



USAID
FROM THE AMERICAN PEOPLE



Inclusive Futures
Promoting disability inclusion



Jane Akinyi, Woman sorghum farmer.
Credit: Sightsavers/Ninth Wonder Productions

**Global Labor Program-Inclusive Futures
Social Network Analysis: Final Report
December 2022**

Global Labor Program-Inclusive Futures

Social Network Analysis Report

December 2022

List of acronyms

AGRA	Alliance for a Green Revolution in Africa
CGA	Cereal Growers Association
CIMMYT	International Maize and Wheat Improvement Center
EABL	East African Breweries Limited
FSC	Farmer Service Centre
FtMA	Farm to Market Alliance
GESI	Gender Equality and Social Inclusion
GLP-IF	Global Labor Program – Inclusive Futures
KALRO	Kenya Agriculture and Livestock Research Organization
NGO	Non-Governmental Organization
OPD	Organization of Persons with Disabilities
SACCO	Savings and Credit Cooperative Organization
SFEA	Syngenta Foundation East Africa
UDPK	United Disabled Persons of Kenya
USAID	United States Agency for International Development

Contents

List of acronyms.....	1
Contents.....	2
List of tables	4
List of figures	4
Executive summary.....	5
Introduction	10
Methodology.....	10
Data collection tool	11
Recruiting and training enumerators	12
Sampling and identifying respondents	13
Data analysis	14
Ethical considerations.....	14
Limitations.....	15
Respondent demographics.....	15
Findings: Network analysis.....	18
Network metrics overview.....	19
Network analysis findings.....	20
Conclusions and recommendations.....	36
Annex: Data collection tool	50

List of tables

Table 1: Standard metrics used for analysis	19
Table 2: Core network actors	22
Table 3: Degree metrics for top ten actors	26
Table 4: Closeness and Reach Efficiency metrics for top ten actors.....	30
Table 5: Summary of key organisations in the network and potential leverage points	38
Table 6: Summary of key individuals in the network and potential leverage points ..	47

List of figures

Figure 1: Overview of the hub model.....	11
Figure 2: Summary of interviews by respondent type	16
Figure 3: Overview of the network.....	21
Figure 4: East African Seed Company cluster.....	24
Figure 5: Farm to Market Alliance cluster.....	25
Figure 6: Bridging role of Cereal Growers Association.....	28
Figure 7: Snapshot of isolated farmers in the network	33

Executive summary

Introduction

Social Network Analysis (SNA) is a systems thinking process which investigates social structures by using networks and graph theory. It characterizes networked structures as nodes (individuals, groups of people or firms within the network) and the ties, edges, or links (relationships or interactions) that connect them. The approach was used by this study to understand an intervention in the sorghum value chain by the Global Labor Program – Inclusive Futures (GLP-IF) as part of a larger context where different stakeholders, driving factors and processes interact to shape outcomes, and evolve over time.

Purpose

The SNA aimed to understand how farmers relate with other actors in the sorghum value chain network, specifically input suppliers (eg seed suppliers, fertilizer suppliers), financial services providers (eg crop financiers and crop insurers), and aggregators. The approach focused on probing relationships between farmers and other actors to understand the relational attributes between farmers and these connections, in the context of their larger relational systems. The objective was to understand the network structure and links that exist among the selected farmers. This would help identify areas of the network where program interventions might have the greatest effect.

Methodology

The SNA activities targeted sorghum farmers as the primary focal actors in GLP-IF's sorghum value chain model. The design explored existing relationships within the current structure of the hub model. A quantitative methodology targeting male and female farmers engaged in the East African Breweries value chain was employed. Farmers were purposively selected from program beneficiary lists and by network managers. Farmers were sampled based on specific attributes considering gender, disability, and participation in the value chain. Using a snowball approach, each of

the interviewed farmers were asked to nominate up to 10 connections (for example, input suppliers or financial services providers). A structured questionnaire was developed in English (with Kiswahili translation) and scripted into Kobo Collect, facilitating electronic data collection.

LINC recruited and trained enumerators to conduct data collection across the following sub-counties in Homa Bay: Rangwe, Karachuonyo, Suba South, Homa Bay Town, and Homa Bay East. A total of 57 quantitative interviews were completed with farmers (n=20), hub owners/agents (n=23), input suppliers (n=9), aggregators who supply EABL with sorghum crop (n=3), and other buyers of sorghum crop (n=2). The study adhered to the ethical principles of informed consent and confidentiality throughout the recruitment, data collection, and data processing stages. Data was analyzed using Microsoft Excel and Kumu software with key outputs being frequency tables, graphs, and visual maps of the relevant network attributes.

Findings

A total of 111 connections - established relationships between various actors in the network - were identified through the 57 interviews. Generally, the network was relatively sparse and was largely structured around Core Actors, who had groups of dense connections, and Periphery Actors, who were more sparsely distributed. However, there were several distinct clusters of organizations that were more densely connected to each other. These tended to be key GLP-IF actors, and other smaller clusters of influential input suppliers including the East African Seed Company and Dryland Seed Limited. Farmers were most likely to be in the Periphery of the network.

The most engaged actors in the network were the key GLP-IF partners, namely Sightsavers, Syngenta Foundation East Africa, and East African Breweries Limited, followed by input suppliers such as Cereal Growers Association, Dryland Seed Limited, Farm to Market Alliance and the East African Seed Company. The Cereal Growers Association demonstrated a strong degree of influence and popularity. Additionally, it connects two major groups of sorghum value chain actors, specifically the GLP-IF partners and other prominent actors.

Besides the Cereal Growers Association and Dryland Seed Limited, individual farmers and hub owners were the most connected network actors. Individual farmers, particularly men and women with disabilities from Rangwe, had the deepest network reach and appeared to be the most effective at exchanging information.

The most poorly connected actors in this network were farmers. In addition to being particularly isolated from the key value chain actors, farmers shared constraints indicating limited access to financial services including accessible credit facilities, quality farm inputs and agricultural support. Farmers also experienced challenges related to fluctuations in market prices and had limited knowledge about good agricultural practices. Each of the constraints listed by farmers demonstrated a weak level of engagement with value chain actors, corroborating the findings of the network analysis. Farmers had generally weak ties with actors such as input suppliers, buyers and aggregators. This disadvantaged them and limited their production, access to information, and access to relevant support.

A key finding from the network analysis related to Reciprocity, or the degree to which actors share mutual links. The survey anticipated that every interviewee would be able to name up to ten influential market actors in the sorghum value chain that they interact with regularly. However, each respondent listed an average of only one or two relationships. Farmers provided very few referrals, indicating their isolation from key value chain actors. However, buyers and input suppliers were most likely to have reciprocal relationships with other actors.

Recommendations

The analysis proposed the following recommendations for how GLP-IF could strategically engage network members for enhanced outcomes and more sustainable impact:

Address network density but focus more on network cohesion

The program may wish to strategically enhance Network Density. This is likely to contribute to a more useful and cohesive network, where information and services travel more easily and effectively, and ultimately reach more farmers in the network.

This requires identifying the right clusters and relationships on which to focus. Enhancing links among disconnected actors in the network is likely to deliver a greater impact.

Strengthen ties between farmers and value chain actors, particularly financial service providers

The program should consider strengthening relationships between farmers and the actors providing quality inputs, agricultural information, and access to credit. Farmers have the closest connections and strongest reach within the network. Empowering them is likely to produce strong outcomes for farmers across the network.

Develop a strategy to prioritize and engage the most influential actors in the network according to program needs

Some of the most influential actors in the network include the East African Seed Company, Cereal Growers Association, and Dryland Seed Company. The program should identify the best ways to engage these actors and use them to create bonds and bridges between GLP-IF's core implementers and farmers. These actors can also help diffuse knowledge in the network, and create stronger pathways between farmers, input suppliers and aggregators.

Invest in strengthening network relationships in Suba South and Karachuonyo sub-counties

Program implementation focused mainly on Rangwe in the first year and so the individual actors with the strongest metrics for Centrality, Reach and Closeness were found in this sub-county. Hubs in Karachuonyo and Suba South were formed more recently, contributing to relatively weaker ties in these sub-counties. As it intensifies activities in Suba South and Karachuonyo, the program should continue to deliberately invest in strengthening relationships between farmers and other actors.

Identify other influential actors outside the hub model

While the survey did not establish whether farmers had other relationships outside the hub model, it is possible that farmers are engaging with other farmers and service providers, including agricultural extension officers. Future iterations of the

network analysis should explore other influential relationships outside the boundaries of the hub model.

Introduction

Social Network Analysis (SNA) is the process of investigating social structures by using networks and graph theory. It characterizes networked structures in terms of nodes (individual actors, people, or firms within the network) and the ties, edges, or links (relationships or interactions) that connect them. The systems thinking approach seeks to understand a social structure as part of a larger context in which different stakeholders, driving factors, and processes interact to shape outcomes and evolve over time. It looks at the relationships among actors in a system to see if and how well they are connected to one another.

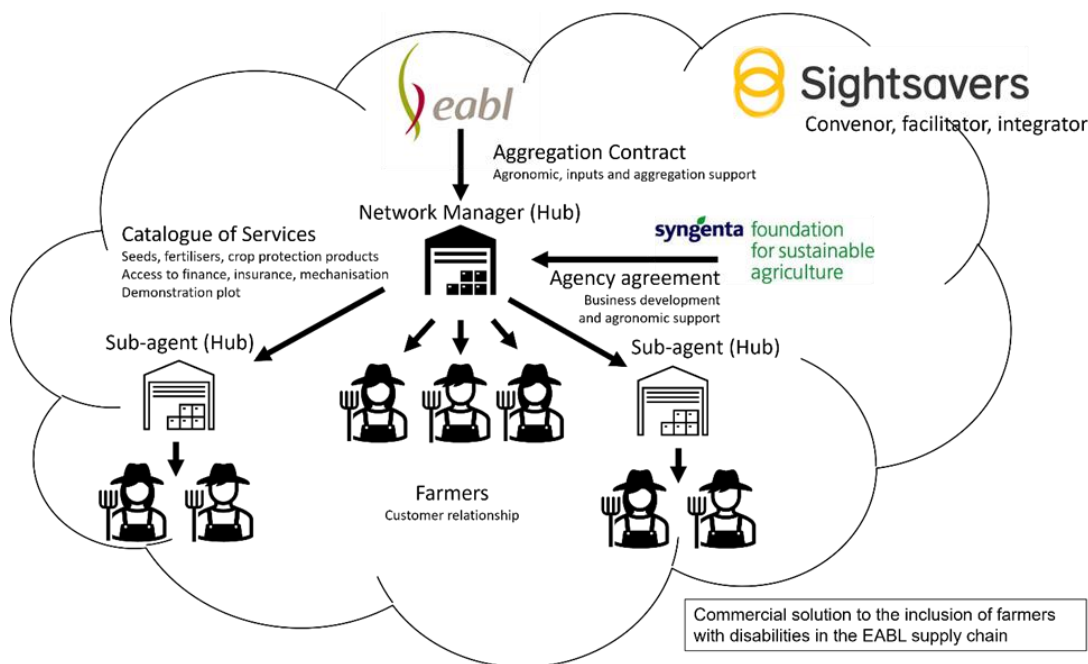
This approach focuses on the actors in a system instead of factors. Factors are the forces and flows that shape a system like structures, attitudes, causes, and effects. Actors are generally individuals or formal or informal groups of people.

The SNA methodology was selected to provide an understanding of existing relationships in the sorghum value chain managed by East African Breweries (EABL), one of GLP-IF's strategic partners. This method was chosen because it provides information that is not available through other sources including routine monitoring data, baseline data, Gender Equality and Social Inclusion (GESI) analyses, and value chain analyses. Ultimately, SNA sought to identify areas of the network where program interventions might have the greatest effect.

Methodology

The SNA involved a quantitative methodology targeting sorghum producers as the primary focal actors in the sorghum value chain. Specifically, it looked at the Farmer's Hub model, as implemented by the Syngenta Foundation East Africa. The design focused on exploring the relationships within the existing structure of the hub model (Figure 1), specifically seeking to understand how farmers related with other actors in the hub model. This covered input suppliers (eg seed suppliers, fertilizer suppliers), financial services providers (eg crop financiers and crop insurers), buyers and aggregators. Our approach focused on probing relationships between farmers and these respective actors, to understand the relational attributes between farmers and these connections, in the context of their larger relational systems.

Figure 1: Overview of the hub model



The study took place in Homa Bay county in western Kenya, an area where GLP-IF implementation is ongoing. Data collection was restricted to one intervention county, which was purposefully selected, Farmers from Rangwe, Karachuonyo and Suba South sub-counties were targeted for the study. These sites provide diverse settings where a cross-section of participants from various demographic backgrounds could be enrolled.

Data collection tool

A structured questionnaire was developed in English with Kiswahili translation. It was scripted into Kobo Collect to facilitate electronic data collection. The questionnaire focused on the following areas:

- Basic identifying information about each respondent (eg name, gender, disability status)¹
- Background information about respondents' businesses (eg farm size, annual revenues)
- Information about respondents' social networks and quality of relationships

¹ Respondents were reassured that all personal information gathered through the survey would be treated confidentially and would not be shared publicly.

- Constraints and challenges relating to sorghum farming.

The data collection tool is in the Annex.

Recruiting and training enumerators

LINC recruited Q Data Mapping and Services (QDATAMS), a local survey firm, through a competitive procurement process. QDATAMS supplied five enumerators, each with at least two years' experience in data collection in the development sector and a bachelor's degree in social sciences. Enumerators were trained on 9 and 10 June 2022 in Homa Bay.

Training covered:

- Introduction to GLP-IF
- Review of the SNA methodology, data collection tool, sampling, and data collection processes
- Ethical considerations for research with human participants
- Disability and Inclusion Etiquette.

LINC sensitized and worked closely with four partners involved in the GLP-IF intervention during the planning, training, and data collection phases of the SNA activity:

- EABL
- Syngenta Foundation East Africa
- UDPK
- Homa Bay OPD representative.

These partners helped mobilize and recruit farmers. They provided orientation on the value chain and support on disability awareness and other relevant considerations.

Sampling and identifying respondents

The SNA's activities were purposive, targeting male and female farmers with disabilities who were already engaged in the EABL value chain. Farmers were selected from GLP-IF's list of beneficiaries and sampled based on specific attributes. These considered gender and disability.²

Using a snowball approach, each of the interviewed farmers were asked to nominate up to 10 connections who subsequently would be interviewed. These connections included input suppliers or financial services providers. In total, 20 farmers and 40 other actors were interviewed.

Overall, participants were included in the survey based on their involvement in one of the following areas:

- Growing sorghum to sell either to EABL or an EABL aggregator
- Providing financial services such as credit and crop insurance to sorghum farmers
- Supplying EABL with sorghum that is aggregated from a group of farmers
- Providing inputs such as seeds, fertilizers, and agrochemicals to sorghum farmers
- Buying sorghum from farmers
- Providing support to sorghum farmers in collaboration with the Syngenta Foundation. This included providing inputs, promoting market links, and extension and advisory services.

There is a detailed breakdown of the sample in the demographic overview section. Data collection started on 24 June 2022 and ended on 18 July 2022.

² The key sampling criteria focused on the respondent's role in the value chain (farmer, aggregator, financial services provider, buyer or inputs supplier). Criteria on gender and disability were only applied to the sample of farmers, which aimed to include an equal number of male and female beneficiaries, and persons with and without disabilities.

Data analysis

The analysis was completed by exporting the raw survey data from Kobo Collect as a .csv file. This data was coded to reflect network analysis terms (edge list, node list and matrix formats) using Microsoft Excel.

The network data was analyzed using Kumu software.³ The clean dataset was analyzed using descriptive statistics with frequency tables, graphs, and visual maps of the relevant network attributes as key outputs.

LINC conducted network mapping via Kumu to identify notable patterns, trends, and points of potential interest in the data. These included:

- Deriving network-level metrics for each relationship type. These metrics measure attributes of the entire network rather than any one member
- Deriving organization-level influence metrics, which measure attributes for each actor within each relationship type
- Identifying sub-groups of connected organizations within the overall network
- Visualizing the network.

Content analysis was also conducted of qualitative data captured in one open-ended question.

Ethical considerations

The survey targeted respondents aged 18 years or older who were willing and able to provide written informed consent.

All potential participants were invited to provide freely given written consent prior to their enrolment in the language of their choice (English, Dholuo, or Kiswahili). During the consent process, participants were fully informed regarding the purposes of the study and the expected duration of the interview. They were provided with information about confidentiality and a description of foreseeable risks or discomforts. Participants were encouraged to ask questions and seek clarification about any queries.

³ Further information is available at www.kumu.io

The study team took precautions to ensure that personal information gathered during the study was treated confidentially and that participants were interviewed in a private environment. Participants were made aware that participation in the study was voluntary, free of any coercion or undue influence. All interviews were accompanied by a completed informed consent form. There were no safeguarding concerns or adverse events reported during data collection.

Limitations

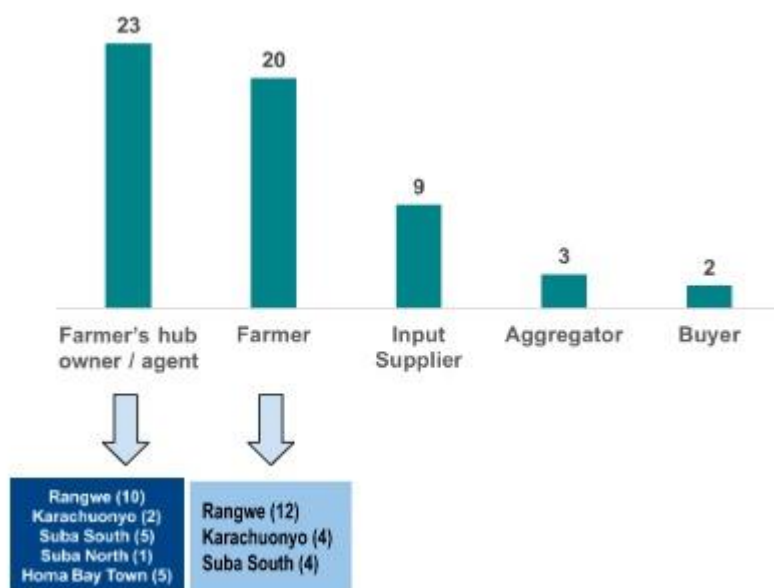
While the SNA approach provides valuable information about the nature of relationships in the sorghum value chain, it does not intend to represent all actors in this value chain in Kenya. The analysis presents information about the size and density of the network, but information on farmer affiliations will be most relevant for program implementation purposes. The findings should not be generalized to the wider population and this methodology does not allow statistical inference to a specific population such as Kenyan farmers with disabilities.

While program implementation was ongoing in Rangwe sub-county, the hubs were not fully operational in Karachuonyo and Suba South sub-counties at the time of data collection. For this reason, more farmers were targeted in Rangwe.

Respondent demographics

A total of 57 interviews were conducted across the following sub-counties in Homa Bay: Rangwe, Karachuonyo, Suba South, Homa Bay Town, and Homa Bay East. A response rate of 95% was achieved with 57 of the 60 targeted interviews achieved. Figure 2 provides a breakdown of interviews achieved by respondent type.

Figure 2: Summary of interviews by respondent type



An overview of respondent demographics for each category is provided below.

Farmers: grow sorghum and have an agreement to sell it to an EABL aggregator

- Total interviewed: 20
- Disability status: 50% persons with disabilities
- Gender: 50% male; 50% female
- Sub-counties: Suba South, Karachuonyo, Rangwe
- Farm size: About 85% (n=17) were farming sorghum on 5 acres or less, while 15% (n=3) were farming on 6 to 9-acre parcels of land
- Average length of time farming sorghum: 7 years
- Annual revenues: 50% made less than KES20,000 last year, while 50% made between KES20,000 and KES100,000

Farmers' Hub owners/agents: provide support to sorghum farmers (inputs, market links, and extension and advisory services) in collaboration with the network manager/Syngenta Foundation

- Total interviewed: 23
- Disability status: 17% persons with disabilities

- Gender: 13% female; 87% male
- Sub-counties: Rangwe, Karachuonyo, Suba South, Homa Bay Town, and Homa Bay East
- Annual revenues: about 50% made approximately KES100,000 last year, 17% made between KES500,000 and KES1million, while 17% made more than KES1million

Input Suppliers: provide inputs such as seeds, fertilizers, and agrochemicals to sorghum farmers

- Total interviewed: 4
- Disability status: no disabilities
- Gender: 100% female
- Sub-counties: Homa Bay Town, Homa Bay East, Rangwe
- Annual revenues: 50% had annual revenues of between KES500,000 and KES1million, 25% made between KES1million and KES5million, and 25% made more than KES5million

Aggregators: have direct contract with EABL to supply sorghum based on crop aggregated from a group of farmers

- Total interviewed: 3
- Disability status: no disabilities
- Gender: 100% female
- Sub-counties: Homa Bay Town, Karachuonyo
- Annual revenue: Between KES100,000 and KES1million in the last year

Buyers: buy sorghum crop from farmers, but do not have a contract with EABL

- Total interviewed: 2
- Disability status: no disabilities
- Gender: Male
- Sub-county: Rangwe
- Average revenues: less than KES100,000 in the last year

Findings: Network analysis

Access results via Kumu

Kumu is user-friendly and allows customizable filtering of all node and edge attributes. This allows even novice users to use the platform for in-depth analysis. A link to the visualization of the network is provided in the respective findings section.

As part of debriefing this report to the Sightsavers team, an orientation to the Kumu system with network data is offered.

Terminology and use of capitalization

To provide more clarity for the reader, this report capitalizes network attributes and metrics when referring to them by name. For example, metrics like Density and Degree are capitalized when referring to the network metric.

Disclosure of individual names

The names of individual respondents associated with the network have been anonymised within this report's analysis. However, respondents gave consent to their names being used within the Network Map in published reports on the program. As such, names are included where the Network Map has been reproduced in full or in part.

Personal information has been retained purely to inform program decisions.

Dissemination and use

LINC will disseminate the findings of this report to Sightsavers and the wider consortium of GLP-IF coalition members. The purpose of this is to share knowledge, validate findings and generate additional recommendations that could help guide potential next steps for programming. The SNA findings will inform the program's stakeholder engagement activities specifically for the sorghum value chain. Findings will also provide evidence to help strengthen relationships between value chain actors.

Network metrics overview

Prior to beginning the analysis, the reader should be familiar with the SNA terms and metrics listed in Table 1.

Table 1: Standard metrics used for analysis

Metric	Description
Node, or Actor	An organization included in the network. Node is used synonymously with Actor(s) .
Connection	A representation of a relationship between two actors or nodes, illustrated by a line connecting them.
Network Size (number of nodes)	The number of actors or organizations in a network.
Ties (number of edges)	The number of reported connections among actors. In-degree ties are ties into a given node: out-degree ties are ties out of a given node. These are given as a whole number and can be an average or total.
Density	The proportion of actual ties relative to all possible ties in a network.
Average Distance	The average steps required to get between any two actors in a network.
Average Degree	The average number of ties of actors in the network.

Reciprocity	The extent to which directed relationships are reciprocated.
Degree Centrality	A normalized measure of the number of a given actor's unique ties. This indicates the importance or significance of an actor for the network. This can be separated for directed relationship types into in-degree centrality (for incoming ties) and out-degree (for outgoing ties).
Betweenness Centrality	The extent to which a node acts as a bridge along the shortest path between two other nodes.

Interpreting and using network maps

Network maps presented in this report show 'nodes' as circles in the map, which each represent an actor. 'Connections' are represented by lines between nodes. The size of each node depends on its Degree Centrality, so more prominent actors in the network appear larger. The position of nodes in a map may vary and is not intended to reflect distance or other attributes of the network. Generally, nodes with the highest number of connections are more central while those with the fewest connections appear at the periphery.

Network analysis findings

Out of the 57 interviews completed, 91 actors or nodes were generated, representing individuals and organizations. A total of 111 connections were identified. These are established relationships between actors in the network.

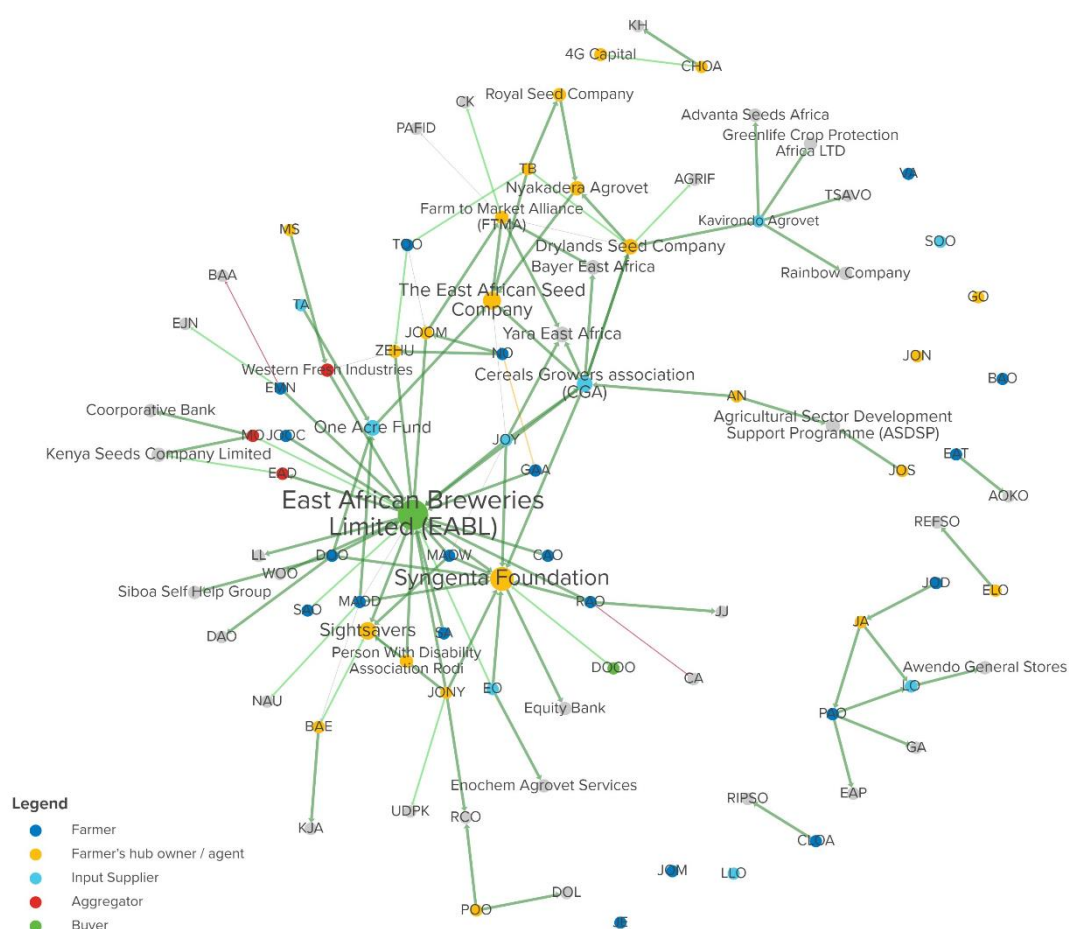
This section presents findings from the analysis. It begins with the network structure, and then explores results of key SNA metrics such as Density and Centrality. This section also includes findings from survey responses to questions about trust, engagement, level of satisfaction, information sharing and constraints.

Network Density

Overall, the whole network is quite sparse. However, there are several distinct clusters of organizations that are densely connected to each other.

Specifically, there were dense clusters around key GLP-IF actors. Smaller clusters surrounded influential input suppliers including the East African Seed Company and Dryland Seed Limited (see Figure 3).

Figure 3: Overview of the network⁴



LINC also analyzed the network structure to determine how groups of actors are organized and how well network actors relate to each other. Generally, the network

⁴ The complete Network Map can be accessed at <https://kumu.io/lincllc/glp-kenya-sna#default-map>. This online version can be enlarged for ease of use.

appeared to be structured around Core actors with groups of densely connected nodes, and Periphery actors with more sparsely connected nodes.

Generally, nodes in the Core were not well connected to those in the Periphery. Farmers were most likely to be in the Periphery of the network. Further, the network appeared to be structured around hubs and spokes, with input suppliers being the most central and influential actors. The Kumu link to the visualization of this network is available at <https://kumu.io/lincllc/glp-kenya-sna#default-map>.

Table 2 shows the seven core actors that were identified. The clusters around these actors were the most conspicuous in the network structure. This indicates that there is a centralized core structure governing all types of relationships in the network. The EABL cluster had the largest number of actors and network ties while smaller clusters formed around Dryland Seed Limited, East African Seed Company and Sightsavers.

Table 2: Core network actors

Cluster	Actor	Actor type	Number of actors in cluster	Density
1.	EABL	Aggregator	25	4%
2.	Syngenta Foundation East Africa	Hub owner ⁵	12	8%
3.	Cereal Growers Association	Input supplier	9	13%
4.	Farm to Market Alliance	Input supplier	8	13%
5.	Dryland Seed Limited	Input supplier	7	17%

⁵ Respondents in the network identified Sightsavers and Syngenta Foundation East Africa as hub owners. This term might have been used because of the role the two actors may play in overseeing access to inputs, market linkages, and extension and advisory services for farmers. While 'hub owner' is not an accurate representation of the role of both actors within the larger context of the programme, the survey did not include an option for 'implementing partner.' As such, the classification 'hub owner' has been maintained in this report.

6.	East African Seed Company	Input supplier	7	14%
7.	Sightsavers	Hub owner	6	17%

Another key observation was the prominence of central GLP-IF actors (EABL, Sightsavers and Syngenta Foundation East Africa) in the network structure. These organizations are critical to the network. They are at the center of clusters of the Core actors that implement the program and drive the network. Other clusters were visible around actors that were not directly affiliated with GLP-IF: Cereal Growers Association; Dryland Seed Limited; East African Seed Company; and Farm to Market Alliance. These were distinct but clearly still central to the network.

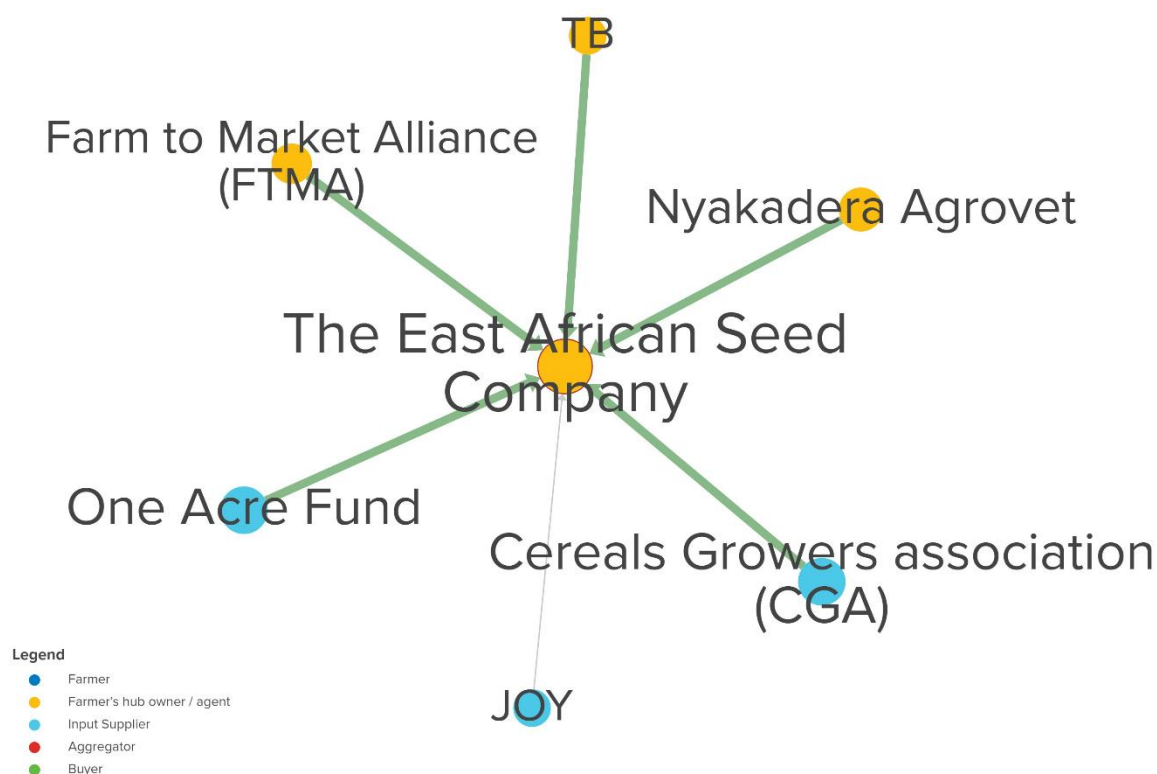
Density considers the proportion of actual links relative to all possible links in a network. LINC’s analysis found that the overall network has a Density score of 1%, indicating that the ratio of actual ties to possible ties was very low. This signifies a limited level of interconnectivity within the network and suggests that its actors do not often form relationships with one another.

While the overall network’s Density is low, it is distributed unevenly. Certain areas of the network display a higher Density than other areas of a network, as detailed in the Density column of Table 2. The Density of individual clusters was higher, particularly for Sightsavers and the Dryland Seed Limited cluster. There was a higher prevalence of links among these clusters, indicating that the actors in them were more likely to interact and form relationships with each other. EABL and Syngenta Foundation East Africa had the largest number of connections and were frequently mentioned as important actors, but the quality of these ties was weaker; these actors were frequently mentioned as key network players, but they did not often form relationships within their own clusters.

Figure 4 and Figure 5 give two examples of high-density clusters. The East African Seed Company emerged as an influential organization that was cited by various actors including small-scale input suppliers and larger value chain actors. The

company is a leading seed production and agri-inputs company in the region. As such, this actor was regarded as an industry leader.

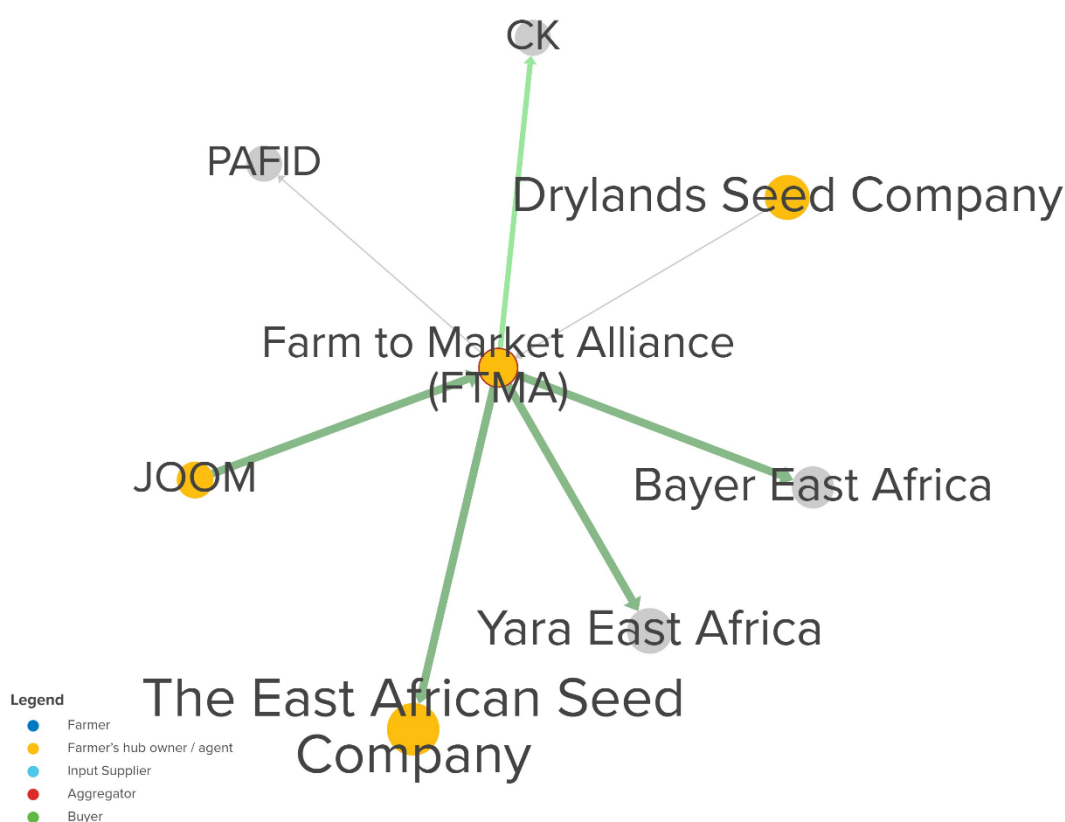
Figure 4: East African Seed Company cluster⁶



The Farm to Market Alliance also emerged as a well-embedded actor. This organization introduced several interesting actors, including two international companies: Bayer East Africa, which focuses on seeds, agrochemicals and crop protection, and Yara East Africa, which focuses on crop nutrition. It also listed a relationship with Participatory Approaches for Integrated Development (PAFID), a Kenyan NGO that promotes climate-smart agriculture and empowers rural farmers.

⁶ The complete Network Map can be accessed at <https://kumu.io/lincllc/glp-kenya-sna#default-map>. This online version can be enlarged for ease of use.

Figure 5: Farm to Market Alliance cluster⁷



Levels of engagement

The most engaged actors in the network were the key GLP-IF partners, followed by input suppliers such as Cereal Growers Association, Dryland Seed Limited, Farm to Market Alliance and the East African Seed Company. The Cereal Growers Association demonstrated a strong degree of influence and popularity. It connects two major groups of sorghum value chain actors; the GLP-IF partners and other prominent actors.

LINC analyzed measures of Centrality to understand how engaged actors were in the network, beginning with Degree Centrality. Degree Centrality is the simplest of the Centrality metrics, counting the number of connections an actor has. Overall, the

⁷ The complete Network Map can be accessed at <https://kumu.io/lincllc/glp-kenya-sna#default-map>. This online version can be enlarged for ease of use.

network's average Degree Centrality stood at 2.4, meaning that each actor in the network had an average of 2.4 connections.

The analysis also looked at Centrality metrics for individual actors. Table 3 shows the ten actors with the highest degree of Centrality. In general, the local connectors or hubs are the actors with high Degree Centrality, but they are not necessarily the best connected to the wider network. Besides the key GLP-IF actors, the actors with the largest number of connections were input suppliers such as Cereal Growers Association, Dryland Seed Limited, Farm to Market Alliance and the East African Seed Company. Several individual actors also emerged as influential connectors in the network, including persons with disabilities.

Table 3: Degree metrics for top ten actors⁸

Degree Centrality		In-Degree Centrality		Out-Degree Centrality	
EABL	25	EABL	18	EABL	7
Syngenta Foundation East Africa	11	Syngenta Foundation East Africa	10	Cereal Growers Association	6
Cereal Growers Association	9	East African Seed Company	6	Farmer MAO (Rangwe)	5
Dryland Seed Limited	7	Sightsavers	5	Farmer DO (Rangwe)	5
Farm to Market Alliance	7	Zehu	3	Input supplier JO (Rangwe)	5
Input supplier JO (Rangwe)	6	Dryland Seed Limited	3	Hub Owner JON (Rangwe)	5
East African Seed Company	6	Cereal Growers Association	3	Input supplier Farm to Market Alliance	5

⁸ While individuals are identified by sub-county, organizations generally have a county-wide presence. The sub-county is only listed for institutions located in a specific sub-county.

Farmer MAO (Rangwe)	5	One Acre Fund	3	Input supplier Kavirondo Agrovot	5
Farmer DO (Rangwe)	5	Yara East Africa	3	Farmer MaAO (Rangwe)	4
Hub owner JON (Rangwe)	5	Input supplier LO (Karachuonyo)	2	Farmer RAO (Rangwe)	4

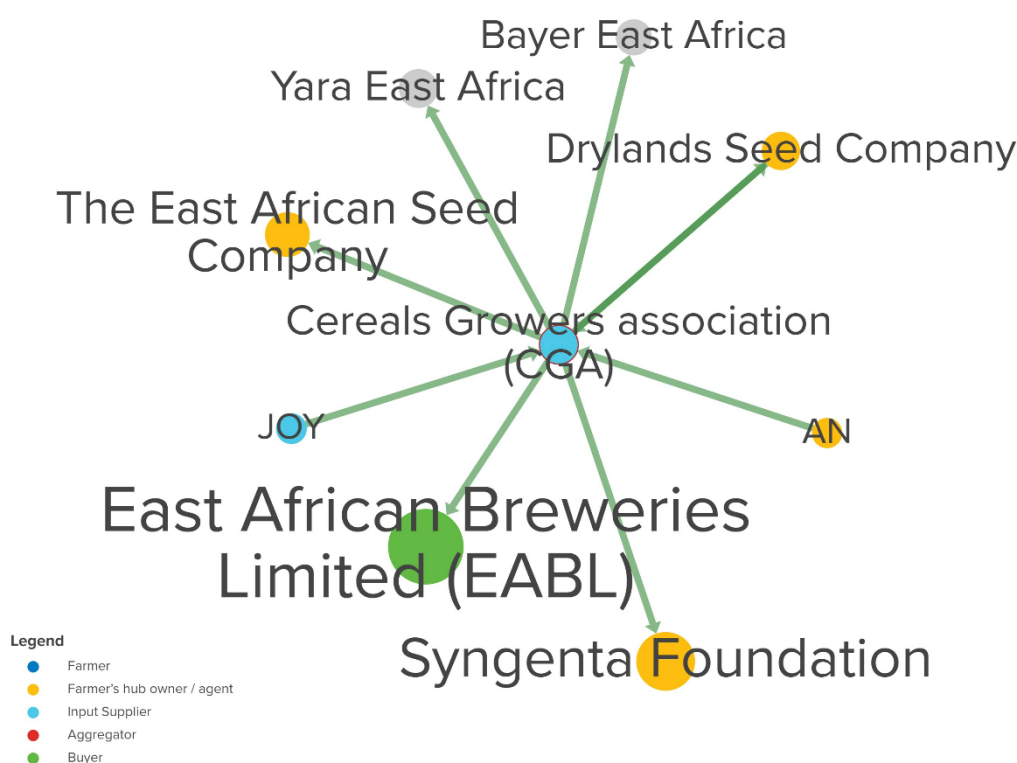
The second measure of Centrality was In-Degree Centrality. This metric measures an actor’s number of in-coming connections. In general, actors with high In-Degree Centrality are perceived as network leaders and are frequently looked to by others as a source of advice, expertise, or information. These are the actors who also enjoy the highest degree of popularity in the network. Despite the small number of connections overall, the organizations with the highest In-Degree scores include East African Seed Company, Zehu, Dryland Seed Limited, Cereal Growers Association, One Acre Fund and Yara East Africa (see Table 3).

The third measure of Centrality was Out-degree Centrality. Out-degree Centrality measures the number of outgoing connections for an actor. In general, actors with high Out-degree Centrality can reach a high number of actors and spark the flow of information across a network. Apart from the Cereal Growers Association and the Farm to Market Alliance, most of the network’s actors operating as effective connectors or helping information to flow were smaller players, including individuals such as farmers, hub owners and small-scale input suppliers (Table 3). Specifically, these individuals and smaller players were most likely to spark information flows between core network actors and more peripheral actors.

Besides the core GLP-IF actors, the Cereal Growers Association featured among the top ten actors for both In-degree and Out-degree metrics. This organization appeared to have a strong degree of influence and popularity and could connect quickly with the wider network. The position of the Cereal Growers Association on the map further illustrated is position as a *bridger*: it plays an intermediary role between two of the major groups of sorghum value chain actors, specifically the GLP-IF partners and other prominent actors such as East Africa Seed Company,

Yara East Africa, Dryland Seed Limited, Bayer East Africa. These actors are not directly involved in the program, but play a role in the value chain and have active relationships with other actors. Without the Cereals Growers Association, these two groups of actors might not interact with each other at all.

Figure 6: Bridging role of Cereals Growers Association⁹



Depth of network reach

Individual farmers and hub owners were the most closely connected network actors apart from the Cereals Growers Association and Dryland Seed Limited. Individual farmers, particularly men and women with disabilities from Rangwe, have the deepest network reach and are the most effective at exchanging information.

⁹ The complete Network Map can be accessed at <https://kumu.io/lincllc/glp-kenya-sna#default-map>. This online version can be enlarged for ease of use.

LINC analyzed additional measures of Centrality, specifically Closeness and Reach Efficiency. Closeness measures the distance each actor is from all other actors. In general, the actors with high Closeness can spread information to the rest of the network most easily and usually have high visibility of what is happening across the network. Among the organizations with the highest Closeness metrics were Cereal Growers Association, Kavirondo Agrovets and Dryland Seed Limited (Table 4). The list also includes a range of farmers and hub owners in each of the three target sub-counties. If there is a need to disseminate information through the network, it takes these actors only a few steps to reach all other members and so it can happen relatively quickly. In contrast, other actors in the network may require many more steps.

Reach Efficiency measures how efficiently each actor reaches the rest of the network, and the degree to which they are exposed to other actors in the network. In general, it is a measure of how efficiently information is exchanged within the network. Actors with a high degree of Reach Efficiency can spread information through the network through their direct and indirect relationships, mainly because their neighbors have a range of unique secondary contacts. The actors with the highest Reach Efficiency (Table 4) in the network were farmers with disabilities from Rangwe sub-county, but the list also featured farmers and hub owners from across the county.¹⁰

¹⁰ Individual names in green in Table 4 represent persons with disabilities (PWDs).

Table 4: Closeness and Reach Efficiency metrics for top ten actors¹¹

Closeness		Reach Efficiency	
Cereal Growers Association	0.137	Farmer SA (Rangwe)	0.049
Input supplier JO (Rangwe)	0.130	Farmer CAO (Rangwe)	0.049
Input supplier Kavironondo Agrovet	0.128	Farmer JOO (Karachuonyo)	0.049
Farmer MaAO (Rangwe)	0.122	Farmer SAO (Karachuonyo)	0.049
Farmer TOO (Suba South)	0.121	Farmer GAA (Suba South)	0.033
Dryland Seed Limited	0.115	Hub owner JoOO (Suba South)	0.033
Farmer MAO (Rangwe)	0.113	Hub owner AN (Rangwe)	0.033
Farmer DO (Rangwe)	0.107	Aggregator EA (Karachuonyo)	0.033
Hub owner AN (Rangwe)	0.104	Farmer MaAO (Rangwe)	0.031
Hub owner TB (Suba South)	0.102	Farmer EMN (Rangwe)	0.030

The actors with the highest Closeness and Reach Efficiency were mostly individuals, specifically farmers and hub owners. This indicates that these individuals were more

¹¹ While individuals are identified by sub-county, organizations generally have a county-wide presence. The sub-county is only listed for smaller institutions located in a specific sub-county.

closely connected to others in the network and were more capable of exchanging information than larger institutions. Male and female farmers with disabilities from across the sub-counties emerged as important conduits of information within the network. Directing information through these actors would produce a good return on energy invested as they have a high potential to reach other members of the network. Only two actors (Farmer MaAO and Hub owner AN) appeared among the top ten in each list with strong scores for both Closeness and Reach Efficiency. Hub owners featured prominently among the top ten actors in Table 4: generally, they appear to be very well-networked and able to reach and communicate with network members easily. This indicates that the selection process for hub owners is working effectively, and they are well engaged. Each of the individuals with high Closeness and high Reach Efficiency represents a valuable connection which the program should invest in maintaining.

While farmers and hub owners had strong Closeness and Reach Efficiency metrics, two major organizations (Cereal Growers Association and Dryland Seed Limited) demonstrated a high degree of Closeness. This was not achieved by any of the GLP-IF actors in the network (EABL, Syngenta Foundation East Africa or Sightsavers). While the latter are dominant actors, findings show they do not have good visibility of what is happening across the whole sorghum value chain. In addition, they do not have a high capacity to exchange information across the network. However, despite their size and scope, Cereal Growers Association and Dryland Seed Limited are highly embedded in the network and maintain a high degree of Closeness to others.

Isolation of farmers

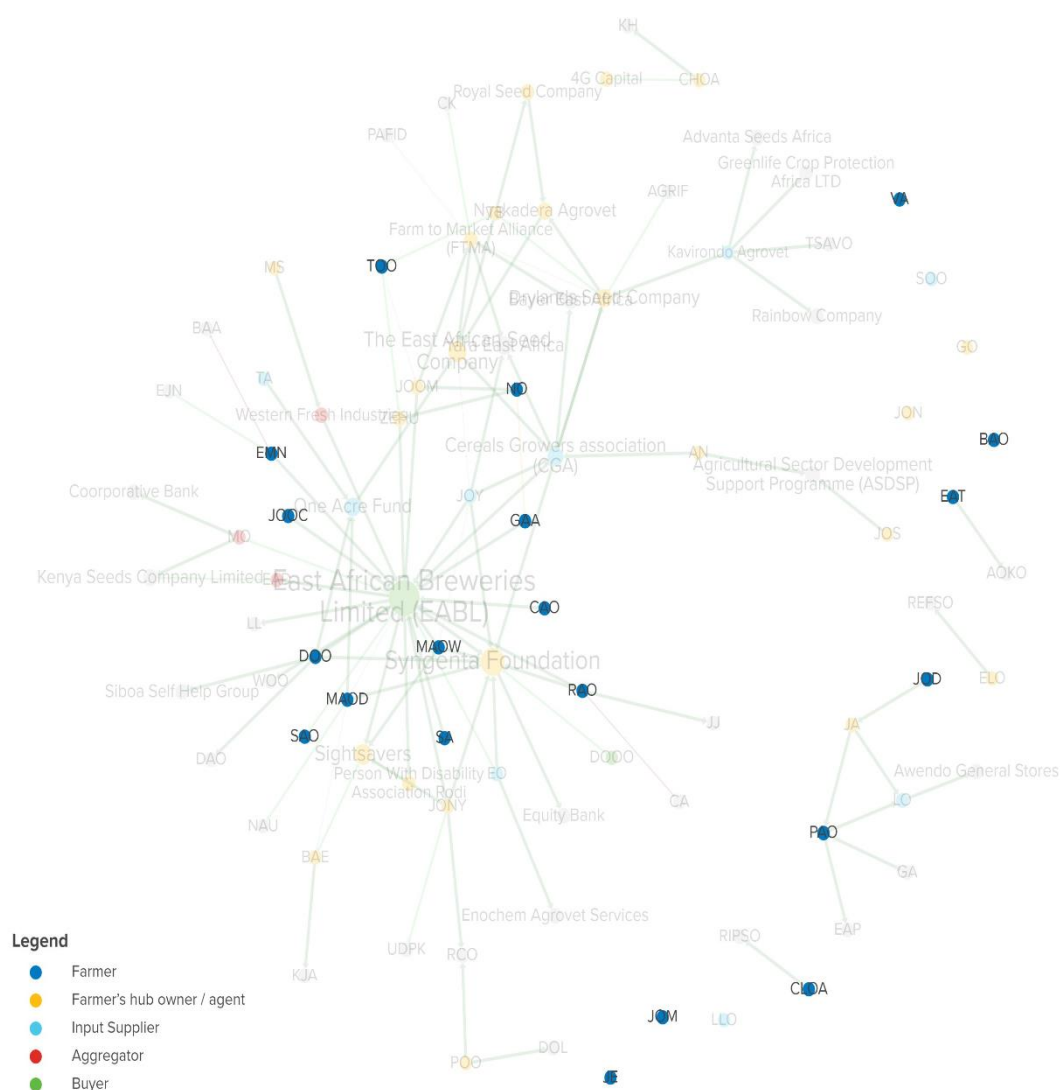
The most poorly connected actors in this network were farmers. In addition to being particularly isolated from the key value chain actors, farmers shared some constraints indicating limited access to financial services, quality farm inputs and agricultural support.

A key observation of the network analysis was the evident isolation of farmers from core areas of value chain activity. Farmers were generally found towards the periphery of the network, a trend which was consistent regardless of sub-county,

disability status, and gender. Figure 7 presents a snapshot of one of the isolated areas of the map, illustrating how farmers are disconnected from other actors, and the limited scope of their connections. There was a healthy level of connection between hub owners and farmers, but overall, there was a limited level of connectivity between farmers and other actors in the network.

There are several reasons that may explain the disconnectedness of farmers. Firstly, the survey interviewed a small group of farmers (n=20) who may have been among the most isolated and disadvantaged, and therefore aptly targeted by the GLP-IF. Secondly, the program was newly launched and in the process of enrolling farmers. This may explain why sampled farmers in the intervention areas were yet to develop connections in the sorghum value chain. Finally, the survey asked farmers to list only a sub-set of their connections, namely financial service providers, input suppliers, hub owners, aggregators, and buyers. The questions on relationships were close ended, and the questionnaire was not designed to capture information about connections outside the hub model. It is possible that these farmers had relationships with other actors, including other farmers and agricultural extension officers. These lessons learned about the timing of similar activities and the selection criteria for survey respondents are important and will be carefully considered for future iterations of the SNA. For example, an additional SNA with a new cohort of GLP beneficiaries is proposed to take place in the second half of Year 2, possibly in Migori county. These lessons should inform that process.

Figure 7: Snapshot of isolated farmers in the network¹²



The survey also asked sorghum farmers to identify the main constraints they face in their agricultural activities. The following challenges were cited as the most significant:

- Lack of capital/financial support/accessible credit facilities to cover key expenses of farming, including costs of inputs, machinery, and labor
- Prohibitive cost of inputs

¹² The complete Network Map can be accessed at <https://kumu.io/lincllc/glp-kenya-sna#default-map>. This online version can be enlarged for ease of use.

- Poor quality sorghum seeds
- Unreliable weather patterns (drought and floods), which affect production and lead to losses
- Bird damage, which results in diminished crop yields
- Limited knowledge of good agricultural practices
- Fluctuations in market prices.

Each of these constraints demonstrated the weak level of engagement with value chain actors and corroborated the findings of the network analysis. Most farmers had weak ties with actors such as input suppliers, buyers, and aggregators. This disadvantaged them and limited their production, and access to information and relevant support. While Equity Bank, Cooperative Bank, One Acre Fund and Siboa Self Help Group were named as financial service providers in the network, only one farmer indicated a relationship with a financial services provider. Further probing revealed farmers frequently relied on the financial support of family and other informal channels, making them less likely to seek out financial services such as credit or crop insurance.

Reciprocity of relationships

Mutual relationships did not occur frequently in the network. However, buyers and input suppliers had the highest tendency for reciprocal relationships.

A key finding of the network analysis related to Reciprocity, or the degree to which actors share mutual links. The survey expected every interviewee to name up to ten influential market actors in the sorghum value chain that they interact with regularly, but most respondents listed only one or two relationships. Farmers provided very few referrals, further indicating isolation from key value chain actors.

LINC's analysis revealed an overall Reciprocity score of 2% in this network: of all the pairs of relationships in the network, only 2% had a reciprocal relationship where interactions flowed both ways. This means that mutual links did not occur frequently, and most actors did not have a reciprocated connection. An examination of the reciprocity of relationships by type of actor yielded the following: buyers (5%), input suppliers (4%), aggregators (0%), financial service providers (0%) and farmers (0%).

This indicates that the actors who were most likely to have reciprocal relationships were buyers and input suppliers. Although these actors account for only 4 out of 57 respondents, they were likely to have the greatest influence in terms of transporting information and collaborating with other actors in the network. These actors may also be most likely to provide and receive support from others in the network, and to maintain and strengthen the network's existing bonds.

Conclusions and recommendations

Conclusions and recommendations from the network analysis are presented below. These include recommendations for how GLP-IF could strategically engage network members for enhanced outcomes and more sustainable impact.

Focus on network cohesion while addressing Network Density

While Network Density (the total number of connections in the network) is important, it is not the only - or best - metric affecting network health. It may be difficult to manage the flow and quality of information if a network is too dense, while a sparse network may leave many actors isolated from core activities.

However, the program may wish to take steps to strategically enhance Network Density. This is likely to contribute to a more useful and cohesive network for farmers. Information and services are likely to travel more easily and effectively across the network, and ultimately reach more farmers. This requires identifying and focusing on the right clusters and the right relationships. While EABL is a very influential actor, increasing connections to EABL does not seem to be critical. Instead, enhancing links among other disconnected actors is likely to have a greater impact.

Strengthen ties between farmers and value chain actors, particularly financial service providers

The program should consider strengthening relationships between farmers and actors who provide quality inputs, agricultural information, and access to credit. Farmers had the closest connections and strongest reach within the network. Empowering them is likely to lead to positive outcomes for farmers across the network.

Develop a strategy to prioritize and engage the most influential actors in the network according to the program's needs

The most influential actors in the network included the East African Seed Company, Cereal Growers Association and Dryland Seed Company. The program should identify the best ways to engage these actors and use them to create bonds and bridges between GLP-IF's core implementers and farmers. These actors can also play a role in disseminating knowledge in the network, and creating clearer pathways between farmers, input suppliers

and aggregators. The program should decide which key network actors should be engaged in its different phases, and if there are opportunities to leverage existing relationships or resources. Table 5 and Table 6 provide a summary of key attributes for the network's most influential organizations and individuals. Additionally, they detail potential leverage points and recommended actions for working with each individual and organization.


Strengthen network relationships in Suba South and Karachuonyo sub-counties

In terms of individuals, the actors with the strongest metrics for Centrality, Reach and Closeness were in Rangwe sub-county. This may be because implementation focused mainly on Rangwe in the program's first year. The hubs in Karachuonyo and Suba South sub-counties were formed more recently, contributing to relatively weaker ties in these sub-counties. The program should continue making deliberate investments to strengthen relationships between farmers and other actors as it intensifies activities in Suba South and Karachuonyo. This could include applying lessons learned from relevant examples of strong relationships in Rangwe (see **Error! Reference source not found.**).


Identify influential actors outside the hub model


The survey did not establish whether farmers had other relationships outside the hub model. It is possible that farmers interact with other farmers and service providers including agricultural extension officers. Future iterations of the network analysis should explore the possibility of influential relationships outside the boundaries of the hub model.

Table 5: Summary of key organizations in the network and potential leverage points


Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
 <p>Cereal Growers Association (CGA) is a national non-profit member-based farmer organization, which was incorporated in August 1996. It brings together commercial cereal farmers to promote collective action for sustained improvement in their farming enterprises and address industry challenges in Kenya. CGA works with industry stakeholders to provide services to its members. These stakeholders include government bodies, agricultural input suppliers, financial institutions, insurance companies, output buyers, development partners and NGOs.</p>	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise - High degree of popularity, Closeness and Reach Efficiency: despite its size, CGA can spread information within the network easily; it has excellent visibility of activities across the network - Strong <i>bridger</i>¹³: links core GLP-IF actors to a range of other central actors 	<ul style="list-style-type: none"> - Enrolling GLP-IF farmers in CGA farmer groups would offer: <ol style="list-style-type: none"> a. Access to credit through the Cereal Growers SACCO Society Ltd b. Increased bargaining power c. Access to information through various publications and bulk SMS platforms d. Access to extension and advisory services e. Sustainable support to farmers after the exit of GLP-IF - Engage GLP-IF farmers in activities such as CGA's farmer field days - Enhance lobbying and advocacy for GLP-IF's farmers with disabilities by working through CGA's platform and collective action mission


¹³ This term is used within the study to describe an individual or organization that plays an intermediary role between two of the major groups of sorghum value chain actors.


Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
<p>CGA offers cereal farmers a functional platform. This provides structure and links to business support services to grow their farming businesses and improve their livelihoods.</p> <p>More information is available at https://cga.co.ke</p>		<ul style="list-style-type: none"> - Draw on CGA’s experience implementing sorghum commercialization projects in partnership with USAID, AgriFund and other development partners - Identify opportunities to connect network managers and hub owners with CGA distributors and agro-dealers, and/or enhance existing relationships - Leverage CGA’s extensive knowledge, relationships, and visibility in the sorghum value chain, and seek out connections with other valuable resources that can complement GLP-IF’s initiatives in the sector
 <p>Dryland Seed Limited is a specialist private company which produces,</p>	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise - High Closeness and Reach Efficiency: despite its size, it can spread information within the network 	<ul style="list-style-type: none"> - Benefit from Dryland’s experience in training farmers on seed varieties - Identify opportunities to connect network managers and hub owners with Dryland’s distributors, and/or enhance existing relationships - Draw on Dryland’s extensive experience of seed certification and

Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
<p>processes, and disseminates drought-tolerant seed crop varieties including maize, sorghum, cowpeas, and pigeon peas.</p> <p>It collaborates with a range of key agricultural actors including Kenya Agricultural and Livestock Research Organization (KALRO) and International Maize and Wheat Improvement Center (CIMMYT).</p> <p>More information is available at https://drylandseed.com</p>	<p>easily, and has high visibility of network activities</p>	<p>access to high quality seeds, including training hub owners on certified seeds</p> <ul style="list-style-type: none"> - Leverage Dryland’s relationships with government actors such as KALRO and Kenya Plant Health Inspectorate (KEPHIS) to raise awareness of GLP-IF’s initiatives in the sector - and identify opportunities to complement them
	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise 	<ul style="list-style-type: none"> - Draw on East African Seed Company’s vast experience in training smallholder farmers on agronomic practices, including access to extension staff and demonstration plots - Benefit from East African Seed Company’s smallholder farmer-focused research initiatives

Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
<p>The East African Seed Company is a private company that supplies agricultural chemicals and equipment, ornamental seed and a wide range of global field crop and vegetable seeds. The company was established in 1972 in Kenya and today has breeding, seed production and sales sites throughout Eastern and Southern Africa. Smallholder farmers make up the majority of the company’s clientele.</p> <p>The company has a smallholder farmer-focused research program for both global and local crops, smallholder feedback mechanisms, collaborative research activities and training program for local plant breeders. The company is committed to engaging smallholder farmers and tailors its agronomic training to the specific needs of individual smallholders. It has a leading pool of dedicated extension staff and implements a range of demonstration and promotion strategies. It also offers smallholder farmers access to agricultural inputs other than seed.</p>		<ul style="list-style-type: none"> - Learn from East African Seed Company’s smallholder feedback mechanisms, and identify potential opportunities to learn from these initiatives - Identify opportunities to connect network managers and hub owners with East African Seed Company distributors, and/or enhance existing relationships - Use East African Seed Company’s extensive experience related to seed certification, access to high quality seeds, agro-chemicals, and equipment, including training hub owners on certified seeds and other inputs

Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
<p>More information is available at https://easeed.com</p>		
 <p>FARM TO MARKET ALLIANCE Making markets work better for farmers</p> <p>Farm to Market Alliance (FtMA) is a global consortium of six public and private organizations, which each bring specific expertise, experience, and assets. They are Alliance for a Green Revolution in Africa (AGRA); Bayer Crop Science AG; International Finance Corporation; Syngenta Crop Protection AG; Rabobank; Grow Africa; the World Food Programme (WFP); and Yara International ASA.</p> <p>FtMA increases the productivity and income of smallholder farmers and</p>	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise - Is a strong connector and can stimulate information flow across the network 	<ul style="list-style-type: none"> - Use FtMA's extensive knowledge of - and relationships with - public and private sector actors in the sorghum value chain. Seek opportunities to form relationships with other valuable connections that can complement GLP-IF's initiatives in the sector - Draw on FtMA's vast experience promoting commercial viability among smallholder farmers, and enhancing relationships between farmers and value chain actors - Identify opportunities to learn from FtMA's Farmer Service Centers (FSCs) model, which is similar to Syngenta Foundation East Africa's hub model

Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
<p>develops their commercial viability. It does this by providing adequate information, investment, and support at all stages of the process – from seed to market.</p> <p>FtMA uses a network of self-sustaining Farmer Service Centers (FSCs) that provide services to enhance farmers’ productivity, increase market linkages and encourage farm digitization. It also connects farmers with services including mechanization providers, financial service providers, agro-dealers, aggregators, and buyers.</p> <p>More information is available at https://ftma.org</p>		<ul style="list-style-type: none"> - Identify opportunities to learn from FtMA’s service model of providing farmers with financial services, yield guarantee crop insurance, logistic and mechanization support. This can help address GLP-IF farmers’ most pressing constraints - Determine how GLP-IF’s and FtMA’s initiatives could complement each other by identifying areas of mutual interest based on existing activities in the sorghum value chain
 <p>Zehu Limited is a social enterprise that aims to increase the number of women and households with diverse, reliable, and</p>	<ul style="list-style-type: none"> - Is a moderately influential source of information and expertise in the network 	<ul style="list-style-type: none"> - Identify opportunities to work with Zehu based on mutual interests relating to empowering rural women and promoting access to decent work - Leverage Zehu’s ongoing activities with EABL, particularly with women sorghum farmers

Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
<p>sustainable incomes. The organization empowers rural communities to lead and cascade sustainable change by providing and developing decent work and enabling economic growth.</p> <p>Through its agribusiness arm, Zehu provides access to technical assistance. It also develops farmers' knowledge and skills around agricultural production, farm inputs, value addition, and access to markets and credit facilities. Zehu is currently a partner of EABL in sorghum production. A total of 300 farmers have been supported to date, covering 450 acres.</p>		<ul style="list-style-type: none"> - Identify opportunities to connect GLP-IF sorghum farmers and Zehu sorghum farmers to enhance relationships and knowledge sharing across farmer groups
 <p>Yara East Africa is Kenya and Uganda's leading crop nutrition company. It provides farmers with knowledge about effective</p>	<ul style="list-style-type: none"> - Is a moderately influential source of information and expertise in the network 	<ul style="list-style-type: none"> - Leverage Yara's vast experience training smallholder farmers on agronomic practices, fertilizer use and crop nutrition - Identify opportunities to connect network managers and hub owners with Yara EA Ltd's distributors, and/or enhance existing relationships

Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
<p>practices to sustainably improve crop yields and quality, and so increase farmers' profits. Yara EA Ltd is a subsidiary of Yara International SA.</p> <p>Yara East Africa began operating in 1995, importing and distributing fertilizer to Kenyan farmers. It has developed crop specific fertilizers and foliar micronutrient crop programs to supply complete balanced crop nutrition for a wide range of arable, horticultural, grassland, fruit, and forage crops. Yara has developed a broad fertilizer portfolio to increase the productivity of the main crop nutrition solutions. This translates to higher farmer and household incomes.</p> <p>Yara also offers capacity building programs to farmers.</p> <p>More information is available at https://www.yara.co.ke</p>		<ul style="list-style-type: none"> - Leverage Yara's extensive experience of agro-chemicals including training hub owners on crop nutrition and safe use of fertilizers


Actor	Key attributes	Leverage points: opportunities to engage or work with this organisation
 <p>One Acre Fund supplies smallholder farmers with finance and training to grow more food and earn more money. The organization offers a full-service program in Eastern and Southern Africa. They work directly with farmers to provide:</p> <ul style="list-style-type: none"> • Quality farm products on credit, which farmers repay over the full growing season • Training for farmers on new agricultural practices and how to sell harvest surplus • Crop insurance and credit. <p>One Acre Fund also works with governments and private sector partners to expand access to quality agricultural services to all farmers.</p>	<ul style="list-style-type: none"> - Is a moderately influential source of information and expertise in the network 	<ul style="list-style-type: none"> - Leverage One Acre Fund’s relationships with public and private sector actors in the sorghum value chain, and seek links with other valuable connections to complement GLP-IF’s initiatives in the sector - Identify opportunities to learn from One Acre Fund’s full-service model, which is similar to Syngenta Foundation East Africa’s hub model - Identify opportunities to learn from One Acre Fund’s service model which provides farmers with credit and crop insurance. This could help address GLP-IF farmers’ most pressing constraints - Determine how GLP-IF's and One Acre Fund’s initiatives could complement each other by identifying areas of mutual interest based on existing activities in the sorghum value chain

Table 6: Summary of key individuals in the network and potential leverage points

Actor	Key network attributes	Leverage points
<p>Farmer MaAO</p> <ul style="list-style-type: none"> - Female - Farmer - Rangwe sub-county - Multiple impairments - Five years' experience sorghum farming - Fewer than five acres of sorghum - Average annual revenue (less than KES20,000) 	<ul style="list-style-type: none"> - High degree of Closeness and Reach Efficiency: can spread information within the network easily and has high visibility of activities across the network - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise 	<ul style="list-style-type: none"> - Identify opportunities to engage this farmer either as a mobiliser or influencer, particularly where gender, disability and inclusion-related needs are concerned
<p>Farmer MAO</p> <ul style="list-style-type: none"> - Female - Farmer - Rangwe sub-county - No impairments - Three years' experience sorghum farming - Fewer than five acres of sorghum - Average annual revenue (KES20,001-40,000) 	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise 	<ul style="list-style-type: none"> - Identify opportunities to engage this farmer either as a mobiliser or influencer, particularly where gender needs are concerned

Actor	Key network attributes	Leverage points
<p>Farmer DO</p> <ul style="list-style-type: none"> - Male - Farmer - Rangwe sub-county - No impairments - Two years' experience sorghum farming - Fewer than five acres of sorghum - Average annual revenue (KES40,001-60,000) 	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise 	<ul style="list-style-type: none"> - Identify opportunities to engage this farmer either as a mobilizer or influencer
<p>Input supplier JO</p> <ul style="list-style-type: none"> - Male - Input supplier - Rangwe sub-county - No impairments - Seven full-time employees - Average annual revenue (KES 250,001 - 500,000) 	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise 	<ul style="list-style-type: none"> - Identify opportunities to engage this input supplier in training and supporting farmers - Explore lessons learned that can be replicated in Karachuonyo and Suba South for agro-dealer relationships with farmers
<p>Hub owner AN</p> <ul style="list-style-type: none"> - Male - Hub owner - Rangwe sub-county - No impairments 	<ul style="list-style-type: none"> - High degree of Closeness and Reach Efficiency: can spread information within the network easily; has high visibility of activities across the network 	<ul style="list-style-type: none"> - Identify opportunities to engage this hub owner as a mobilizer or influencer - Explore lessons learned that can be replicated in Karachuonyo and Suba South for hub owner relationships with farmers

Actor	Key network attributes	Leverage points
<ul style="list-style-type: none"> - Five full-time employees - Average annual revenue (less than KES100,000) 		
<p>Hub owner JON</p> <ul style="list-style-type: none"> - Male - Hub owner - Rangwe sub-county - Physical impairment - No full-time employees - Average annual revenue (less than KES100,000) 	<ul style="list-style-type: none"> - Strong Centrality: has many connections in the sorghum value chain; is an influential source of information and expertise 	<ul style="list-style-type: none"> - Identify opportunities to engage this hub owner as a mobilizer or influencer, particularly where disability needs are concerned - Explore lessons learned that can be replicated in Karachuonyo and Suba South for hub owner relationships with farmers

Annex: Data collection tool

Social Network Analysis

Global Labor Program – Inclusive Futures

Please read to respondent before starting the survey:

My name is [NAME]. I am working with Q-Data and Mapping Services, a local research company. I am conducting a survey of people who are involved in the sorghum value chain in Homa Bay county. The study is intended to understand your relationship with various people and organizations that are involved in the sorghum industry. You were suggested to us by representatives of the Global Labor Program implemented by Sightsavers Kenya and its partners. This survey usually takes less than 30 minutes to complete, and we would appreciate your participation. Your participation in this survey is entirely voluntary. The analysis based on this survey will be used for learning purposes. Because the analysis will be looking at relationships between organizations, there will be parts of the analysis which include looking at specific organizations, and therefore your responses should not be considered as fully anonymous. We appreciate your openness and honesty.

Section 1: Respondent and firm/organization information

Read: *First, I will ask some basic identifying information about you/your organization. These questions are meant to provide some background information about your business. Personal information is private and will not be shared publicly.*

Respondent information	
1. Respondent first name:	
2. Respondent last name:	
3. Respondent's telephone:	
4. County:	
5. Sub-county:	
6. Ward:	
7. Gender:	

8. What category best describes your role in the sorghum value chain? (Select only one. Please read all responses before finalizing selection.)

- a. _____ Farmer [I grow less than 10 acres of sorghum on my farm, and I have an agreement to sell it to an EABL aggregator]
- b. _____ Grower [I grow 10 or more acres of sorghum on my farm, and I have an agreement to sell it to EABL directly]
- c. _____ Financial services provider [I provide financial services such as credit and crop insurance to sorghum farmers]
- d. _____ Aggregator [I have a direct contract with EABL to supply sorghum that I aggregate from a group of farmers]
- e. _____ Inputs supplier [I provide inputs such as seeds, fertilizers, and agrochemicals to sorghum farmers]
- f. _____ Buyer [I buy sorghum crop from farmers, but I do not have a contract with EABL]

g. _____ Farmer's hub owner / agent [I provide support to sorghum farmers (inputs, market linkages and extension and advisory services) in collaboration with Syngenta Foundation]

9. Do you have any form of disability? (Single response)

a. _____ Yes

b. _____ No

10. If yes, which type of disability? (Multiple responses)

a. _____ Visual impairment (blind or low vision)

b. _____ Hearing impairment (deaf or hard of hearing)

c. _____ Deafblindness

d. _____ Intellectual impairment

e. _____ Psychosocial impairment

f. _____ Multiple impairments

g. _____ Other (please specify): _____

11. Do you have any full-time employees?

a. Yes

b. No (Skip to Q15)

12. If yes, how many: _____

13. Do you employ anyone with any form of disability? (Single response; for respondents with at least one full-time employee.)

a. _____ Yes

b. _____ No

14. If yes, please specify the type(s) of disability. (Multiple responses. Please read all responses before finalizing selection.)

a. _____ Visual impairment (blind or low vision)

b. _____ Hearing impairment (deaf or hard of hearing)

c. _____ Deafblindness

- d. _____ Intellectual impairment
- e. _____ Psychosocial impairment
- f. _____ Multiple impairments
- g. _____ Other (please specify): _____

Section 1a: Farmers only

15. Approximately how many years have you been farming sorghum? _____

16. On what size of land are you currently farming sorghum?

- a. _____ 1/8 acre or less
- b. _____ About a 1/4 acre
- c. _____ About a 1/2 acre
- d. _____ About a full acre
- e. _____ About 1 to 5 acres
- f. About 6 to 9 acres
- g. About 10 or more acres

17. Approximately how much revenue did you generate from selling your sorghum crop last year?

- a. _____ KES 0 - 20,000
- b. _____ KES 20,001 - 40,000
- c. _____ KES 40,001 - 60,000
- d. _____ KES 60,001 - 80,000
- e. _____ KES 80,001 - 100,000
- f. _____ More than KES 100,000

18. Do you normally employ seasonal workers?

- a. _____ Yes
- b. _____ No

19. If yes, how many per season? _____

Section 1b: Other respondents (non-farmers)

20. Is your business formally registered with any government authority?

a. _____ Yes

b. _____ No

21. If yes, in what year was it registered? _____

22. Approximately how much revenue did your business generate last year?

a. _____ KES 0 - 100,000

b. _____ KES 100,001 - 250,000

c. _____ KES 250,001 - 500,000

d. _____ KES 500,001 - 1,000,000

e. _____ KES 1,000,001 - 5,000,000

f. _____ More than KES 5,000,000

Section 2: Respondent and firm/organization information

Read: *Now I will ask you some questions about how you/your firm interact/s with other groups of market actors in the sorghum value chain. We understand that you may not know all of the interactions that members of your firm have with other market actors, but please answer to the best of your knowledge. If you feel unable to answer a question on behalf of your firm, please let me know and I will note this.*

23. Please think about all the organizations and individuals you normally interact with in the course of either producing, marketing, financing, or buying sorghum crop in Homa Bay county. Please name up to 10 of the most important individuals or organizations that you have a relationship with in this line of business. (*Interviewer, probe for organizations and individuals located in Homa Bay only.*)

i. _____

ii. _____

iii. _____

iv. _____

v. _____

vi. _____

vii. _____

viii. _____

ix. _____

x. _____

24. How many years/months have you had this relationship? ____ years ____ months

25. Do you buy sorghum from this individual/organization?

a. ____ Yes

b. ____ No

26. Do you sell sorghum to this individual/organization?

a. ____ Yes

b. ____ No

27. Do you get information about sorghum farming from this individual/organization?

a. ____ Yes

b. ____ No

28. Do you receive financial services (eg credit, crop insurance) for your sorghum farming from this individual/organization?

a. ____ Yes

b. ____ No

29. Do you purchase agricultural inputs (eg sorghum seeds, fertilizers, or agrochemicals) for your sorghum crop from this individual/organization?

a. ____ Yes

b. _____ No

30. In the past six months, how many times have you communicated with this individual/organization in a month? _____ times

31. Using the following scale, please score how reliable/trustworthy this individual/organization is. (*Interviewer, please read all responses before finalizing selection.*)

1. _____ Very untrustworthy
2. _____ Somewhat untrustworthy
3. _____ Neutral
4. _____ Somewhat trustworthy
5. _____ Very trustworthy

32. Using the following scale, please score how effective the information and communication with this individual/organization is. (*Interviewer, please read all responses before finalizing selection.*)

1. _____ Very ineffective
2. _____ Somewhat ineffective
3. _____ Neutral
4. _____ Somewhat effective
5. _____ Very effective

33. Using the following scale, please score your level of satisfaction with the costs offered by this individual/organization (*Interviewer, please read all responses before finalizing selection.*)

1. _____ Very dissatisfied
2. _____ Somewhat dissatisfied
3. _____ Neutral
4. _____ Somewhat satisfied
5. _____ Very satisfied

34. Using the following scale, please score your level of satisfaction with the quality of services from this individual/organization. (*Interviewer, please read all responses before finalizing selection.*)

1. _____ Very dissatisfied
2. _____ Somewhat dissatisfied
3. _____ Neutral
4. _____ Somewhat satisfied
5. _____ Very satisfied

35. Please provide a contact number for this individual/organisation:

Section 3: Constraints

36. What are the main constraints/pain points to growing your business in the sorghum value chain? Please list. (*Interviewer, please probe for descriptive responses of any challenges they face in their business.*)