INTERNATIONAL AID SERVICES Kenya

Enhanced Climate Change Adaptation Project for Improved Agricultural Production for 1090 Farmers in Tharaka North and South by the End of December 2023

A Value Chain Analysis of Drought-tolerant Seeds in Tharaka North and South Sub-Counties of Tharaka Nithi County in Kenya

ANALYSIS REPORT

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The consultants for this assignment wish to convey their gratitude to IAS Kenya for granting us the opportunity to undertake this important analysis of drought-resistant seeds in Tharaka North and South Sub Counties of Tharaka Nithi County

We hope that all the efforts we put in undertaking this assignment will, in some small way, contributed towards the efforts by IAS Kenya to promote increased food production and better livelihoods in the targeted areas, and in the process build resilient communities in Kenya.

Signed on this 23rd day of August 2023 by:

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ACRONYMS AND ABBREVIATIONS

ASAL	Arid and Semi-Arid Lands
CBO	Community Based Organization
CIDP	County Integrated Development Plan
FGD	Focus Group Discussion
GDP	Gross Domestic Product
IAS K	International Aid Services- Kenya
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Service
KNAP	Kenya's National Adaptation Plan
KII	Key Informant Interview
MENR	Ministry of Environment and Natural Resources.
MoALF	Ministry of Agriculture, Livestock and Fisheries
NDMA	National Disaster Management Authority
NEMA	National Environmental Management Authority
NGOs	Non-Governmental Organizations
SHG	Self Help Group
SPSS	Statistical Package for Social Sciences
TDA	Tharaka Agro-Dealers Association
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

Introduction

In the month of July 2023, IAS Kenya commissioned a value chain analysis of drought-tolerant seeds in Tharaka North and South Sub-Counties of Kenya, to inform a proposed climate change adaptation intervention aimed at improving food security and livelihoods in the target locations. The aim of the intervention is to empower the communities of Tharaka to take up adaptive practices and enable IAS Kenya to establish a long-term partnership with the government and other stakeholders on climate change adaption. Besides increasing the self-sufficiency and food security of farmers, the intervention also seeks to serve as a piloting and capacity-building exercise for IAS Kenya and its partners to play a vital role in future climate change adaptation efforts.

Objective

The purpose of the assessment was to contribute towards the successful implementation of the project by availing analytical information about the value chain of drought-tolerant seeds in the target areas in Tharaka North and South Sub Counties of Tharaka Nithi County. The specific objectives included the identification of drought resistant seeds ideal for the target area, and the assessment of the entire value chain dynamics of each of the seeds. It also included the identification of factors influencing the production of the identified seeds; the production methods and the related factors; the volumes of seeds produced by types and seasonal implications; the market dynamics for the seeds; the challenges and lessons learnt in the production of the seeds; and make appropriate recommendations.

Methodology

The methodologies employed included a desk review of available documents; the exploratory study design method, to inform the key study processes; the use of general interview methods; the use of key informant interview methods; general and focused group discussions; farmers survey; the use of *Kobo Toolkit* in the administration of qualitative and quantitative questionnaires; and the use of MS Excel and SPSS for data analysis.

Findings

The findings of the analysis were that:

- The most common drought-tolerant seeds in Tharaka North and South were green grams; sorghum; cowpeas; and maize
- There existed a drought-tolerant seed value chain in Tharaka North and South Sub Counties, even though it was not developed
- The primary sources of seeds for green grams, cowpeas and sorghum is East African Seed Company, KALRO Katumani and Dryland Seeds Company while maize is from Kenya Seed Company
- There is no distributor based in the lower zone and therefore the agro dealers must order them from the companies directly.
- Agro-dealers are mostly based in the main local markets
- There were a few markets outside the target locations that sold similar seeds including Meru Town, Nkubu Town, Chuka Town and Mitunguu Market
- The average price of seeds per kilogram were Ksh. 550 for green grams; Ksh. 380 for cowpeas; Ksh. 400 for sorghum; and Ksh. 650 for maize. However, these prices were fluid and subject to

fluctuations.

- The other category of inputs supplied are agro-chemicals, the most common being seed dressers; pests and disease control chemicals; and storage dusts. Just like the seeds, these inputs are sourced from long distances either through the distributors or the producer companies directly. Unlike the seeds, the agro chemicals vary in source and type.
- The challenges experienced by input suppliers include high prices of seeds; lack of small seed packages for small scale farmers; low supply of seeds against very high demand; few seed producers with low capacity; long distances to the seed producers; occasional poor-quality seeds with low germination rate; inadequate financial capacity for the seed retailers
- In the production node, farmers are mostly small-scale with between 2 and 5 acres of land, They access seeds and other inputs from the input suppliers to aid their production activities
- Produce from the farmers are sold per kilogram units at Ksh. 70 for green grams; 60 for sorghum; 60 for cowpeas; and 80 for maize
- The notable challenges at the production node included high poverty levels; erratic rainfall; poor farming technologies; land degradation; lack of reliable cash crops; recurrent crops failure; lack of coordination support to encourage value chain approaches; inadequate extension services; inadequate certified seeds; and late deliveries of seeds by stockists
- The traders or aggregators node was established to be a non-homogeneous, with sub-groups of middlemen within the larger node, whose presence along the value chain ended up pushing the farm gate price downwards to the disadvantage of the producer farmer.
- Each market centre has several traders who buy right from the farm or from the local markets.
- The average selling prices of farm produce fluctuated depending on market forces but ranged from Ksh. 80 per kilo for green grams; 70 for sorghum; 65 for cowpeas; and 90 for maize.
- The noted challenges for this node included inadequate resources to aggregate the desired quantities; inadequate resources for any value addition; inadequate storage facilities; the use of different weighing methods of measure; price fluctuations; long distances from farmers to the main aggregators; and competition from other aggregators
- In the processors or value addition node, there was very limited value addition along the drought-tolerant seed value chain in the target locations other than those engaged in sorting, grading, packing, milling and distribution of the finished product.
- The main processors were located far places away from farms, and mostly in towns, and their main role was to aggregate, process, and sell their seeds to end users or to distributors.
- The marketers of processed product node were identified to be the distributors and retailers of the finished products from the drought tolerant seed vale chain. Other than receiving and selling the finished seed products, there was little that was done within this category of the value chain.
- In the cross-cutting node, a number of actors were identified whose actions affected all segments of the seed value chain, like transporters; auxiliary service providers; county cess office; weights and standards office; health regulators; financial service providers; researchers and academic institution; policy and legislations bodies; county government; and the national government.

Lessons Learnt

The lessons learnt from this exercise included the fact that:

- There was very limited investment in the agriculture sector in the target locations
- There was limited access to funds for farmers, and this impeded their production efforts
- There was lack of reliable market information for timely decision-making
- And there was untapped use of existing agricultural offices.

If all these were addressed, production of crop would improve to the overall benefit to the farmer.

Recommendations

The recommendations of the study was for IAS Kenya to:

i. Through engagements with respondents, the study obtained the challenges that they experience, and the related recommendations made by the farmers. These have been presented under each value chain node or segment since some are unique to particular segments. In the interest of developing the seed value chain, those recommendations should be considered on their own merit.
ii. The study established that the drought tolerant seed value chain in the target locations is not well developed, yet the target communities depend on the production and marketing of these crops for their livelihoods. This calls for an intervention targeting the development of the drought-tolerant seed value chain in Tharaka North and South into a viable economic activity that will support the livelihood of the target populations. Such an intervention should adopt the cost-sharing approach where farmers will invest up to 50% of the related cost, to instill ownership and promote the sustainability of the benefits of such an intervention.
iii. This study established that up to 86.3% of the primary respondents already engaged in the production of drought tolerant fodder crops, even though they faced challenges like lack of seeds; inadequate rainfall; and pests and diseases. Given the general scarcity of food for livestock in the target locations, it will be prudent to consider the development of the fodder value chain to fill the current existing gap in animal feeds, especially in the dry seasons
iv. One of the findings of this study was the inadequate extension advice on pre-harvesting, harvesting and post-harvest handling and marketing. Tied to this was the study conclusion that the presence of agricultural officers in the activities of the farmers is still limited. This calls for targeted strategies to engage the services of such officers in working with farmers along the seed value chain to increase crop production and marketing and enhance food security and livelihoods in the target locations. For sustainability purposes, it will be worthwhile to work with the county government as well as other NGOs in the agriculture space to particularly develop the input supply and the production nodes of the seed value chain that the rest of the value chain depends on.
v. One of the challenges that was identified by farmers in the production node of the seed value chain was poor marketing structures, which encouraged exploitation by middlemen due to existing disorganized marketing structures. In mitigation, the farmers proposed bringing them together into small, organized, producer marketing groups, with an umbrella platform to coordinate their efforts. This initiative should go hand-in-hand with the development of their access to better markets, to diversify their marketing options and allow them to get the best prices possible from their farming efforts
vi. Like all other farmers the world over, farmers in Tharaka North and South equally depend on accurate information to make timely and informed decisions. Indeed, farmers can use the real-time data generated by sensors on machines, tools, and animals to identify areas for improvement (KENAFF, 2022). This component is missing in the target locations, and actors along the chain make decisions using inaccurate or even arbitrary information. This calls for the development of a value chain information management system that collects, collates, and shares vital farming and the related information with farmers in real time

1.0 INTRODUCTION

It is now accepted globally that the earth is about 1.1°C warmer than it was in the 1800s. Lots of efforts are now being channeled towards keeping global temperature from exceeding 1.5°C above pre-industrial levels, which is considered the upper limit to avoid the worst fallout from climate change (United Nations, 2023). Adaptation to climate change has now moved to the forefront of global concern, in the knowledge that adaptation safeguards people from higher temperatures, rising seas, fiercer storms, unpredictable rainfall and more acidic oceans. Some people are more vulnerable to these effects, such as those living in poverty. Over 60 percent of countries have nature-based strategies in national climate action plans; a similar share has acknowledged that adaptation depends on protecting ecosystems and biodiversity (ibid).

In the effort to manage climate change, consideration is made to the fact that extreme temperature and precipitation can prevent crops from growing, and extreme events, especially floods and droughts, can harm crops and reduce yields. Dealing with drought could become a challenge in areas with rising temperatures causing soils to become drier. Although increased irrigation might be possible in some places, in other places water supplies may also be reduced, leaving less water available for irrigation when more is needed (US EPA, 2023).

Climate change adaptation in Kenya goes alongside its history on drought management that dates to 1985, with the design of a drought contingency planning system, the Emergency Drought Recovery Project (from 1992), and its successor, the ALRMP, both of which were supported by the World Bank, and covered a total of 28 arid and semi-arid districts (now 23 counties. Over time, the drought periods became increasingly frequent and intense, directly affecting the household food security and livelihoods of more than ten million people and calling for more concerted efforts towards enhancing adaptation (NDMA, 2023).

In Tharaka Nithi County, drought is a recurring challenge to the livelihoods of those living there, being situated within the arid and semi-arid (ASAL) zone of the country. The area has been marginal to the economic and political life of Kenya for many years, with inhabitants having to deal with challenges including privatization of landownership, rapid population growth, political decentralization, increased conflict over natural resources, different market conditions, and environmental shifts. Measures directed towards improved food production in Tharaka Nithi County can only be seen to be appropriate and timely, as is the case with the Enhanced Climate Change Adaptation for Improved Agricultural Production Project for 1090 Farmers in Tharaka North and South by the End of December 2023, to be implemented in Tharaka North and South Sub Counties by IAS Kenya.

1.1 Background and context

International Aid Services (IAS) Kenya is a Non - Governmental Organization registered as a local NGO in 2017 under the NGO Coordination Board in Kenya. IAS Kenya pursues the vision of “a World where Communities are empowered to Live Dignified Lives”, and a mission “seeking to empower communities through the promotion of access to education, sustainable livelihood, environmental stewardship and human rights”. IAS K works with partners in project implementation, hence is committed to developing organisational capacity and to support effective functioning and efficiency of its partners.

IAS Kenya has been actively involved in agriculture, disaster risk reduction and resilience programming in the semi-arid region of Tharaka for over 13 years. With remarkable progress and valuable lessons learned, the organization is now proposing a climate change adaptation approach to improve food security and livelihoods in the area. The aim is to empower the communities of Tharaka to adopt adaptive practices and enable IAS Kenya to establish a long-term partnership with the government and other stakeholders on Climate Change Adaption. This project not only aims to increase the self-sufficiency and food security of farmers, but also serves as a piloting and capacity-building exercise for IAS Kenya and its partners to play a vital role in future climate change adaptation efforts.

1.2 Project Context

In the wake of the adverse impact of climate change on vulnerable populations that IAS K works with in Tharaka Nithi County, the organization has been working towards integrating resilience in their development work since 2019. It is now building on the gains made and lessons learnt from past efforts, while incorporating available research findings and ensuring efforts complement existing government plans, in the strong belief that perhaps the most sustainable way of dealing with the negative impact of climate change is climate change adaptation. Thus, the proposed intervention is in line with the Government of Kenya ASALs National Vision and Strategy: Vision 2030 Development for Northern Kenya and other Arid Lands. The Vision 2030 is the County's new development blueprint covering the period 2008-2030. It aims at making Kenya a newly industrialized middle-income country providing high quality life for all its citizens by the year 2030- The Vision is based on economic, social, and political pillars. ASALs provide the framework for action for various stakeholders that will lead to sustainable development using the ASAL's natural resource base. Furthermore, Kenya's National adaptation plan 2015 - 2030 (KNAP) outlines the Kenyan Government's ambitions for climate adaptation. It has the purpose for shaping a framework for coordinating and mainstreaming adaptation plans from the national to county level within respective development plans and budgets. This framework also serves as a streamlined learning and monitoring channel meant to report on adaptation progress across all stakeholders within local government adaptation plans.

The County government of Tharaka Nithi has outlined budget allocation for climate adaptation through the County integrated development plan (CIDP) 2018 - 2022. The CIDP strategizes on the development of the agricultural sector prompting a technical strategic focus, including conservation agriculture and water harvesting as well as improved production through better-adapted seeds and breeds, pests and disease control, and capacity building.

The National Drought Management Authority (NDMA), a government department, has identified the selected target area and groups as the most underdeveloped locations in Tharaka Nithi County. Some of the most underdeveloped locations in the county according to NDMA's subsequent food security analysis reports are specifically 1829 boys, 1846 girls, 1830 male adults, 1995, female adults, according to 2019 census (KNBS, 2019)[1].

The intervention will aim to target farmers, agro-pastoralists, youth and women, different government ministries, students, and tutors in higher learning institutions, CBOs/SHGs, local leaders and members of the community. The target group is therefore composed of mostly peasant farmers and vulnerable households

[1] https://www.knbs.or.ke/2019-kenya-population-and-housing-census-results/

surviving from hand-to-mouth and living on less than 1.90 dollars a day. They are mixed farmers practicing both crop and livestock production. The target group has previously been implementing resilience focused interventions with IAS K. However, this project seeks to fill in gaps that were identified through interaction and discussions with the communities, and the evaluation reports of given from previous interventions.

IAS Kenya has been engaged with extensive interventions, reviews, and consultations with the local communities in Tharaka where IAS K operates. The results of these have been documented well, and recommendations are given. However, IAS Kenya, together with local communities and partners, needs to be aligned with Government and local government policy and strategy. The purpose of this intervention is to address the consequences of climate change in Tharaka and facilitate a process by which sustained adaptation policy and plans are prepared for the future.

To be a relevant resource for the farmers, IAS K will, based on previous experience with implementation of disaster risk reduction and resilience programming, engage in an innovation in climate change adaptation approach together with vertical integration. In this short-term intervention, which serves as pilot for a larger intervention assumed when qualified further, drought-tolerant seeds will replace previously failing seeds which will be introduced and a sustainable value chain of seed selection, conservation, and propagation.

Other sectoral targets identified to be addressed by the project will include:

a) Awareness creation on climate change and understanding of agronomic practices (crop rotations, intercropping, agroforestry, cover crops, and no-tillage) for propagating drought-tolerant crops.
b) Promotion of fodder to sustain livestock during the drought season and as an alternative for crop production.
c) More knowledgeable water committee members
d) Availability of resource people in the community to assist with water harvesting technologies.
e) Increased volume of water retained to be used during the drought period.
f) Partnerships for stronger climate adaptation and resilience building.
g) Introduction of sustainable financial mechanisms for haymaking, liners, seed acquisition, and fodder production

The intervention focuses on agriculture as the main sectoral theme in addressing climate change adaptation, while water supply is a sub-sector.

It was towards supporting the implementation of this project that IAS Kenya commissioned this value chain analysis of drought-tolerant seeds in Tharaka North and South Sub-Counties of Kenya.

1.3 Aim and Objectives of the Study

The purpose of the analysis was to contribute towards the successful implementation of the project by availing analytical information about the value chain of drought-tolerant seeds in the target areas in Tharaka North and South Sub Counties of Tharaka Nithi County.

The specific objectives of the assignment were to:

- Identify the drought resistant seeds ideal for the target area and assess the entire value chain dynamics of each of the seeds.
- Identify the factors influencing the production of the identified seeds, including small-scale and large-scale producers, if applicable
- Identify the production methods and the related factors.
- Assess the volumes of seeds produced by types and seasonal implications.
- Assess the market dynamics for the seeds, factoring in availability by season, price regime.
- Potential for enhanced production.
- Document the challenges and lessons learnt in the production of the seeds; and
- Based on the above, make appropriate recommendations.

1.4 Scope of Work

The geographic scope of this assignment was the project implementation areas of Tharaka North and South Sub Counties of Tharaka Nithi County, where it focused on the five (5) locations Kanjoro, Kathangachini, and Maragwa, and in Tharaka North, and Chiakariga and Kamanyaki in Tharaka South Sub Counties.

The scope of content of this analysis was aligned towards the achievement of the stated objectives, as summarised in the table below:

Table 1 – Primary study areas

Objective / Outcome Areas	Desired information
Outcome 1: Improved agricultural production introduced for 1090 farmers in Tharaka Nithi County through innovative and enhanced and scalable climate change adaptation strategies by the end of December 2023	
Output 1.1 Increased adoption of drought-tolerant crops by 600 farmers in Tharaka North and South Sub Counties	- The different types of drought-resistant crops grown in the target area
	- The number of farmers growing drought-resistant crops
	- The amounts of crops grown, by type and volume
Output 1.2: Increased animal production through the adoption of drought-tolerant fodder crops and pasture conservation by 600 farmers	- The types of drought-tolerant fodder crops grown in the area, by type and volume
	- The factors affecting the growing of these fodder crops
	- The number of people using these fodder crops
	- The number of animals currently being fed on these crops
	- The current animal production rates by types
	- The number of people practicing pasture conservation
Information Area	**Potential questions asked**
Identity of drought resistant seeds	- Which are the drought resistant crops grown in your area?
Value chain dynamics	- Which are the sources of each seed? - Who are the main actors along the value chain of each identified crop? - How many actors are they in each node or stage? - What is their role along the specified value chain?

	- How do they add value to each seed along the value chain? - What is the extent of their influence? (How far can they harm or improve the value chain?) - Which challenges do they face? - What can be done to enhance their effectiveness along the value chain?
Value addition	- Is there any value addition done to each seed? - Who are the actors in value addition for each seed? - Where are they located? - Which value addition do they do to each seed? - Which are the challenges they face in their value addition activities? - How have these been addressed so far? - Which recommendations can they propose to enhance their effectiveness?
Seed production dynamics	- Which is the high season for producing each seed? - How much of each seed is produced in the high season? - Which is the low season for producing each seed (if applicable)? - How much of each seed is produced in the low season? - How many large-scale producers are there for each seed? - Which are their most common methods of production for each seed? - What is their volume of production? - Which are the factors affecting their production? - What can be done about these factors to make them more effective? - What is their volume of production? - Which are the factors affecting their production? - What are their recommendations for making them more effective?
Market dynamics	- Name the local markets available for each seed - What is the average distance from an average farmer to the local market? - Name any outside markets available for each seed - What is the average distance from an average farmer to the local market? - How easy is it to access these markets? - In which months is the supply of each seed highest? - What is the price per unit of each seed in the high season? - To which other markets are the seeds taken in the high season? - Who sets the price of seeds per unit? - How often does the price change? - What recommendations can market actors make to enhance their effectiveness?
Challenges and mitigation measures	- Which are the challenges encountered in the production of each seed? - Who is doing anything to address these challenges? - What is being done so far to address these challenges? - What more can be done to address the identified challenges?
Cross cutting issues	- How much support do they receive from the county or national government? - Which organizations or agencies are supporting their efforts, and how? - What is the role of named disasters in their identified activities? - Which mitigation measures do they take to cope with disasters? - Does gender play any role in any seed value chain? - Describe the role of gender in identified seed value chains

2.0 LITERATURE REVIEW

As a prelude to the study, a review of available literature was conducted for the purposes of putting the assignment into correct perspective, and to identify key study issues that have been addressed previously, as well as the common emerging issues worth focusing on. These are presented in the section that follows.

2.1 Drought-tolerant Seeds: A Conceptual Understanding

Since this was an analysis of the value chain for drought-tolerant seeds, it was necessary to start with a conceptual understanding of the term, to provide its working definition for the rest of the study. Two definitions of the concept stood out as appropriate to this study.

In the first instance, drought tolerant seeds or crops was established to refer to the ability of plants to sustain a certain level of physiological activities under severe drought conditions through regulating a number of genes and metabolic pathways to reduce or restore the occurring stress damage (Shi and Hussain, 2020). This definition was deemed appropriate given the severe drought conditions in the target locations and the perennial need for plants to sustain themselves regardless of the climatic circumstances. In the second but parallel instance, drought tolerance was established to refer to the degree to which a plant is adapted to arid or drought conditions. This is because plants in dry environments are subjected to random droughts, and it is generally impossible for them to escape from such adverse conditions. Thus, plants in such environments have the ability to endure water stress through certain biochemical or morphological adaptations and avoidance of cell injury (Azhar and Rehman, 2018).

However, the perception of rural farmers in the target locations, and in Kenya in general, is rarely scientific or technical, but rather based on their observation of the performance of the seeds in the face of adverse climatic and weather conditions. From many years of planting different seeds or crops that have survived harsh droughts and still managed to produce meaningful harvests, they are quite aware about the seeds that would technically qualify as drought-tolerant. Fortunately, their net understanding of drought tolerant seeds or crops is in tandem with the technical definition of the concept that it is the degree to which a plant is so adapted to arid or drought conditions that it still produces yields regardless of the adverse circumstances. This too is how drought tolerance was used for the purposes of this study.

2.2 Value Chain Analysis: A General Perspective

It is important for an analysis of this nature to be launched on the platform of a broad understanding of the value chain concept, a general understanding of value chain analysis, and the key elements that inform the process.

2.2.1 Understanding a value chain

Cascade (2023) defines a value chain as a set of activities, processes, and inputs that go into the creation of the final product, while Stobierski (2020) views it as the various activities and processes involved in creating a product or performing a service. A simplified version of a value chain can be understood as the full range of activities which are required to bring a product or service from conception, through the different phases of

production. It involves a combination of physical transformation and the input of various producer services; delivery to final customers; and final disposal after use, where applicable (Hellin and Meijer, 2006). A value chain therefore can consist of multiple stages of a product's lifecycle. It is the process of trying to gain a deeper understanding of the intricacies and workings of a given value chain that constitutes a value chain analysis.

2.2.2 The value chain analysis concept

A value chain analysis may be viewed as a means of evaluating each of the activities in a value chain to understand where opportunities for improvement lie (Stobierski, 2020). It is a strategic framework that helps in analyzing activities needed to create a product or service and deliver it to its consumers (Cascade, 2023). But perhaps the simplest understanding value chain analysis, particularly in the context of agriculture, is the identification of major actors playing a key role in an agricultural product, from the farm to the table, and in the process assessing the efficiency of the actors (Negash, 2020).

2.2.3 The purpose of conducting a value chain analysis

The purpose of conducting a value chain analysis is to discover gaps and identify opportunities to increase operational efficiency; reduce wasted resources; increase financial performance and profitability; increase the quality of a product while reducing costs simultaneously; and to identify a sustainable competitive advantage of the product (Cascade, 2023). Conducting a value chain analysis prompts one to consider how each step adds or subtracts value from the final product or service. This, in turn, helps in realizing the competitive advantage of the product (Stobierski, 2020).

2.2.4 Types of value chain analyses

From available literature, there are two types of value chains, namely cost advantage analysis, and differentiation analysis. Whereas the first one is about competing on costs and involves cutting production costs and streamlining the processes to increase profitability, the latter involves adding value by offering a unique or high-quality product (Pipedrive, 2023). The value chain analysis that was conducted set out to add value to the efforts of targeted farmers by offering unique or high-quality seed products that are drought resistant and therefore with higher chances of doing well in the arid and semi-arid areas that define Tharaka North and South Sub Counties of Tharaka Nithi County.

2.2.5 The value chain analysis process

The process of value chain analysis can be grouped into five distinct stages. This includes the collect of raw data and information; identification of entities and process functions; connecting the entities and functions; valuing the links in the chain; and creating a diagram for documentation (Raza and Miller, 2021).

2.2.5.1 Identification of entities and process functions performed

The first step in value chain analysis is to identify the different nodes or segments in a given value chain. This is also known as mapping the market. It involves identifying all the stages that support that chain; the main actors in each segment; and the functions they perform that constitute adding value along that chain. This process helps in building an understanding of the different players or actors in the seed input and product;

output chains and the relationships between them, along with the factors that determine how well or badly the chains are working. It will also shed light on some of the factors determining why different farmers engage in the production of different types of seeds. This will in turn help the study to determine the most effective tools to use for different respondents along the respective value chains (Hellin and Meijer, 2006).

2.2.5.2 Connection of the entities and functions

The second step in the value chain analysis process is to connect the identified entities and their respective functions along the value chain (Raza and Miller, 2021). And in line with this position, careful thought and planning was exercised in the defining of the functions performed by each actor, to accurately depict and delineate their role from other actors. Cases were encountered where some roles overlapped between actors, making it difficult to identify value addition at one stage from the next stage. However, efforts were made to isolate as much of the activities of each stage that distinguished it from the next.

2.2.5.3 Value the links in the chain

In addition to identifying the links comprising a value chain, it is important so describe contributions of value creation or addition by actors at each stage. This involves a functional analysis of key functions performed by each actor; important risks assumed; and important assets used by actors at each stage in the value chain (Raza and Miller, 2021). It is important to develop a framework to assess relative magnitudes of value contribution by actors in all stages of the value chain, including demand profiling; production rates; actual functions performed by the actors; and profits by the impact of the function on performance of the product.

During this exercise, a number of things were considered in the framework, including the following:

- Leverage functions: Functions that have high impact on performance (e.g., branding);
- Non-critical functions: Functions that are rudimentary and low risk (e.g., freight-forwarding);
- Strategic functions: Functions that are high risk and high impact (e.g., research and development activities); and
- Bottleneck functions: Functions that have low impact but high risk (e.g., location-restricted activities).

2.2.5.4 Creation of a diagram for summary

It is recommended that a diagram should be developed to give a graphic image of the value chain. For this analysis, the following diagram graphically captured the tentative value chain, and the link between the different actors.

2.2.5.5 Collection of the raw data and information from each value chain segment

The final step in a value chain analysis is a qualitative and quantitative approach to collect, synthesize, and organise the raw information necessary for the analysis. The surveys and interviews with key stakeholders should focus on a detailed discovery of the activities and functions performed by each of the actors at each node of the value chain. Challenges encountered, risks incurred, and all other aspects of the value chain should be documented at this stage (Raza and Miller, 2021).

This conceptual context informed the value chain analysis that was conducted in Tharaka North and South Sub Counties of Tharaka Nithi County, whose summary profile is presented below.

2.2.6 The value chain concept: a local perception

From preliminary engagements with key stakeholders and informants, the study established that even though the value chain concept was not new to the target population, their interaction with it was fairly limited to only those aspects that were directly related to their daily activities. This came down to where they sourced their inputs, and where they took their produce, and nothing else beyond that. For instance, they bought their seeds from the nearest agro-vet shop, but hardly bothered to know where those seeds came from, or any of the upstream actors involved in the production of the seeds. Similarly, one farmer expressed his awareness of the people he sold his produce to, and the fact that they probably took those produce somewhere else downstream; however, he was least bothered by who the downstream actors were, or what value addition activities those actors engaged in. To this extent the presentation of the value chain concept to the respondents was only to the extent where they were engaged with it directly, upstream and downstream along the chain.

2.3 Seed Value Chain Analysis: A Comparative Dimension

Efforts were made to examine similar value chain analyses of seeds that have been conducted before, both locally and internationally. Findings in this regard are discussed below.

2.3.1 Value chain analyses of drought-resistant seeds in Kenya

The study made efforts to establish if any study has been undertaken on seed value chain in Tharaka Nithi County but found no information in this regard. That compelled the study to look at any analysis done on the seed value chain in Kenya, from where a number were engaged with.

A 2018 study on field pests and disease diagnostics in seed crops established that the success of a seed business is controlled by three factors, namely valuable research products; careful production of the products as per regulations; and good marketing strategies. All these are heavily interdependent on each other. Efficient seed production, processing and distribution under quality assurance standards may still not work as expected due to the influence of external factors, including restrictions from the national regulations set on seed quality standards; inappropriate market restrictions; low farm productivity that makes the enterprises unprofitable; functionality of grain (and value added) markets. Success in seed business is intertwined with success in agricultural economy, and seed is only one of the key factors (Nzuve, 2018).

Earlier in 2016, a value chain analysis of grass seeds in the drylands of Baringo County, Kenya established that the grass seed value chain actors play roles that complement each other. The value chain was dominated by bulking and processing agents who work through field agents. The fodder producers in Baringo County had a preference for market outlets that allowed for seed price negotiations over those offering fixed prices. Contractual agreements that integrate provision of inputs and purchase of seeds were not portrayed as advantageous by producers. Overall, the promotion of fodder production by provision of technical training and subsidization of start-up costs but extending assistance to the marketing stage of the value chain, misses a large part that will make the system work better. As such, there is need to strengthen the fodder producer groups with a possibility of registering them as cooperatives for the purpose of collective bargaining for better grass seed prices (Lugusa, Wasonga, Elhadi & Crane, 2016).

In a similar grass seed value chain analysis in the southern range lands of Makueni and Kajiado Counties in Kenya, it was established that there is low commercialization of both hay and grass seed production among livestock farmers in the study, as indicated by high dependency level on free basic inputs. A majority of farmers depend on own labor and fencing materials respectively, while grass seed harvested from naturally growing grasses on the farm was the dominant source of seed for reseeding, followed by seed from KALRO. A smaller portion of harvested grass seed was used for further reseeding, while the rest was sold mainly to NGOs, other farmers and seed bulker/ brokers. Pasture producers do not embrace leasing of pasture due to adverse effects of poor grazing practices. However, some farmers prefer leasing as they consider it cheaper and does not require any labor. The price of grass depends on various factors including seed quality, season, species as well as social factors. The informal nature of the market and seed quality control and standardization restrictions limit marketability of the seeds. These markets therefore need to be formalized with proper structure and policies that do not only open them up but also encourage private investment in providing missing services such as mechanized harvesting (Omollo, Wasonga, Elhadi & Mnene, 2016).

From the above findings, it was for this study to empirically establish if similar dynamics played any role in the seed value chain in Tharaka North and South Sub Counties of Tharaka Nithi County in Kenya

2.3.2 Value chain analyses of drought-resistant seeds elsewhere

Further afield in Ghana, a study on Africa's "Seed" revolution and value chain constraints to early generation seeds commercialization and adoption determined that institutional challenges limit the ability to deliver quality seeds to farmers. The state-dominated seed system undermines other actors' participation, culminating in failure to deliver quality seeds to smallholder farmers. The study also identified a number of related challenges including limited capacity of public institutions; constrained capacity of the emerging private sector; a lack of well-defined, fair and enforceable contracts between stakeholders in the delivery system; land-tenure limitations; poor forecasting of farmers' demands for seeds by research institutions and seed producers; sparse marketing arrangements for improved maize seeds; and concentration of power to control seed supply in the hands of few institutions. The study established that these challenges result in unavailability, inaccessibility, and unaffordability for smallholder farmers, culminating in a poor adoption rate of improved seeds, particularly hybrid maize seeds. Consequently, weak power of the governance mechanism of the maize seed value chain has enabled nodal points that gives prominence to key public institutions, NGOs, and research institutions who control production and distribution of improved seeds in ways that undermine the effective delivery of maize seeds. Likewise, the power dynamics obstacles undermine trust among value chain actors in ways that negatively affect seeds' delivery (Quarshie, Abdulai, and Fraser, 2021.

Elsewhere in India, a value chain analysis of maize seed delivery system in public and private sectors in Bihar, established that the release of many improved cultivars (hybrid seeds, etc.) by various seed companies and public institutions, did not result in farmers taking up new maize varieties with the enthusiasm that was expected. This was suspected to have been as a result of inadequate facilitation of the promotional activities, coupled with weak horizontal linkages among research, extension and seed companies. It was also observed that even though the public research institutions have adequate research and development facilities, they lacked the marketing bent to popularize their products. The farmers have also felt that the improved varieties need huge capital investment in terms of assured irrigation and fertilizer to respond to their potential. This has undermined the extent of adoption of certified maize seed with the probable consequent effect of high seed prices brought about by reduced economies of scale. There is need to harmonize existing laws and

regulations governing the seed sub-sector besides ensuring good and stable producer prices, quality farm inputs, and improved extension services. Public research institutions should also evolve measures to take their products to the growers, demonstrate the potential of the seeds developed and produce the seed materials adequately to fill the gap left open by the private players. Most importantly, development of efficient and integrated maize grain market is essential to drive the sector together with the maize seed sector in the region (Kumar, Alam, Krishna, and Srinivas. 2012).

On the strength of findings from Ghana and India, it was upon the study to examine and find out if the same challenges apply in the context of Tharaka Nithi County, with specific reference to Tharaka North and South Sub Counties that form the epicenter of this study.

2.4 Tharaka Nithi County: An Overview

Tharaka Nithi County is a semi-arid area in the Eastern side of Central Kenya with a trend of becoming highly vulnerable to adverse impacts of climate change. The area is classified as a water scarce region with less than 650mm3 of freshwater per capita. A greater part of Tharaka Nithi County is classified as Arid and Semi-Arid Lands (ASALs).

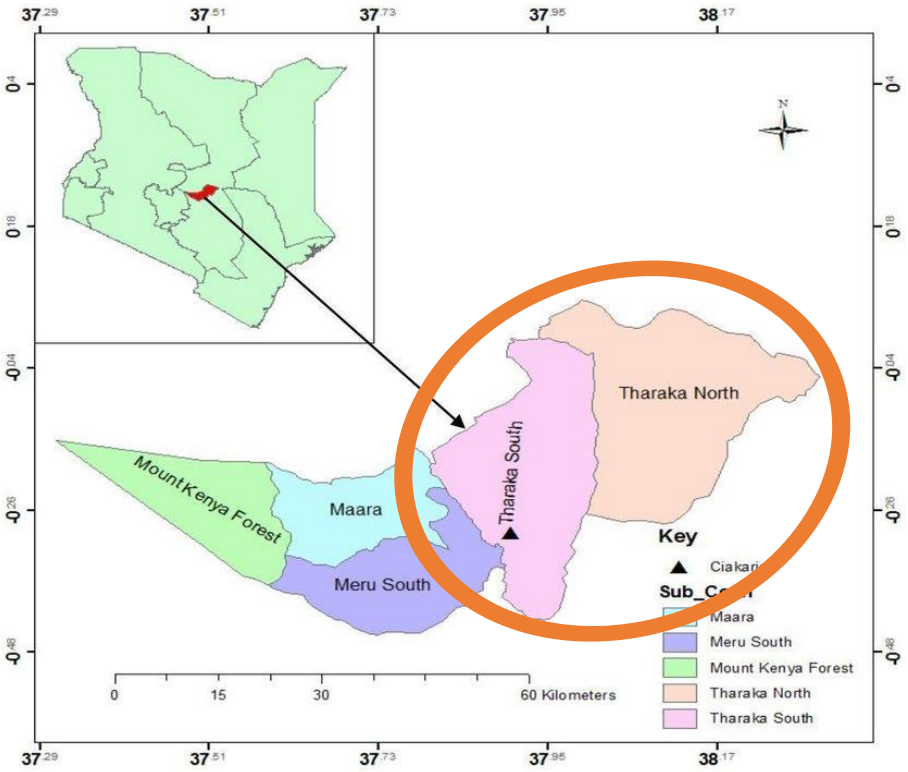

Figure 1 – Map showing Tharaka North and South Sub Counties

ASALs are generally marked by low human development, high levels of poverty, low literacy, low population density, poor infrastructure, unreliable rainfall patterns and recurrent droughts. Climate-related shocks and

stresses, especially recurrent drought significantly undermine food security and livelihood and other aspects of community life of a large section of community system in Tharaka including health, education, economy, social cohesion, and unity, among others. And the findings of IAS Kenya are supported by many sources.

Local communities in Tharaka Nithi County experience a wide variety of climate-related shocks and stresses including hunger and famine due to crop failure, loss of livestock, water shortage, and outbreak of human diseases such as cholera. There is evidence of poor farming methods that lead to decline in land productivity, such as slash and burn cultivation methods, overgrazing, and charcoal burning leading to destruction of vegetation cover, uncontrolled soil erosion, and deep gullies. The long-term exposure to environmental degradation, increasing incidences of climate-related stresses and shocks, coupled with accelerated aridity of the land, reduced land sizes, and land degradation, has had a combined effect of eroding the livelihood of the people of Tharaka Nithi County and exposing them to food insecurity, poverty, and morbidity among other vulnerabilities.

2.5 Tharaka Nithi: County Risk Profile

Kenya is highly exposed to many natural hazards, most commonly floods and droughts. It is estimated that over 70% of natural disasters in Kenya are attributable to extreme climatic events. Typically, major droughts occur approximately every ten years and moderate droughts or floods every three to four years. Repeating patterns of floods and droughts in the country have had large socio-economic impacts and high economic costs. For example, the 1998 to 2000 drought cost an estimated $2.8 billion, principally due to crop and livestock loss, as well as forest fires, damage to fisheries, reduced hydropower generation, reduced industrial production, and reduced water supplies. Droughts have affected more people and had the greatest economic impact (8% of GDP every five years). As many as 28 droughts have been recorded in the past 100 years, and these appear to be increasing in frequency, which is why scientist claim climate change as the main contributing factor. Droughts are often nationwide but have the most severe impacts in the country's highly arid zones. Drought also remains a significant concern to Kenya's agricultural sector. Arid and semi-arid areas comprise 18 or the 20 poorest counties and are particularly at risk from increased aridity and periods of drought (The World Bank Group, 2021). Kenya's arid and semi-arid lands (ASAL) cover 48 million hectares or with approximately 80% of the country's total land surface. Of this, 9.6 million hectares support marginal agriculture, and almost 15 million hectares are suitable for largely sedentary livestock production (The World Bank, 2018). Tharaka Nithi County, and particularly Tharaka North and South Sub Counties, are some of the most affected ASAL areas within the county.

According to the Tharaka Nithi Climate Risk profile report, over 40% of the county's population lives below the poverty level (<1$ a day) and have challenges accessing necessities like food, clothing, and decent shelter. This is attributed to lack of resources to invest in the other sectors that can enhance their income generating capacity, poor infrastructure, low food productivity, and adverse climatic conditions (MoALF, 2017). Tharaka Nithi County's vulnerability to hazards occasionally results in crop failure and reduction in pasture availability, particularly when short and inadequate rainfall is followed by prolonged droughts.

2.6 Agriculture and Food Production in Tharaka Nithi County

Agriculture is the main source of food and livelihood in the semi-arid Tharaka Nithi County. It is therefore a primary source of income for most households in the county. Approximately 80% of the population are subsistence farmers, focusing on crop and livestock production. Crop production is the main economic activity in the mixed farming and rain-fed cropping livelihood zones contributing to about 70% of household income, which is rarely achieved due to unreliable rainfall in the area (MoALF, 2017). Livestock diseases and acute water shortages continue to pose a great challenge to the resilience of the communities. Both the long and short rains have been erratic in the recent past and become more unpredictable because of climate change. This calls for communities to be more adaptive if they are to survive. Since 2019, the area has received inadequate rainfall, and this has affected crop and livestock production, which led to most farmers replanting two to three times hoping for a better plant yield (NDMA, 2022). From engagement with farmers, it emerged that such recycled seeds do not yield the anticipated harvest. Sometimes the seeds also fail to germinate, and the subsequent replanting process subjects the farmers to additional labour as well as additional costs of new seeds. Such seeds remain a threat to food security.

2.7 Main crops produced

The main food crops grown in Tharaka Nithi County include maize, beans, cowpeas, sorghum, millets, green grams, bananas, and pigeon peas. Some of the current crop-related coping strategies to climate hazards for agriculture and livestock farming systems in the county include small scale rainwater harvesting, implementation of good agricultural practices, and conservation agriculture, planting drought-tolerant and early maturing varieties, post-harvest management, and agro-forestry. Longer term adaptation strategies for crops include enhanced water harvesting, irrigation development, scaling up of conservation agriculture and efficient irrigation. Off-farm efforts to increase resilience to climate change include services such as early warning systems, expansion and capacity building of agricultural extension and improvement of marketing information and infrastructure (MoLAF, 2017).

2.8 Emerging Issues for Analysis

From the review of available literature, it was established that not much has been documented or shared about the key elements of the analysis, creating an information gap that the study set out to fill. The following areas were therefore confirmed to remain the key issues for the planned analysis:

- Identity of drought resistant seeds
- Value chain dynamics
- Value addition
- Seed production dynamics
- Market dynamics
- Challenges and mitigation measures
- Cross cutting issues

It was of particular interest to this study to bring out detailed information about the identified study areas, with an inclination towards drought-resistant seeds grown in Tharaka North and South Sub Counties of Tharaka Nithi County.

3.0 METHODOLOGY

This study employed participatory as well as other methodologies aimed at generating information in an inclusive manner that ensured ownership of the findings by the stakeholders. Below is a discussion of some of the key methods that were useful to this study.

3.1 Desk Review

It is advisable to commence a study of this nature with a desk review of available literature, on the basis that before carrying out a field visit, it makes sense to see what people have done in the past that relates to it. It is likely that someone has almost certainly tried to answer related questions (Travis, 2016). In line with this position, this study started by undertaking a desk review of available documents. This process provided valuable background and offered it a solid foundation from which to launch the study. The exercise also gave an insight into the issues to be addressed by the study. It was based on this secondary information that other study methodologies were designed.

3.2 Study population, sampling, and respondent distribution

The core study population was identified by the terms of reference for this assignment as "1, 090 farmers in Tharaka North and South", who are the primary target of the pilot project. It was from this target population that the study sample was scientifically calculated.

The study adopted the *Slovin's Formula* for the calculation of the sample. In this formula, $n = N/(1+Ne^2)$, where n is the sample size, N is the population size and e is the margin of error to be decided by the researcher (Castillo, 2016). The study adopted a 5% error margin, informed by an opinion that an acceptable margin of error used by most survey researchers typically falls between 4% and 8% at the 95% confidence level. It is affected by sample size, population size, and percentage (Pollfish, 2021). Based on Slovin's Formula, the ideal sample size for this study was calculated to be 137 respondents, as shown below.

Table 2 – Calculation of primary study sample

Item	Number
Formula	$n = N/(1+Ne^{2)}$
Project beneficiary population	1,090
N = Population	1,090
e = error margin of 8% (at 90% confidence level)	0.08
e*e	0.0064
N*e*e	6.976
$(1+Ne^2)$	7.976
$n = N/(1+Ne^2)$	136.6599799
Total	**137**

The figure of 137 respondents was treated as indicative, with a commitment to engage with as many respondents as time and resources allowed. The study sample was distributed as follows.

Table 3 – Respondent distribution by location	
Location	**No. of respondents**
Chiakariga	30
Kamanyaki	30
Kanjoro,	30
Kathangachini	30
Maragwa,	30
Total	**150**

3.3 Key Informant Interview (KII)

Key informants are knowledgeable individuals who contribute a perspective on a research phenomenon or situation that the researchers themselves lack. They provide information about, and contribute to expanding a researcher's understanding and precise insights and help to reduce potential bias (Cossham and Johanson, 2019). On this basis, KII was used by the study to obtain information from strategically placed stakeholders with unique information arising from their equally unique positions. Included in this exercise were the following key informants, forming the secondary respondents for the study.

Table 4 – Secondary respondents	
Respondent Group	**Sample Size**
Leaders of farmers associations	5
Crop transporters	5
Crop retailers at the market	5
Bulk crop traders	5
Agrovet shop owners	5
Sub county officers for agriculture	2
TOTAL	**27**

Of interest to the study from these key informants, and that formed the basis for the questions they were asked included:

- If their members grew DTC, and the volumes grown per season (for farmer association leaders)
- Where their members mostly took their produce and the prices they fetched (for the same group)
- Where they collected produce from and took them to (for transporters)
- The impact of erratic supply and demand, and how this influenced the price regime (for retailers}

- The major sources of the produce they dealt in, and where they took them to (for bulk traders)
- The seed supply, demand, and pricing (for Agro-vet shop representatives)
- The kind of support given to farmers growing DTC (for the agriculture officers)
- The challenges faced by all of them (posed to all the key informants)
- The way forward for DTC, and any recommendations (also posed to all)

3.4 Focus Group Discussions (FGD)

This was used to capture information from members of homogeneous respondent groups. The exercise benefited from among the known advantages of FGD, including participants "feed off each other" as they responded to each other's comments. Participants also supported or disagreed with one another, creating more energy and thus more data. Using FGD, the exercise managed to get at perceptions, attitudes, and experiences more than a quantitative survey.

The key interest of the study, and that formed the basis for the questions they were asked included:

- If they grew DTC, by types and volumes grown per season
- Where they obtained seeds from, and any related challenges
- Where they took their produce, and the prices they sold at
- Any challenges they faced in transporting produce
- The factors that influenced prices at the market
- The kind of support they received from agriculture officers
- Broad based challenges they faced, and possible mitigation measures for them
- Any recommendations

3.5 Questionnaires and Checklists

A mixed method was used to develop questionnaires that collected both qualitative and quantitative information from respondents. Information obtained was triangulated against those collected through FGD and other methods, for verification. Samples of the questions posed to survey respondents appear in Table 1 of this report.

3.6 Data Analysis

In the data analysis of collected information, primary data was triangulated against information collected from various sources and methodologies and crosschecked with secondary data. The study used both MS Excel as well as the SPSS tool for analysis. The process involved scientifically accepted data analysis techniques including comparative analysis, causal effect analysis and stakeholder analysis, among others. First to be analysed was information from the 161 primary respondents, starting from their distribution by sub-county, as is captured below.

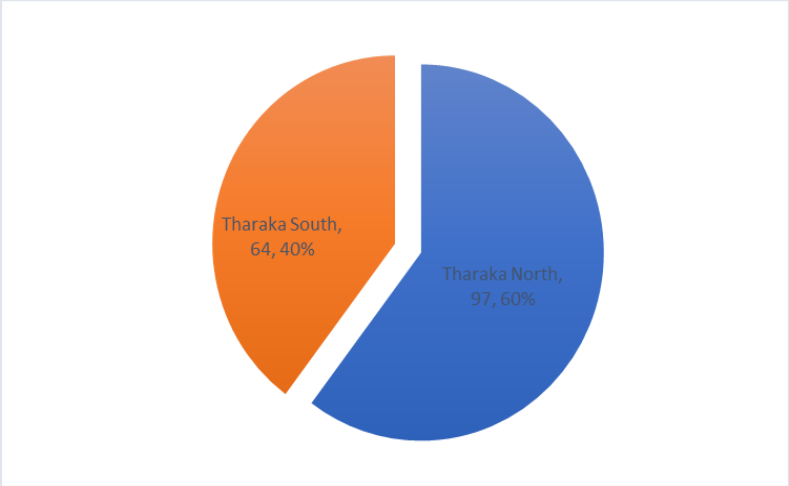

Figure 2 – Respondent distribution by location

The figure shows that 60% (or 97) of the respondents were from Tharaka North Sub-County, while 40% (or 64) were from Tharaka South Sub-County. Their gender distribution followed the expected pattern across the target locations as shown by the figure below.

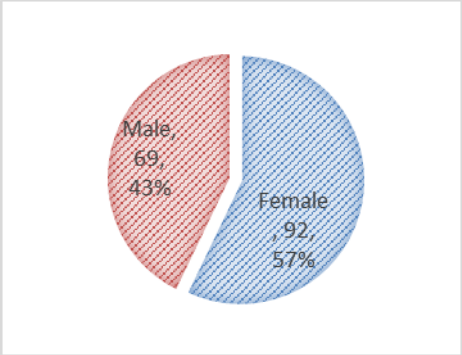

Figure 3 – Respondent distribution by gender

From this figure, 57% (or 92) of the 161 respondents were female while 43% (or 69) were male. Besides this reflecting the actual gender distribution across the target communities, it was also indicative of the representative nature of the subsequent information adduced by these respondents, and an assurance of the balance of such information.

An analysis of the same information by age showed a fair representation of the youth, as shown by the figure below.

Table 5 – Respondents distribution by age		
Age	**Frequency**	**Percentage**
30+	56	34.78%
50+	54	33.54%
40+	46	28.57%
20+	4	2.48%
Below 20	1	0.62%
Grand Total	**161**	**100.00%**

The figure shows that a combined total of 37.88% (or 61) of the primary respondents fell within the youth bracket, which ranges from 20 years to 35 years, with the implication that their voices were heard regarding their role in the seed value chain in the target locations.

A respondent analysis by ability or disability revealed that 8 of the 161 respondents were persons with disability, as shown below, thereby representing this segment of the respondents.

Table 6 – Respondents distribution by ability or disability		
Disability	**Frequency**	**Percentage**
No	153	95.03%
Yes	8	4.97%
Grand Total	**161**	**100.00%**

It was feedback from these primary respondents, together with information from other sources, that was analysed and presented for discussion as findings of the analysis, that appears in the section that follows.

4.0 PRESENTATION AND DISCUSSION OF FINDINGS

Following is a presentation of the findings of the value chain analysis of drought-tolerant seeds in Tharaka North and South Sub-Counties. For the ease of following the flow, the report presents the various drought-tolerant seeds in the target locations, before it presents findings on the various value chain nodes. Cross-cutting issues are discussed at the end.

4.1 Drought-tolerant Seeds in Tharaka North and South

The first thing that was established by the study was that a majority of the respondents grew drought resistant crops (DTC), as illustrated by the table below.

Table 7 – Respondents growing DTC

2.1 As a farmer, you grow drought-resistant crops	Frequency	Percentage
Strongly agree	102	63.35%
Agree	39	24.22%
Fairly agree	18	11.18%
Disagree	1	0.62%
Strongly disagree	1	0.62%
Grand Total	**161**	**100.00%**

The study then established that the main types of drought-tolerant seeds or drought-tolerant crops (DTC) in Tharaka North and South were sorghum (65%); millet (26%); green grams (24%); pigeon peas (18%); cow peas (16%); and maize (3%) in order of priority, as illustrated in the figure below.

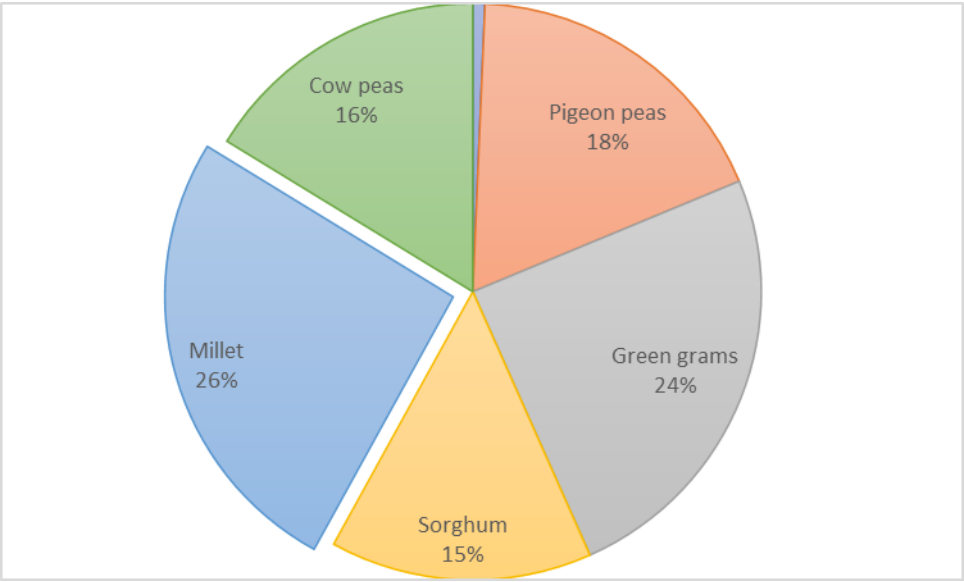

Figure 4 – Distribution of DTC grown, by type and proportion of respondents growing them

The main varieties of the DTC grown are listed in the table below:

Table 8 – Main types of DTC and their respective varieties

Crop	Varieties
Green grams	N26, Karembo, Biashara, and KS20.
Millet	Hybrid
Green grams	Gadam, Sila
Pigeon peas	Hybrid
Cowpeas	(Hybrid) M66
Maize	Duma 43 and 419; Sungura; Panner 4; DH04; Decalb 9084; and Tosheka

It emerged that green grams and cowpeas have composite traits and that if well managed in the farms, seeds can be selected and replanted for 3 to 5 seasons without losing vigor. They are also highly preferred by farmers because of their dual purpose as both food as well as cash crops.

Further, it was also established that demand for fodder has provoked the production fodders seeds which are well adopted to the area. In response to the question about whether they used drought resistant fodder crops, the following responses were obtained.

Table 9 – The usage of fodder crops by the respondents

2.7 You use drought resistant fodder crops	Frequency	Percentage
Strongly agree	71	44.10%
Agree	58	36.02%
Fairly agree	20	12.42%
Strongly disagree	8	4.97%
Disagree	4	2.48%
Grand Total	**161**	**100.00%**

The table shows that a combined total of 92.6% (or 143) of the 161 respondents were in some form of agreement with the assertion that they used drought resistant fodder crops, against a combined total of only 7.5% (or 12) of the respondents who did not.

Asked if they produced fodder, the following responses were obtained:

Table 10 – Respondents who grew fodder

2.4 You also grow drought-tolerant fodder crops	Frequency	Percentage
Strongly agree	52	32.30%
Agree	52	32.30%
Fairly agree	35	21.74%
Disagree	15	9.32%
Strongly disagree	7	4.35%
Grand Total	**161**	**100.00%**

The table shows that a combined total of 86.3% (or 139) of the 161 primary respondents were in some form of agreement with the question that asked if they grew fodder crops, with only 13.7% (or 22) in disagreement with the question. Further discussion with the respondents revealed that the most common types of fodder grown were *Boma Rhodes*, and *Bracharia*. Among the factors that affected the production of fodder included lack of seeds (as was supported by 96.3% (or 155) of the 161 respondents; inadequate rainfall (86.3%, or 139 of the respondents); and pests and diseases (75.8%, or 122 of the respondents).

4.2 Drought-tolerant seeds value chain: Entities and process functions performed

In conducting the market mapping of the seed value chain for Tharaka North and South sub counties, the study identified the following actors:

- Seed engineers (Kenya Agricultural Research Institute)
- Commercial seed producers, with the key ones identified as the East African Seed Company; Seeds Simlaw; Seedco Group; Agripark Seeds; Royal Seeds; Advanta Seeds Africa; Elgon Seeds Ltd.; Syngenta; KEPHIS; and Amiran Kenya (Jua Kenya, 2023).
- Commercial seed sellers (Agro-vet shops)
- Farmers (Large scale producers)
- Subsistence farmers (small scale producers and peasant farmers)
- Farming input actors (mostly Agro-vet shops)
- Agricultural extension service providers (from the County Ministry of Agriculture)
- Farm labour service providers (family and paid farm workers, involved in land preparation, planting of seeds, weeding, harvesting, chaffing, packing into sacks, and storage, where applicable).
- Transporters (including donkey carts; wheelbarrow; pick-ups; tractors; and trucks)
- Processors, bulk traders, and retailers at the market
- County Cess Office
- Consumers

These actors were grouped into five (5) main market segments of input supply; production (of DTC and fodder); traders or aggregators; seed processors (or key value addition actors); and marketers of processed products, discussed in the sections that follow.

4.3 The Input Segment of the Drought-tolerant Seeds Value Chain

Agriculture is highly dependent on inputs. To this extent, the study found a lot of information on the seed inputs, as discussed below.

4.3.1 Direct inputs

The main inputs required by the farmers are mainly seeds, agrochemicals, and equipment, and there are 21 local stockists or agricultural dealers in the target area who have come together to form Tharaka Agro-dealers Association (TADA). There are a few others who are not in the association but still supply these inputs. These are located within the main and rural markets. The main types of seeds stocked are the

drought tolerant crop seeds. There is one seed producer who gets pure seeds from breeders and is licensed by KEPHIS to multiply seeds for farmers.

The sources of seeds for green grams, cowpeas and sorghum is East African Seed Company, KALRO Katumani and Dryland Seeds Company while maize is from Kenya Seed Company through distributors. There is no distributor based in the lower zone and therefore the agro dealers must order them from the companies directly.

The main markets where the agro-dealers are based are Gatunga, Mukothima, Kathangachini, Makutano, Manyanga, Gaciongo, and Gachoroni in Tharaka North, and Marimanti, Nkondi, Mucubi, Chiakariga, Thunyai, Kibunga and Nkarini in Tharaka South. There are a few outside markets selling similar seeds including Meru Town, Nkubu Town, Chuka Town and Mitunguu Market. Different agro dealers who sell from these different markets have variations in volumes depending on the number of farmers within the area. However, on average the volume of seeds sold by most agro-dealers during the high season (October-November-December) are captured in the table below.

Table 11 – Volume of seeds sold by input suppliers

Crop	Sales per season
Green grams	300 (24Kgs per Bale)
Cowpeas	20 Bales (24Kgs per Bale)
Sorghum	200 Bales (24Kgs per Bale)
Maize	40 Bales (24Kgs per bale)

The price for the seeds is set by the producers who further regulate a certain margin for the distributors. Retailers set their prices depending on their distance from the suppliers, mainly to offset the transport costs. Below are the average price of seeds in the study region.

Table 12 – Average prices of seeds sold by input suppliers

Seed type	Unit Price (2kg packets)
Green grams	550/=
Cowpeas	380/=
Sorghum - Gadam var	400
Sorghum - Sila var	450
Maize	650/=

Prices fluctuate annually with a margin of between 30 shillings and 50 shillings. These changes are determined by the seed producers.

The other category of inputs supplied are agro-chemicals, the most common being seed dressers; pests and disease control chemicals; and storage dusts. Just like the seeds, these inputs are sourced from long

distances either through the distributors or the producer companies directly. Unlike the seeds, the agro chemicals vary in source and type.

There are several types of tools and equipment which the agro-dealers stock for farmers. These include land preparation equipment such as the oxen-drawn ploughs; weeding tools; and knapsack spray pumps. From outside the target areas, a few youths have also bought thrashers to ease post-harvest management. Also found with the agro-dealers are the hermetic bags (for storage), and the tarpaulins.

4.3.2 Challenges experienced by input suppliers

Among the challenges that were identified within the input node of the drought-tolerant seed value chain in Tharaka, include the following:

- High prices of seeds: This forced farmers to recycle seeds, leading to poor crop yields
- No small seed packages (1 kg) for small scale farmers
- Low supply of seeds against very high demand, resulting in high costs of seeds
- Seed producers are few (only one in the study area) and have low capacity
- Long distances to the seed producers
- occasional poor-quality seeds with low germination rate
- Inadequate financial capacity for the seed retailers
- Counterfeits seeds

4.3.3 Recommendations

Based on the above findings, recommendations were provided by the input suppliers:

- There is a need to link agro-dealers to financiers so that they can support them to buy the seeds in bulk
- Organize agro-dealers into a stable associations or organization for bulk collection purchases
- There is need for timely delivery of seeds, to prevent onward late delivery to farmers
- Awareness and capacity building for farmers to use certified seeds
- Identify a distributor within Tharaka for bulk purchases and faster distribution to farmers

4.4 Production node

Next to be analysed was the production node of the seed value chain, where most of the farmers belong.

4.4.1 Node Status

Farmers are the key players on this node. They access seeds and other inputs from the input suppliers to aid their production activities. Most of the farmers are small-scale in nature with between 2 and 5 acres, with a few having between 5 and 10 acres and a negligible number with more than 10 acres. Farmlands are highly degraded due to the outdated farming practices.

As at the time of the survey, the prices for the produce from the farmers were as follows:

Table 13 – Average prices of farm produce	
Grain Type	**Selling price* (Kshs/Kg)**
Green grams	70
Sorghum	60
Cowpeas	60
Maize	80

* *Prices at the main markets within the area*

4.4.2 Challenges

The poverty levels in Tharaka Nithi County are high due to a wide range of factors such as erratic rainfall, poor farming technologies, land degradation and lack of reliable cash crops among others. The county's natural resources, which are a major factor of production, are under threat due to human activities coupled with the effects of climate change. A summary of the main cause of poverty among the farming and seed producer communities include the following:

- Crops failure which is caused by low rainfall and neglect on drought tolerant crops
- Illegal over-extraction of wood and other natural resources, which has depleted the resource base below sustainability but not below recovery levels
- Absence of coordination to encourage value chain approaches
- Inadequate extension advice on pre-harvesting, harvesting and post-harvest handling and marketing
- Inadequate certified seeds for farmers
- Late deliveries of seeds by stockists, making farmers to use any similar grain found in the market at the onset of the rains
- High prices of seeds, discouraging farmers from buying them
- Long distances to the agro-dealer shops, with some farmers covering over 15 kms to reach a shop
- Absence of strategic storage reserves and failure to diversify storage techniques, and poor storage at the farmer level
- Poor farming technologies
- Lack of value addition strategies
- Poor marketing structures, encouraging middlemen to take stage
- Exploitation by middlemen due to existing disorganized marketing structures

4.4.3 Recommendations

To address the above identified challenges, the following recommendations were put forward:

- Capacity building of farmers on the general benefits of agronomy, and planting certified seeds
- For composite crops whose seeds can planted for 3-5 years, farmers need capacity building in seed selection, storage, and treatment
- There is a need to train farmers on the available technologies for water conservation and use in agriculture

- Organize farmers into producer marketing groups with an umbrella platform, to scale down middlemen
- Promote diversification of livelihood options, for enhanced resilience
- Influence the county and national government to come up with policies and legislations which are pro poor and pro-farmers
- Moderate the price of certified seeds, to encourage uptake by farmers
- Promote the timely availability of seeds, especially before the onset of rains
- Promote contract farming, to encourage production
- Address inadequate finances for production

4.5 Traders or Aggregators Node

This was found to be a distinct but very critical category of the seed value chain which feeds off the farmers and creates employment to many people, and as such deserved a proper mention.

4.5.1 Node status

This is not a homogeneous group since within this node, there may be two or even three other levels of middlemen, depending on distance from the farms to the markets. This arrangement ends up exploiting the farmer as each level of middlemen try to push down their buying price to leave them with a profitable mark up at their next point of sale. The farm gate price end up being pushed as far downwards as possible, to the disadvantage of the producer farmer.

There are the small traders who buy directly from farmers and from small markets, for the big aggregators. They set their buying price below the prices they have been offered by the main aggregator for them to also make a profit. Each market centre has several traders who buy right from the farm or from the local markets. Following are the average prices of farm produce that were encountered at the time of the study, with a caveat that such prices fluctuate upwards or downwards freely, depending on the usual market forces of supply and demand.

Table 14 – Average prices of produce by aggregators (traders)

Grain	Buying Price* (Kshs/ Kg)	Selling price* (Kshs/Kg)
Green grams	70	80
Sorghum	60	70
Cowpeas	60	65
Maize	80	90

* *Prices at the main markets within the area, by aggregators*

4.5.2 Challenges

The key stakeholders in this node of the value chain were free to share the challenges they faced, which included the following:

- Inadequate resources to aggregate the desired quantities
- Inadequate resources for any value addition e.g., storage for a period; packaging; etc.
- Inadequate storage facilities
- The use of scooping when buying while using the weighing balance when selling. This makes it difficult to get the right weights in the stores due to that difference in methods of measure
- The price fluctuation due to market forces
- Long distances from farmers to the main aggregators
- Competition from other aggregators
- Fragmented markets

4.5.3 Recommendations

A few recommendations were put forward for addressing the identified challenges including the following:

- The need to link aggregators with financial institutions, for easier access to capital
- The need for a platform for sharing information on market prices in real time, to aid them in proper decision-making purposes.
- Since there are stores within the target area, the county government can start a warehouse receipt system so that traders can aggregate more grains

4.6 Processors or Value Addition Node

There was very limited value addition along the drought-tolerant seed value chain in the target locations. The processors found were those that receive the grains from the traders and engage in sorting, grading, packing, milling and distribution of the finished product. They displayed adequate capacity for these activities. Most of them were located in far places away from farms, and mostly in towns. Their main role was to aggregate, process, and sell their seeds to end users or to distributors.

Among the challenges identified at this node of the value chain included limited finances to aggregate and process the desired volumes; limited access to classified means of transportation; poor access roads into some areas where they source their products; and lack of direct link with farmers so as to share a common understanding on the expectations of each level. The limited recommendations they shared were focused on addressing the identified challenges,

4.7 Marketers of Processed Product Node

These were identified to be the distributors and retailers of the finished products from the drought tolerant seed vale chain. Other than receiving and selling the finished seed products, there was little that was done within this category of the value chain.

4.8 Cross cutting Node

A number of actors were identified along the value chain whose role could not be categorized into a distinct segment. Besides, their actions affected all segments of the seed value chain. For the ease of reference, they were grouped into the cross-cutting node of the value chain. Included in this node were transporters at all segments of the value chain; auxiliary service providers; county cess office; weights and standards office; health regulators; financial service providers; researchers and academic institution; policy and legislations bodies; county government; and the national government. Each of these actors contribute towards the functioning of the seed value chain in their different ways, and as such should also be involved in all planning and capacity building initiatives targeting the seed value chain in Tharaka North and South Sub Counties.

4.9 Map of the Drought-tolerant Seed Value Chain

All the above information is captured diagrammatically in the figure below.

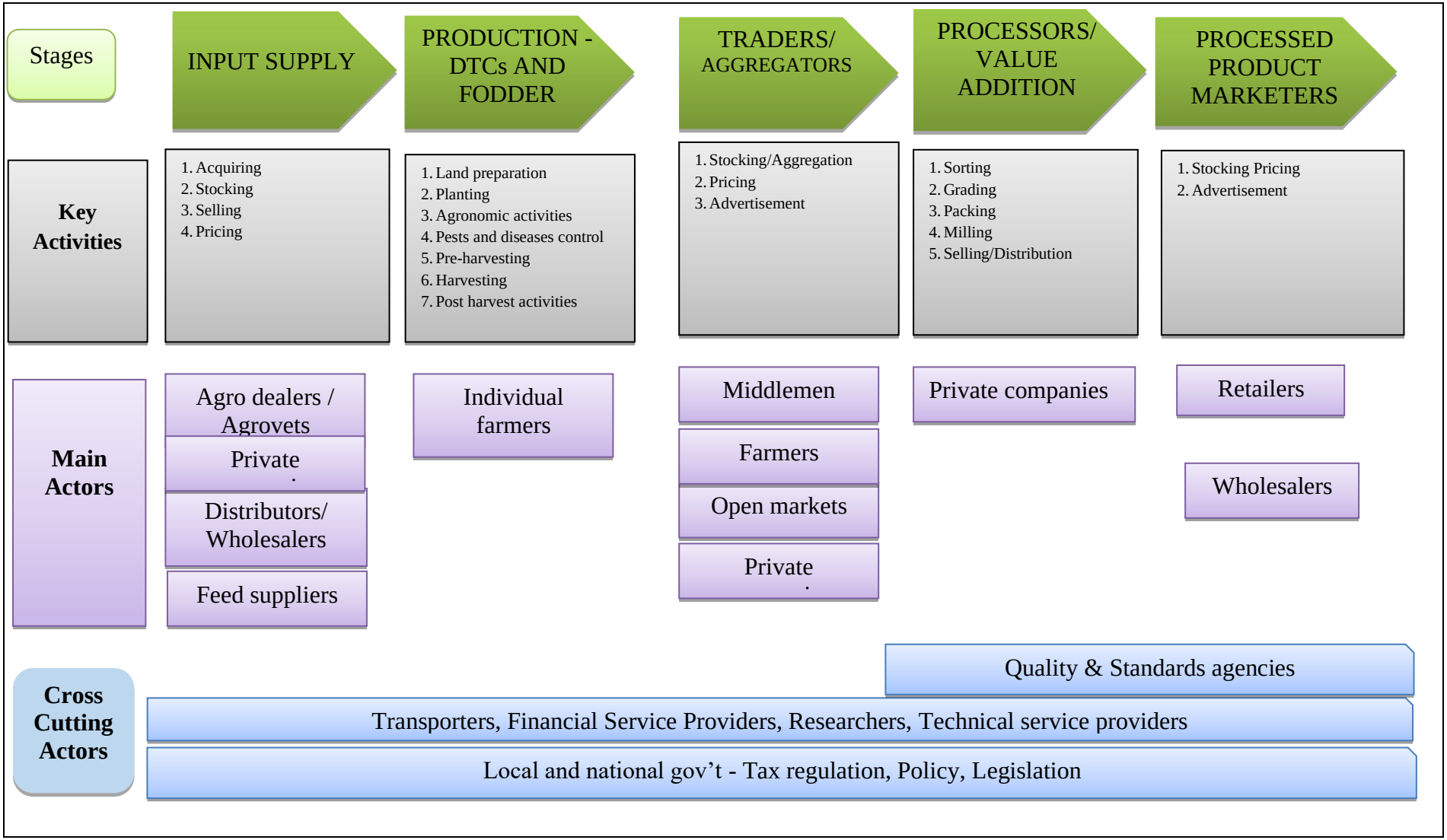

Figure 5 – Map of drought-tolerant seeds value chain in Tharaka County

5.0 CONCLUSION AND RECOMMENDATIONS

The ultimate goal of a value chain analysis is to pin down the practices and processes of a product or products, and if possible, use the results to evaluate ways to improve its competitive advantage (Hart, 2023). In line with this position, when this value chain analysis exercise commenced, it was with a view to improving the processes and if possible, the results of the production and marketing of drought tolerant seeds in Tharaka North and South Sub Counties of Tharaka Nithi County, in Kenya. Through engagement with key stakeholders, this study was able to identify the main actors along the value chain, the respective segments that they represented, and the interface between the identified segments or nodes. The study identified the key issues affecting each node of the value chain from the respective actors of that node or segment, and also collected potential actions that could be taken to address the identified issues, from the perspective of the respondents. It was on the basis of the consolidated findings of this study that it was possible to draw the following conclusions.

5.1 Conclusion

- The drought-tolerant seed value chain does exist in Tharaka North and South, with a predominant production of green grams, cowpeas, sorghum, and maize, which serve as both food as well as cash crops. This places these seeds at the centre of the livelihood of the target populations.
- Much as it is still low in uptake, the use of fodder for livestock is gaining traction in Tharaka North and South Sub Counties, creating yet another opportunity for the target population to explore, both for feeding their livestock as well as for sale to other livestock keepers
- The current drought-tolerant seed value chain is not yet developed and exists as a natural process of the production and sale of the crops by mostly subsistence farmers. This creates an open opportunity for the development of the value chain as a way of boosting food production and improving the livelihoods of the target population.
- Input supply and the production nodes are the most critical nodes in the drought-tolerant crops value chain. They control and supply all the other nodes with raw materials. There is therefore a need to have them well developed and well managed for the sustenance of the value chain. At the moment, they experience lack of adequate funding, in addition to other factors, resulting in low productivity.
- Much as agriculture is the backbone of the economy of the target locations, very little has been invested towards improving production. Much of it is still being done using traditional agricultural methods, with the inevitable low production, low yields, poor benefits, and ultimately discouragement of farmers to view farming as a viable source of livelihood.
- The presence of agricultural officers in the activities of the farmers is close to nil, yet that is the primary role of their offices. With targeted strategies that ropes in the services of such officers, food and crop production in the target locations is bound to improve by a big margin
- The role of accurate information in real time along a value chain cannot be overemphasized, yet this is missing, and actors along the chain make decisions using inaccurate or even arbitrary information. This is an element that requires consolidated attention to improve the efficiency of the entire value chain.
- Farmers in the targeted locations still depend on the local markets to sell their produce and miss out on potentially higher prices of faraway markets. There is a need to address the marketing node of the value chain, to help them in maximizing on profits from their farming efforts.
- There is a node grouped as cross-cutting, yet the success of the entire value chain is pegged on their respective inputs. Any efforts to address the value chain must factor in their active participation, if any success is to be realized.

5.2 Recommendations for the project

Based on the findings of this study, and the above conclusions, the following recommendations were then made:

i) Through engagements with respondents, the study obtained the challenges that they experience, and the related recommendations made by the farmers. These have been presented under each value chain node or segment since some are unique to particular segments. In the interest of developing the seed value chain, those recommendations should be considered on their own merit.

ii) The study established that the drought tolerant seed value chain in the target locations is not well developed, yet the target communities depend on the production and marketing of these crops for their livelihoods. This calls for an intervention targeting the development of the drought-tolerant seed value chain in Tharaka North and South into a viable economic activity that will support the livelihood of the target populations. Such an intervention should adopt the cost-sharing approach where farmers will invest up to 50% of the related cost, to instill ownership and promote the sustainability of the benefits of such an intervention.

iii) This study established that up to 86.3% of the primary respondents already engaged in the production of drought tolerant fodder crops, even though they faced challenges like lack of seeds; inadequate rainfall; and pests and diseases. Given the general scarcity of food for livestock in the target locations, it will be prudent to consider the development of the fodder value chain to fill the current existing gap in animal feeds, especially in the dry seasons

iv) One of the findings of this study was the inadequate extension advice on pre-harvesting, harvesting and post-harvest handling and marketing. Tied to this was the study conclusion that the presence of agricultural officers in the activities of the farmers is still limited. This calls for targeted strategies to engage the services of such officers in working with farmers along the seed value chain to increase crop production and marketing and enhance food security and livelihoods in the target locations. For sustainability purposes, it will be worthwhile to work with the county government as well as other NGOs in the agriculture space to particularly develop the input supply and the production nodes of the seed value chain that the rest of the value chain depends on.

v) One of the challenges that was identified by farmers in the production node of the seed value chain was poor marketing structures, which encouraged exploitation by middlemen due to existing disorganized marketing structures. In mitigation, the farmers proposed bringing them together into small, organized, producer marketing groups, with an umbrella platform to coordinate their efforts. This initiative should go hand-in-hand with the development of their access to better markets, to diversify their marketing options and allow them to get the best prices possible from their farming efforts

vi) Like all other farmers the world over, farmers in Tharaka North and South equally depend on accurate information to make timely and informed decisions. Indeed, farmers can use the real-time data generated by sensors on machines, tools, and animals to identify areas for improvement (KENAFF, 2022). This component is missing in the target locations, and actors along the chain make decisions using inaccurate or even arbitrary information. This calls for the development of a value chain information management system that collects, collates, and shares vital farming and the related information with farmers in real time

LIST OF ANNEXES

REFERENCES

Azhar MT and Rehman A. 2018. Overview on Effects of Water Stress on Cotton Plants and Productivity. In Biochemical, Physiological and Molecular Avenues for Combating Abiotic Stress Tolerance in Plants. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/drought-tolerance

Cascade. 2023. Value Chain Analysis: Overview, How to Use It (With Examples). https://www.cascade.app/blog/value-chain-analysis-guide

Castillo R. 2016. Who is Slovin and where and how did the Slovin's Formula for determining the sample size for survey research originated? Batangas State University. In ResearchGate. https://www.researchgate.net/post/Who-is-Slovin-and-where-and-how-did-the-Slovins-Formula-for-determining-the-sample-size-for-a-survey-research-originated

Cossham A and Johanson G. 2019. The benefits and limitations of using key informants in library and information studies research. vol. 24 no. 3, September 2019. Published quarterly by the University of Borås, Sweden. http://informationr.net/ir/24-3/rails/rails1805.html

Government of Tharaka Nithi. 2018. Tharaka Nithi County Integrated Development Plan 2018-2022 https://repository.kippra.or.ke/handle/123456789/564

GoK. 2008. The Kenya Vision 2030. The Government of Kenya. https://vision2030.go.ke/

Hart M. 2023. The Straightforward Guide to Value Chain Analysis. https://blog.hubspot.com/sales/value-chain-analysis

Hellin J and Meijer M. 2006. Guidelines for value chain analysis. http://www.spiencambodia.com/filelibrary/Value_Chain_Research_Methodology.pdf

IAS K. 2023. Terms of Reference for the Drought-tolerant Seeds Value Chain Analysis for the Enhanced climate change adaptation for improved agricultural production for 1090 farmers in Tharaka North and South by end of December 2023.

Jua Kenya. 2023. Top Seed Companies in Kenya. https://www.jua-kenya.com/top-seed-companies-in-kenya/

KENAFF. 2022. The Role of ICT in Agriculture: How It's Improving Farming Methods and Increasing Yields. In Kenya National Farmers Federation. https://kenaff.org/wp/2022/09/26/the-role-of-ict-in-agriculture-how-its-improving-farming-methods-and-increasing-yields/

KNBS. 2019. The 2019 Kenya Population and Housing Census Results. Kenya National Bureau of Statistics. https://www.knbs.or.ke/2019-kenya-population-and-housing-census-results/

Kumar R, Alam K, Krishna VV, and Srinivas K. 2012. Value Chain Analysis of Maize Seed Delivery System in Public and Private Sectors in Bihar. Agricultural Economics Research Review Vol. 25 (Conference Number) 2012 pp 387-398. file:///C:/Users/ADMIN/Downloads/4-Ranjit-Kumar.pdf

Lugusa KO, Wasonga OV, Elhadi YA & TCrane AT. 2016. Value chain analysis of grass seeds in the drylands of Baringo County, Kenya: A producers' perspective. https://pastoralismjournal.springeropen.com/articles/10.1186/s13570-016-0053-1

MENR. 2015. Kenya's National adaptation plan 2015 - 2030 (NAP). Republic Of Kenya - Ministry of Environment and Natural Resources. https://www4.unfccc.int/sites/NAPC/Documents%20NAP/Kenya_NAP_Final.pdf

MoALF. 2017. Climate Risk Profile for Tharaka Nithi County. Kenya County Climate Risk Profile Series. The Ministry of Agriculture, Livestock and Fisheries (MoALF), Nairobi, Kenya.

NDMA. 2023. Committed to Ending Drought Emergencies. The National Drought Management Authority. https://www.ndma.go.ke/index.php/features/about-ndma

NDMA. 2022. Tharaka Nithi County (Tharaka) Drought Early Warning Bulletin For February 2022. The National Drought Management Authority. http://knowledgeweb.ndma.go.ke/Content/LibraryDocuments/Tharaka-Nithi_DEW_Bulletin_-_February_202220220314111418.pdf

Negash F. 2020. Methods of value chain analysis in agriculture? https://www.researchgate.net/topic/Value-Chain-Analysis

Njagi S. 2019. Strengthening community resilience to climate-related shocks and stresses in Kenya: The Case study of Tharaka North and Tharaka South Sub-counties of Tharaka Nithi County, Kenya. https://kenya4resilience.org/wpcontent/uploads/2020/09/Community-resilience-research-report-Kenya-Case-Study-August-2019-1.pdf

Nzuve F. 2018. Overview of seed value chain: Field pests and disease diagnostics in seed crops. Seed Enterprise Management Institute, University of Nairobi. http://erepository.uonbi.ac.ke/bitstream/handle/11295/103731/Nzuve_Overview%20of%20Seed%20Value%20Chain%20%28SEMIs%29.pdf?sequence=1&isAllowed=y

Omollo E, Wasonga O V, Elhadi YAM & Mnene, WN. 2016. Grass seed value chain analysis in the Southern Kenya range lands of Makueni and Kajiado counties. A paper presented to the 5th RUFORUM Biennial Conference and African Higher Education Week 2016, Century City Conference Centre, Cape Town, South Africa, 15-21 October 2016. https://repository.ruforum.org/system/tdf/Omollo%20Erick.pdf?file=1&type=node&id=37000&force=

Pipedrive. 2023. A simple guide to value chain analysis. https://www.pipedrive.com/en/blog/value-chain-analysis

Pollfish. 2021. Margin of Error & Sample Size Calculator. What is the margin of error in a survey? https://www.pollfish.com/margin-of-error-calculator/

Quarshie PT, Abdul-Rahim Abdulai AR, and Fraser EDG. 2021. Africa's "Seed" Revolution and Value Chain Constraints to Early Generation Seeds Commercialization and Adoption in Ghana. https://www.frontiersin.org/articles/10.3389/fsufs.2021.665297/full

Raza A and Miller B. 2021. A five-step process for value chain analysis. https://www.internationaltaxreview.com/article/2a6a8ayk2vg7s1juc3xfk/a-five-step-process-for-value-chain-analysis

Shi BJ and Hussain SS. 2020. Toward elucidating the functions of miRNAs in drought stress tolerance. In Plant Small RNA Biogenesis, Regulation and Application. https://www.sciencedirect.com/science/article/abs/pii/B9780128171127000122

Stobierski T. 2020. What Is a Value Chain Analysis? 3 Steps. Harvard Business School - Business Insights https://online.hbs.edu/blog/post/what-is-value-chain-analysis

The World Bank Group. 2021. Climate Risk Country Profile: Kenya. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-05/15724WB_Kenya%20Country%20Profile-WEB.pdf

The World Bank. 2018. Land and natural resources degradation in the Arid and Semi-Arid Lands, Kenya: Technical Report. https://documents1.worldbank.org/curated/en/461701571216895387/pdf/Land-and-Natural-Resource-Degradation-in-Arid-and-Semi-Arid-Lands-in-Kenya.pdf

United Nations. 2023. Climate Action Fast Facts. In Climate Action. https://www.un.org/en/climatechange/science/key-findings#physical-science

USEPA. 2023. Climate Impacts on Agriculture and Food Supply. In Climate Change Impacts. United States Environmental Protection Agency. https://climatechange.chicago.gov/climate-impacts/climate-impacts-agriculture-and-food-supply