to RCI

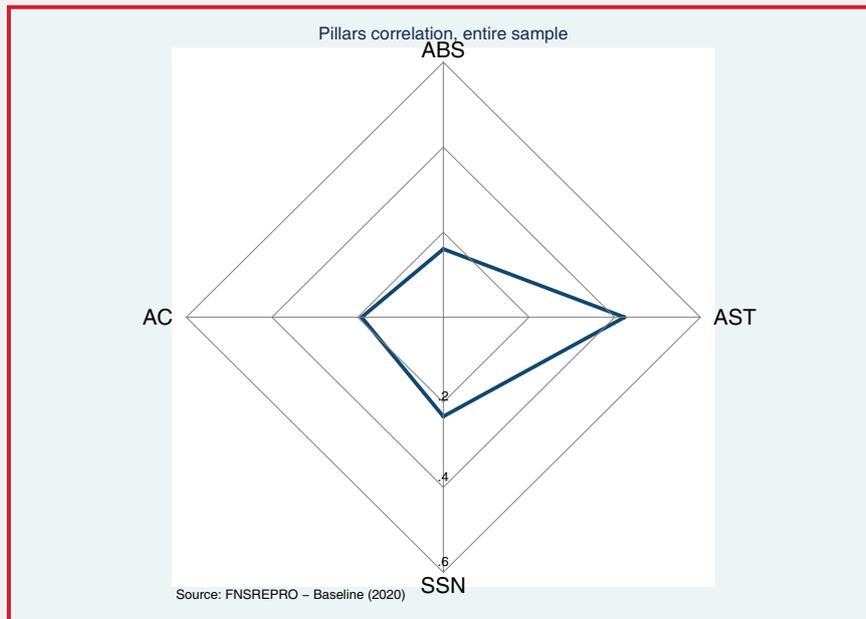


Figure 26: Contributing observed variables of Asset pillar

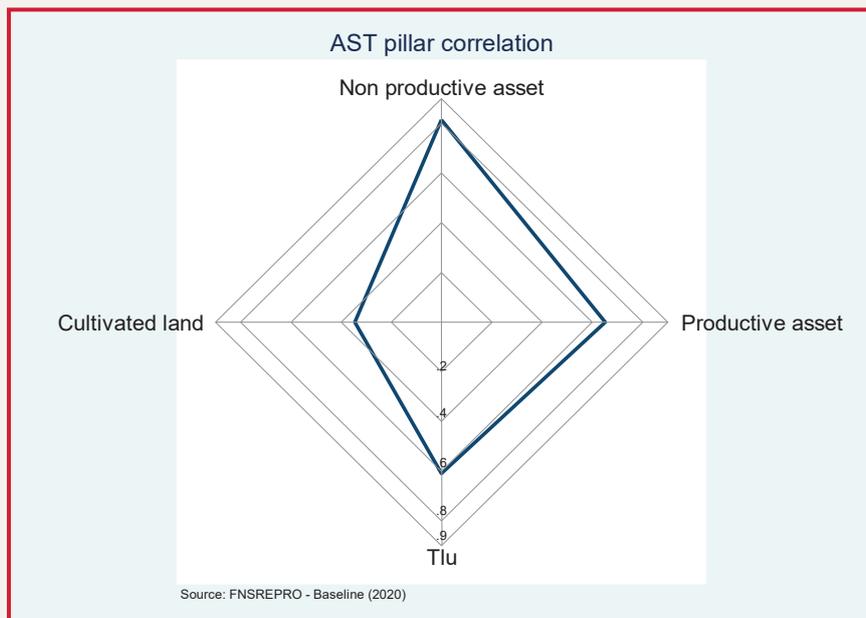


Figure 27: Contributing observed variables of SSN pillar

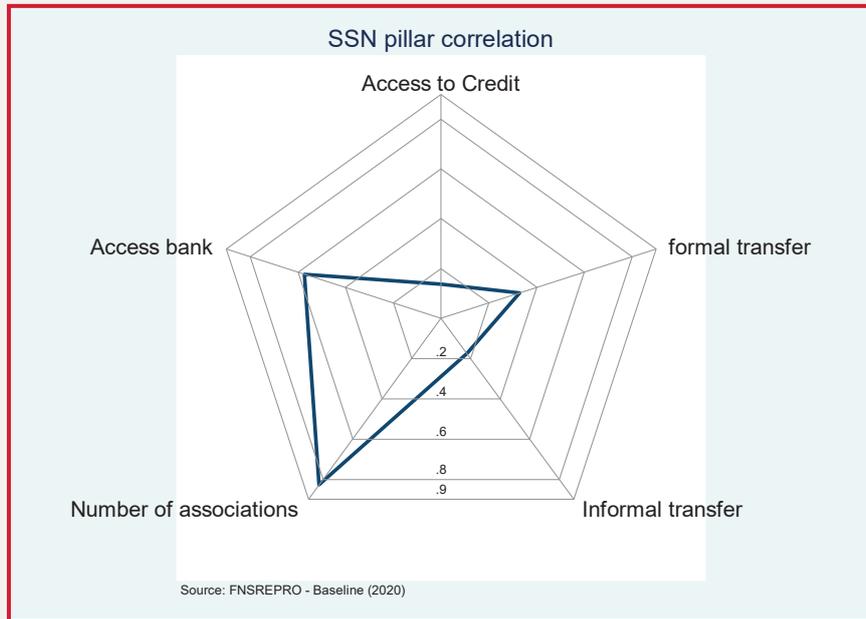
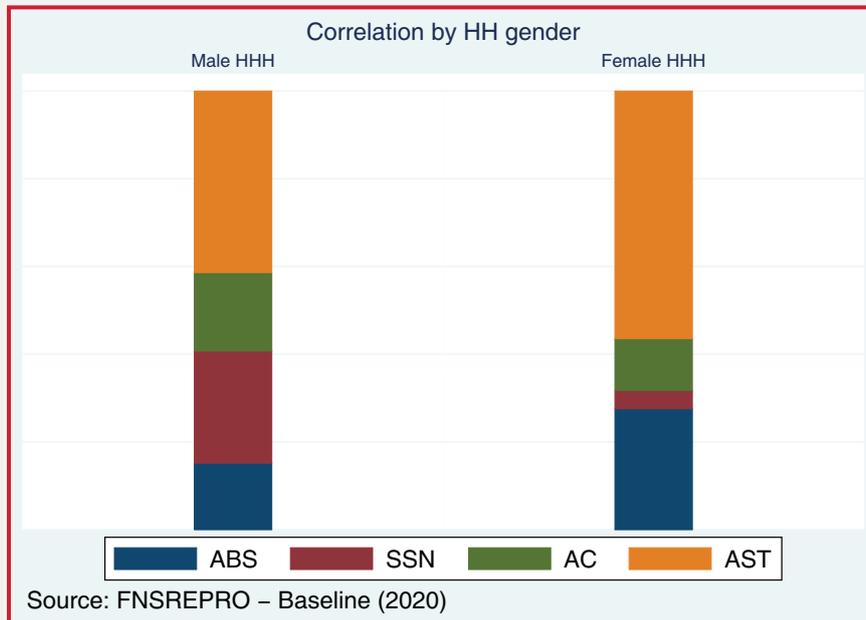


Figure 28: Contributing pillars of RCI by gender of household head



3.6.3 EFFECT OF SHOCKS ON RESILIENCE CAPACITY INDEX

Table 17 presents the effect of shocks on the estimated resilience capacity index (RCI) in the survey area while controlling for household characteristics. The main shocks in the study area that have a significant negative effect on the resilience of households are reduced income of household member(s) and unusually high food prices (for consumers).

Figure 29: Contributing pillars of RCI by beneficiary type

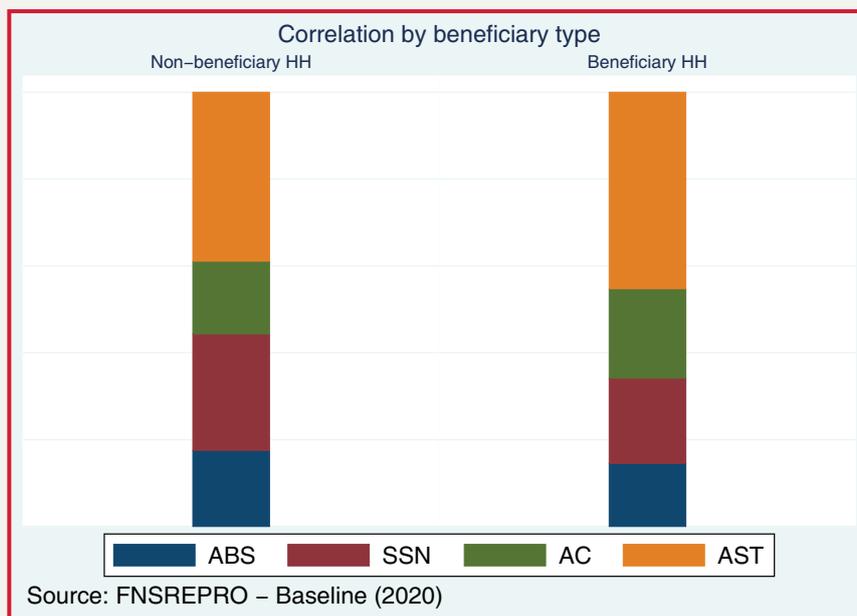


Table 17: Effect of shocks on RCI

VARIABLES	RCI
Household head gender: Female	-3.690** (1.485)
Livelihood dummies	Yes
County dummies	Yes
Shock: Loss or reduced employment for household member(s)	-2.830 (1.802)
Shock: Reduced income of household member(s)	-3.644*** (1.309)
Shock: Serious illness or accident of household member(s)	1.103 (1.368)
Shock: Unusually high food prices (for consumers)	-5.320*** (2.052)
Shock: Unusually high food prices (for producers)	-1.252 (1.285)
Shock: Epidemics	2.511 (1.691)
Constant	73.17*** (9.837)
Observations	658
R-squared	0.177

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1



4

BASELINE FINDINGS RELATED TO SPECIFIC INDICATORS OF THE LOGICAL FRAMEWORK

4.1 SUMMARY OF LOG-FRAME INDICATORS

Table 18 presents a summary of baseline values of selected log-frame indicators that can be derived from a household survey.

Table 18: Summary of key log-frame indicators

Indicator	Beneficiary	Non-beneficiary	Overall value
RCI	56.1	55.9	56
Total annual income (USD)* (median)	1176	1066	1122
Median annual income from sale of gum Arabic** (USD)	253	181	253
Median annual income from sale of crops (USD)	434	452	452
Median annual income from sale of livestock and products (USD)	222	181	217
FCS	51	53	51
HDDS	7	7	7
FIES – Prevalence of moderate food insecurity	36%	34%	35%
FIES – Prevalence of severe food insecurity	8%	13%	10%

* The income was estimated in the Sudanese Pounds (SDG) and converted to USD based on the official exchange rate in December 2020 (1 USD = 55 SDG). At the time there was a significant difference between the official rate and the parallel (black market) rate – with the parallel market approximately five times the official rate (1 USD = 280 SDG). However, on 21 February 2021, the Sudan's central bank sharply devalued the Sudanese Pound, announcing a new regime to unify official and black market exchange rates in an effort to overcome a crippling economic crisis and access debt relief. As a result, the official central bank rate was changed to 1 SDG = 380 SDG. This should be kept in mind when comparing the income (USD) data from baseline with the midterm and end line data, to avoid drawing incorrect conclusions on project outcomes in the future.

** It is important to note that *Acacia senegal* is a perennial crop which starts to be productive after approximately four years. Hence, the income-related results linked to an increase in dedicated production area and increase in productivity due to the adoption of agroforestry systems can only be seen after four years (project duration). However, the additional income generated by the promotion of food/cash crops in *Acacia senegal* production systems can be monitored.



5

DISCUSSION OF LEARNING AGENDA QUESTIONS

The RIMA baseline analysis is one of the main data sets informing the learning agenda (output 4) of FNS-REPRO, which is aimed at establishing and implementing learning mechanisms to inform policy and practice, including adaptive management of FNS-REPRO. In FNS-REPRO's Monitoring, Evaluation, Accountability and Learning (MEAL) framework, all information is collected and analysed to formulate answers to FNS-REPRO's learning questions, which have been contextualized for each FNS-REPRO country. RIMA, among other data sets, forms one of the main information sources, fuelling the learning agenda and the MEAL framework.

Key learning questions will be addressed from the analysis of RIMA, combined with the analysis of other studies and trajectories which have already taken place within the project such as context analysis, food/seed system resilience assessments, special studies, learning journeys and communities of practice (all under output 4) and the beneficiary and benefits mapping from the target sites.

The objective of the learning agenda of FNS-REPRO is threefold:

- a) Improving project implementation: Evidence-based information supporting programme management with insights to be used towards achieving the objectives described in the monitoring and evaluation databases.
- b) Observatory: To develop new policy/practice insights and perspectives about food system resilience programming in areas of protracted conflict, for the benefit of target beneficiaries and partners.
- c) Building capacity: To build the capacity of FNS-REPRO staff and partners (including donors, government, UN organizations, NGOs, the private sector and knowledge institutes) by offering an ongoing facility for reflection and sense-making. This will enable a learning process among partners on what works best and which practices need amplification as the implementation progresses.

The learning agenda forms part of improving the implementation specific to the context, based on evidence derived from the field and co-created with local actors and partners. Moreover, the learning agenda enables adaptive and flexible programming by identifying critical food system resilience factors on an iterative basis.

Please note that this is a baseline report. A similar survey will be carried out at mid-term and end-term. Analysis will be carried out over time and by beneficiary type. In order to measure the impact of the FNS-REPRO, the baseline data will be combined with midline or endline data to establish the changes in the key indicators of interest. Attribution of the changes to the FNS-REPRO will be established by use of econometric models for impact evaluation.

5.1 IMPACT-LEVEL LEARNING QUESTIONS

LQ 11. To what extent are households better able to withstand and recover from shocks and stressors as a result of FNS-REPRO? (project and country level)

Relevant RIMA indicators include household income and resilience capacity index, disaggregated by beneficiary and non-beneficiary households.

Indicator	Beneficiary	Non-beneficiary	Overall value
RCI	56.1	55.9	56
Total annual income (USD)(median)	1 176	1 066	1 122

Income

The poverty line is USD 1.90 per day (World Bank, 2015). The median annual income of households in the survey area is USD 1 112, which is USD 3.05 per household per day. The median household size in the study area is 7. So, on average, there is USD 0.44 per household member per day, which is substantially below the poverty line. The situation for female-headed households (USD 760 annually) is worse compared with male-headed households (USD 1 208 annually). There is no statistical difference between beneficiaries and non-beneficiaries in terms of household income.

The three main sources of household income in the study area are crop farming (excluding gum Arabic) (77 percent), agricultural labour (43 percent) and non-skilled labour (25 percent). Male-headed households are more dependent on income from crop production, agricultural labour and livestock production, while female-headed households are more dependent on crop production, agricultural labour and trade/petty trade.

Resilience capacity index

The average RCI is estimated at 56. Male-headed households (RCI=57) are more resilient than female-headed households (RCI=51.7). Households in El Daein (RCI=65.4) and Rural El Fasher (RCI=65.8) have the highest resilience capacity, while households in Tweisha (RCI=50.2) have the lowest.

In order to understand the extent to which the FNS-REPRO has influenced all these indicators, a midline or endline dataset is required so that the change in these indicators can be estimated and attributed to the current project.

LQ 13. Is a value-chain approach an effective catalyst for building resilient communities and who benefits or not?

This question cannot be answered at baseline as there is no value-chain approach applied by FNS-REPRO.

LQ 14. To what extent is there improved food and income security as a result of FNS-REPRO?

Relevant RIMA-based survey indicators include food security indicators such as HDDS, FCS and FIES, disaggregated by beneficiary type. Household income is derived from various sources.

Household dietary diversity score

The average HDDS for the households in the survey area is 7. On average, a household in the survey area consumed seven different kinds of food out of the 12 food groups in the 24 hours preceding the survey. Male-headed households tend to have a higher HDDS compared with female-headed households. There is not much variation in HDDS between beneficiaries and non-beneficiaries. There is high consumption of cereals, oils and sugar in the survey area. The main source of protein is milk and meat; few households consume eggs. Approximately 40 percent of the households consumed fruits in the 24 hours preceding the survey. Households engaging in livestock production and non-skilled labour have the lowest HDDS. There is room to improve on the diversity of foods eaten, especially in terms of eggs, fruits and vegetables.

Food consumption score

Approximately 68 percent of the households have an acceptable FCS. There is a statistically significant difference in FCS by gender of the household head — male-headed households have a higher FCS. In terms of the specific foods eaten in the seven days preceding the survey, oils and fats, cereals, spices and milk were frequently consumed, at least four days in a week. Proteins from meat, eggs and pulses were least consumed by the households.

Food insecurity experience scale

Some eight percent of beneficiaries felt severely food insecure compared with 13 percent for non-beneficiaries. About one-third (36 percent) felt moderately food insecure (36 percent beneficiaries, 33 percent non-beneficiaries). These variations between beneficiaries and non-beneficiaries are not statistically different.

Income

Wealth index, agricultural assets index, tropical livestock unit holding, size of land cultivated during summer and education of the household head (years) were found to be positively associated with household food security. The main shock that undermines food security in the survey area is reduced household income.

LQ 15. What are the positive and negative (expected and unexpected) effects of FNS-REPRO on households and communities (in terms of income, social cohesion, stability, triple nexus [development, humanitarian aid, conflict], etc.)?

Country situation: Despite the reduction in violence, the structural drivers of conflict (poor rule of law, lack of basic services, economic marginalization, land tenure system and unsustainable management of natural resources), coupled with the structural impact of 15 years of active fighting, remain unaddressed.

Target areas: Wealth index, agricultural assets index, tropical livestock unit holding, size of land cultivated during summer and education of the household head (years) were found to be positively associated with household food security. The main shock that undermines food security in the survey area is reduced household income.

5.2 OUTCOME-LEVEL LEARNING QUESTIONS

LQ 02.4. What is the contribution of improved income to improved FNS and resilience status?

Relevant indicators: income, resilience index, FNS data.

Reduced household income is currently the main shock that undermines food security in the survey area.

Extent to which income is improved by FNS-REPRO and how this relates to improved FNS and resilience is to be determined at mid- and end-term after another set of data has been collected from the same households (panel data).

LQ 03.1. What is the role of FNS-REPRO and other factors in stimulating healthy diets by targeted communities?

Relevant indicators: HDDS, FCS.

The role of FNS-REPRO and other factors is yet to be determined, but currently wealth index, agricultural assets index, tropical livestock unit holding, size of land cultivated during summer and education of the household head (years) were found to be positively associated with household food security, while reduced household income is the main shock that undermines food security in the survey area.

LQ 03.3. What role does FNS-REPRO play in reducing gender disparities?

Based on this RIMA study, there are currently significant differences between male- and female-headed households in terms of:

- **Income:** Female-headed households have a lower median annual income (USD 760) compared with male-headed households (USD 1 208).
- **Income sources:** Male-headed households are participating in many income sources compared with female-headed households.
- **Wealth index:** Male-headed households have a significantly higher wealth index – this captures key household items.
- **Resilience:** Male-headed households (RCI=57) are more resilient than female-headed households (RCI=51.7).
- **HDDS:** Male-headed households tend to have a higher HDDS compared with female-headed households.
- **FCS:** Male-headed households have higher FCS than female-headed households.
- **Agricultural assets index:** Male-headed households have a significantly higher agricultural assets index – this captures key agricultural equipment that households have/own.
- **Livestock:** Male-headed households have higher livestock holding than female-headed households.
- **Land:** Male-headed households cultivated almost double the size of land cultivated by their female counterparts.
- **Basic services:** Male-headed households seem to be staying closer to many basic services than female-headed households.

Chapter 5 – Discussion of learning agenda questions

- **Literacy:** A higher proportion of household heads that are male can read and write compared with female household heads.
- **Schooling:** The cumulative number of years household members have attended formal schooling is higher for male-headed households than for female-headed households.

The above-mentioned RIMA information will have to be analysed in combination with data from other sources to make sense of available information that can answer the learning questions. Some of this sensemaking takes place in the communities of practice and some during the annual sensemaking events that are held prior to the annual review and planning meetings of FNS-REPRO at country and regional levels. The sensemaking of available documentation on the different learning questions can inform policy and practice of FNS-REPRO and other stakeholders.



6 CONCLUSION

Gum Arabic production areas in the Sudan are generally characterized by very low and highly variable rainfall, which is a major impediment to agricultural production. Gum Arabic is a resin collected from several species of Acacia. In the Sudan, the common tree is hashab. The resin is used as a stabilizer, binder and emulsifier in the production of soft drinks, liquor, confectionery, paints, adhesives, pharmaceuticals, cosmetics and textiles (Barbier, 2000).

Production of gum Arabic in the Sudan is generally undertaken under a traditional land-use system known as the gum Arabic cultivation cycle (or Acacia senegal bush fallow). In this production system, the land is used to produce crops continuously for approximately five years, after which the land is abandoned to an Acacia senegal bush fallow.

Gum Arabic production is still regarded as a major path for promoting economic rural development in the Sudan and has high potential for securing rural livelihoods and empowering otherwise disenfranchised and vulnerable populations. The FNS-REPRO programme is tailored to focus on this path. The programme is aimed at assisting smallholder farmers to increase their production and income from the sale of gum Arabic through the expansion of gum Arabic tree areas, reduction of land degradation and effective training and use of good agricultural practices in a safe and secure environment.

This baseline provides characteristics of the gum Arabic production and gum Arabic-producing households in the project area. It was estimated that 23 percent of the households in the study area were involved in gum Arabic production, of which 90 percent were male-headed households. Strategies to facilitate the participation of female-headed households in this value chain are critical.

Households involved in gum Arabic production had limited access to information on gum Arabic production and prices. Furthermore, the households in the area received little to no training on aspects of gum Arabic production. This calls for an evaluation and improvement of agricultural extension services for the gum Arabic producers, which will assist in streamlining good agricultural practices among gum Arabic farmers. Pests and plant diseases can also be managed through proper training through the extension services. The main challenges to gum Arabic production were bush fires.

GAPAs were found to exist in the study area as reported by households. Revitalization and equipping of the GAPAs to support farmer organizations for proper marketing of gum Arabic will be an important undertaking to improve production.

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APPENDICES

APPENDIX I: RESILIENCE MEASUREMENT APPROACH

RIMA-II methodology (FAO, 2016a) was used to measure resilience in this study (see Figure 30). The methodology estimates the RCI based on a two-stage procedure:

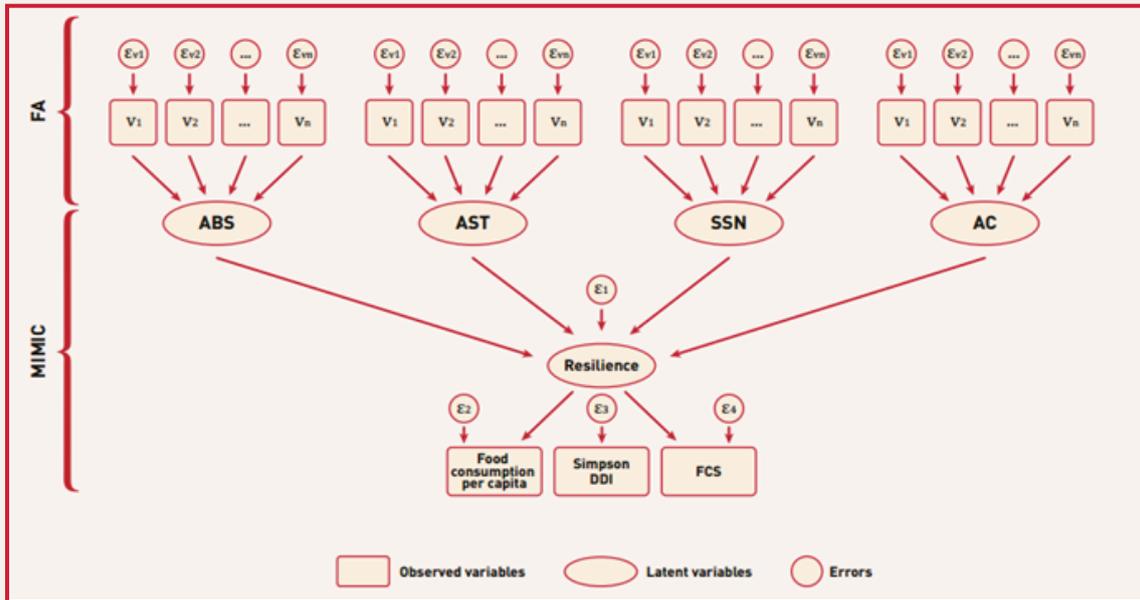
- i) The resilience pillars are estimated from observed variables through factor analysis. The definition of each pillar of resilience and the related variables are reported in Table 19.
- ii) The RCI is estimated from the pillars, taking into account the indicators of food security using the Multiple Indicators Multiple Causes (MIMIC) model. The food security indicators are considered outcomes of resilience.

After estimating the pillars, the RCI is estimated through its pillars and the food security indicators. After estimating the RCI, a min-max scaling is used to transform the RCI value into a standardized index, ranging between 0 and 100, with higher values indicating higher resilience capacity.

Table 19: Definition of variables used in each pillar for RCI estimation

Pillars of resilience	Definition	Variables
ABS	ABS shows the ability of a household to meet basic needs by accessing and effectively using basic services such as sending children to school; accessing water, electricity and sanitation; and accessing markets for selling and buying goods.	Access to safe water; access to safe toilet; access to soap for handwashing; improved cooking energy and improved lighting energy; closeness to services such as schools, health facilities, hospitals, markets, financial services and public transport.
AST	AST, both productive and non-productive, are the key elements of a livelihood as they enable households to produce and consume goods. Examples of productive assets include land and agricultural index (e.g. agricultural equipment), while non-agricultural assets take into account the monetary value of the house where the household is located, and its appliances.	Household asset index; ownership of productive tools and equipment; cultivated land area; tropical livestock units (TLU) per capita.
SSN	SSN proxies the ability of the household to access formal and informal assistance from institutions, as well as from relatives and friends.	Access to credit; access to formal transfers; access to informal transfers; access to credit from financial institutions; having a bank account; participation in social networks such as market associations, cooperatives, women and youth networks.
AC	AC is the ability to adapt to a new situation and develop new livelihood strategies. For instance, proxies of the AC are the average years of education of household members and the household perception of the decision-making process of their community.	Average education of the household head and whether they can read and write in any language; number of income sources; dependency ratio (active/non-active members).

Figure 30: RIMA-II model structure



For causal analysis, two models are fitted to identify the determinants of household resilience and food security status.

For resilience determinants (excluding any household variable used to construct the index), the model employed is:

$$RCI_i = \beta_0 + \alpha X_i + \varepsilon_i; \tag{1}$$

where

RCI_i is the resilience capacity index of household i .

X_i is a vector of household control characteristics and a shock.

$\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$ is the error term.

For food security determinants, the model employed is:

$$\begin{bmatrix} HDDS_i \\ FCS_i \end{bmatrix} = \begin{bmatrix} \beta_{01} & \theta_1 & \vartheta_1 & \alpha_1 \\ \beta_{02} & \theta_2 & \vartheta_2 & \alpha_2 \end{bmatrix} \begin{bmatrix} 1 \\ R_i \\ \gamma_i \\ X_i \end{bmatrix} + \begin{bmatrix} \varepsilon_{1i} \\ \varepsilon_{2i} \end{bmatrix}; \tag{2}$$

where,

$HDDS_i$ and FCS_i is the household dietary diversity score (HDDS) and food consumption score (FCS) for household i respectively;

γ_i is a vector of shocks; and

X_i is a vector of household control characteristics.

R_i is the vector of all observed variables employed in the estimation of the pillars.

$\alpha, \theta, \vartheta$ and β_0 are the parameters in the models.

$\hat{a}_i \sim N(0, \sigma_a^2)$ is the error term.

APPENDIX II: SUMMARY STATISTICS DISAGGREGATED BY BENEFICIARY TYPE AND GENDER OF HOUSEHOLD HEAD

Table 20: Summary statistics

Variable	Non-beneficiary	Beneficiary	Male	Female	Overall
RCI	55.966	56.150	57.039	51.700	56.075
FCS	52.919	51.037	52.899	46.879	51.807
HDDS	6.930	7.046	7.050	6.767	6.998
Wealth index	0.321	0.307	0.318	0.288	0.313
Agricultural assets index	0.203	0.182	0.197	0.163	0.191
Per capita TLU	0.088	0.077	0.086	0.060	0.081
Land cultivated during summer	7.032	7.371	7.776	4.779	7.233
Access to formal transfers	0.314	0.772	0.583	0.592	0.585
Access to informal transfers	0.066	0.100	0.077	0.125	0.086
Number of associations	0.210	0.368	0.315	0.250	0.304
Access to bank account	0.037	0.026	0.035	0.008	0.030
Distance index (inverted)	0.058	0.065	0.045	0.141	0.062
Distance to water source (inverted)	0.055	0.062	0.060	0.056	0.059
Improved water (dummy)	0.897	0.946	0.930	0.908	0.926
Improved toilet (dummy)	0.033	0.023	0.030	0.017	0.027
Household head read/write (dummy)	0.690	0.721	0.764	0.458	0.708
Household head education (years)	1.771	1.770	1.926	1.067	1.770
Income diversification	2.380	2.570	2.539	2.283	2.492



This document forms part of a series of FNS-REPRO resilience baseline analyses prepared by FAO Representation in Sudan and the FAO Resilience Team for Eastern Africa.

The series is aimed at providing programming and policy guidance to FNS-REPRO actors, policy-makers, practitioners, UN agencies, NGOs and other stakeholders by identifying the key factors that contribute to the resilience of households in food insecure countries and regions.

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