INFLUENCE OF SOCIAL CAPITAL AND NETWORKS ON MARKETING PERFORMANCE OF SMALLHOLDER GRAIN FARMER GROUPS IN THARAKA NORTH AND THARAKA SOUTH SUB-COUNTIES, KENYA

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EGERTON UNIVERSITY

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this thesis is my original work and has not been submitted before in this or any other university for the award of a degree.

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Recommendation

This research thesis has been prepared and submitted with our approval as the Egerton University supervisors.

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DEDICATION

With love and gratitude, I dedicate this research work to my mum Teresia Muthoni, my late dad Dalex Wambua, my twin brother Victor Mbatha and my sister Lilian Mwikali.

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ABSTRACT

Over the years, the Kenya government has promoted formation of smallholder farmer groups as part of a strategy to enhance agricultural productivity. The groups are valued for their potentials to foster collective action and social capital useful in linking smallholder farmers to lucrative markets. However, existing groups seem to vary widely in facilitating access to better markets. Little is known about the causes of the differentials in the groups' performance. This study analyzed marketing performance of 100 smallholder grain farmers' marketing groups in Tharaka North and Tharaka South Sub-Counties, Kenya. The aim was to characterize the groups and assess the influence of social capital, group's structure and conduct on performance using a four year (2013-2016) panel data. Per Capita Value of Grains Sold (PCVCS) across the years was used as a proxy for group marketing performance. Descriptive statistics indicated that farmer groups varied significantly in their structure and conduct and they served diverse purposes to their members where reciprocity and welfare motives played a big role in fostering farmer group collective action. Social Network Analysis (SNA) results suggested that farmer groups were networked with diverse actors basically to access information, inputs, capacity building and market linkages. Social capital results indicated that the groups' bonding social capital was relatively high and equal. However, the groups varied significantly ($p \leq 0.1$) in their level of bridging social capital where high performing groups had the highest average score (0.88), followed by average groups (0.44) and then low groups had the least (0.35). The performance (average PCVCS) of the groups rose steadily and significantly from KES 7,046.13 in 2013 where 41 percent of the groups participated in collective marketing to KES 10,239.13 in 2016 with 62 percent of the groups. Random Effects Model (REM) results indicated that bridging social capital, active marketing committees, selling to institutional buyers, leadership training and collective access to high-yielding inputs had significant ($p \leq 0.1$) positive influence on group performance. On the contrary, group's motive for formation, internal management practices, and received loans had significant ($p \leq 0.1$) negative influence on performance. It was noted that bonding social capital, while necessary, was not sufficient in facilitating groups' access to better markets. To enhance group performance, diverse linkages are important in exposing the groups to wider input and output market horizons and also encourage selling under contracts. Support actors can also reach out for more farmer groups to strengthen their management and marketing skills. However, this should be done carefully to avoid creating donor dependency among groups.

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ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
CBO	Community Based Organization
CGA	Cereals Growers Association
CRS	Catholic Relief Services
DRC	Democratic Republic of Congo
EABL	East Africa Breweries Limited
ECM	Error Components Model
FAO	Food and Agriculture Organization
FBOs	Farmer Based Organizations
FEM	Fixed Effects Model
HYT	High Yielding Technologies
ICE	Institute of Culture and Ecology
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
KEPHIS	Kenya Plant Health Inspectorate Services
KES	Kenya Shillings
KM	Kilometre
KNBS	Kenya National Bureau of Statistics
MDGs	Millennium Development Goals
MGCSD	Ministry of Gender, Children and Social Development
MoA	Ministry of Agriculture
NGOs	Non-Governmental Organizations
NRC	Nokia Research Center
OECD	Organization for Economic Co-operation and Development
PCA	Principal Component Analysis
PCVCS	Per Capita Value of Grains Sold
PMGs	Producer Marketing Groups
RCMRD	Regional Center for Mapping of Resource for Development
REM-FGLS	Random Effects Model - Feasible Generalized Least Square Regression
REM-GLS	Random Effects Model - Generalized Least Square Regression
RIDEP	Rural Initiatives Development Programme
RPOs	Rural Producer Organizations

SACCOs	Savings and Credit Cooperatives
SCP	Structure Conduct Performance
SDGs	Sustainable Development Goals
SHGs	Self Help Groups
SNA	Social network analysis
SOCAT	Social Capital Assessment Tool
SPSS	Statistical Package for the Social Sciences
SSE	Sum of Squared Error
TCDIP	Tharaka Nithi County Integrated Development Plan
TCGA	Tharaka Cereals Growers Association
VECO	VredesEilanden Country Office (VECO) East Africa
WFP	World Food Programme

CHAPTER ONE
INTRODUCTION

1.1 Background information

One of Kenya's agricultural policy strategies is to promote collective action as a means of linking smallholder farmers to lucrative markets (Wiggins *et al.,* 2009). This has seen an increase in the number of primary-tier smallholder farmers' groups. Statistics show that the registered number of women groups increased from 142,783 in 2010 to 150,857 in 2014 (Kenya National Bureau of Statistics [KNBS], 2015). The growth in numbers can be attributed to promotion by agents like government extension and research departments; donors; and individuals' efforts or community communal decisions to form groups to meet specific needs (Nokia Research Center [NRC], 2009). Most of these farmer groups are formed along gender lines, with majority being women groups followed by youth groups (Ayieko *et al.,* 2014). This shows their importance in not only agricultural marketing but also in creating welfare and business opportunities for women and the youth (Abaru *et al.,* 2006).

Recent studies argue that challenges and opportunities presented by agricultural market liberalization and globalization (Francesconi and Wouterse, 2011; Kassam *et al.,* 2011), coupled with income inequalities create demand and supply driving forces for smallholder farmers to venture into collective action (Ampaire *et al.,* 2013; Fischer and Qaim, 2014). The demand forces include the need to gain the economic benefits of collective access to high yielding technologies (HYT), extension services, and mobilizing low interest credit (Kassam *et al.,* 2011; Njera *et al.,* 2012). Supply forces include creating economies of scale in bulking output for transportation, storage, and marketing in order to reduce transaction costs, enhance bargaining power and improve performance of smallholder rural markets (Conroy, 2003; Kassam *et al.,* 2011; Njera *et al.,* 2012; Bijman, 2012).

Due to importance and increase in numbers of farmers' groups, practitioners and researchers are increasingly showing interest in understanding their formation and operations. However, empirical evidence on the functioning, capacity, and constraints of the groups, and hence, how their operations can be improved, is still scarce. Additionally, existing literature shows mixed findings on the performance and challenges faced by farmer groups depending on the local context the groups operate in. Most studies on collective action focused more on factors influencing membership to groups, the role of groups in management of natural resources, common pool resources and agricultural production (Bernard *et al.,* 2008a; Agarwal, 2009,

2010; Madrigal *et al.*, 2011; Ratner *et al.*, 2013). Francesconi and Wouterse (2011) argue that farmer groups in developing countries are new, small and fail to mobilize collective action. Additionally, they also tend to fail to achieve their objectives (Castella *et al.*, 2011). The failure of these farmer groups is a problem that is not only a threat to the livelihoods of smallholder farmers, but also to the socio-economic progress of most developing countries.

Markelova and Mwangi (2010) noted that the functioning and performance of farmer groups is influenced by the nature of products they deal with, their institutional arrangements and the nature of their external environment which includes associations with other farmer groups, the state, civil societies and markets. This draws our attention to the role of social networks on the development and success of collective action. Recent studies show that farmer group linkages with different actors involved in marketing can enhance their skills, facilities, market access and overall performance (Markelova and Mwangi, 2010; Shiferaw *et al.*, 2009; Pastor *et al.*, 2010).

Development and promotion of reliable farmer groups that empower smallholder farmers has been given attention by different actors including governments and their development partners in order to improve rural livelihoods, alleviate poverty, and enhance food security (Abaru *et al.*, 2006; Ampaire *et al.*, 2013). In 2008, the government of Kenya launched Kenya vision 2030 blueprint which highlighted the need to promote use of farmer groups as channels to address food crisis through income and supply related policy interventions (International Food Policy Research Institute [IFPRI], 2012). These policies were: (i) Income related policy aimed at assisting farmers to establish rural producer and marketing associations to enable them exploit economies of scale through collective action, and (ii) Supply policy involved in development of rural agricultural markets and agribusiness skills. These polices were in response to the inadequate capacity of smallholder subsistence agriculture to address food insecurity especially where families have limited alternative sources of income (IFPRI, 2012).

Despite existence of different interventions to promote farmer groups, scarcity of information about their potential, features and performance leads to application of poorly informed policies. This may favour collective action of some farmer groups; in some cases become a barrier to it; or lead to unsustainable improvements that fail to address specific smallholder farmers' problems. This research aims at addressing information gaps on the potential, features and performance of farmer groups through a study in Tharaka North and Tharaka

South Sub-Counties, Kenya. Diversity of farmer groups operating different activities in different areas makes the challenges they face to vary across space and time. With specific reference to grain farmer groups in Tharaka North and Tharaka South Sub-Counties, little was known about their progress and performance with regard to collective grain marketing. In order to make well informed policies and development interventions, it was paramount to understand how these groups function, and the factors that influence their marketing performance. This could contribute towards promotion of performing and sustainable farmer groups to drive collective marketing among smallholder farmers.

1.2 Statement of the problem

There has been a general rise in number of farmer groups in Kenya especially in areas like Tharaka North and Tharaka South Sub-Counties where projects targeting smallholder farmers were mainly implemented through groups. However, general observation in 2013 and early 2014 indicated that most grain marketing farmer groups that were in operation in the area had varying levels of performance. In addition, despite their perceived importance and observed differential performance, there was little empirical evidence to confirm or reject the observed varying levels of performance. This increased the probability of applying poorly informed policies and development interventions by Tharaka Nithi County Government and development partners in the area. Given this information gap problem, there was a need to provide more insights and establish whether there was a link between performance of these groups and their social networks, structure and conduct. Therefore, to gain a deeper understanding of the situation, this study applied a structure-conduct-performance framework to analyze the marketing performance of smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya.

1.3 Objectives

1.3.1 General Objective

The general objective of this study was to contribute to improving the livelihoods of smallholder farmers in Tharaka Nithi County, through demonstrating the role of social networks and internal strengths of smallholder grain farmer groups.

1.3.2 Specific Objectives

1. To characterize the structure and conduct of smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya

2. To establish the nature of social networks of smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya
3. To estimate the level of social capital in smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya
4. To determine the influence of social capital, structure and conduct of groups on marketing performance of smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya

1.4 Research questions

1. How do structure and conduct characteristics vary across smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya?
2. How does the nature of social networks vary across the smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya?
3. What are the levels of social capital in smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya?
4. How do social capital, structure and conduct factors influence the marketing performance of smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya?

1.5 Justification

Despite the attention given to addressing the needs and challenges of farmer-groups through government interventions and research, coming up with viable solutions is still a problem (Magreta *et al.,* 2010). For this reason, Kanyinga and Mitullah (2006); and Ragasa and Golan (2014) argue that there is need for further studies to investigate performance, challenges and benefits of smallholder farmers groups. Place *et al.* (2004) also recommend the need for studies that focus on groups that undertake similar activities to allow for a deeper analysis of the drivers of performance.

This study provides recommendations to enhance smallholder grain farmers groups' performance. This may help Tharaka farming community which is characterized by many grain marketing-oriented farmer-groups mostly involved in green grammes, sorghum and cowpeas production and marketing. Development organizations in Tharaka North and Tharaka South Sub-Counties may be interested in knowing the findings on farmer groups' progress and performance, and challenges that need further intervention. To help inform the development organizations, a brief report will be provided through the Ministry of

Agriculture (MoA) and Ministry of Gender, Children and Social Development (MGCSD) in the constituency. This will facilitate successful establishment, collaboration and strengthening of the capacity of these groups to be a significant economic force in modern markets and trade and more so contribute to development of Tharaka North and Tharaka South Sub-Counties. Findings on social networks and bridging social capital may aid the actors especially the development partners to weave a more cohesive and productive stakeholders' network. This may drive collaborations and minimize unwarranted competition and duplication of efforts while serving the grains farmers in Tharaka North and Tharaka South Sub-Counties.

Tharaka Nithi County Integrated Development Plan [TCDIP] 2013-2017 stipulates that there is need to invest in farmers' oriented research, and enhance farmers bargaining power and access to local and international markets through re-organizing them into viable cluster groups (TCIDP, 2013). Therefore, the findings of this study may contribute to providing information that may help in meeting the county's goal and need to enhance farmer's welfare. This research also contributes to filling knowledge, methodological and conceptual gaps related to the role and marketing performance of smallholder grain farmer groups. The research also explores gaps for further research.

1.6 Scope and limitation of the study

The study was limited to smallholder grain farmer groups across all the five county assembly wards of Tharaka North and Tharaka South Sub-Counties. Marimanti, Nkondi and Chiakariga County Assembly Wards in Tharaka South Sub-County and Gatunga and Mukothima in Tharaka North Sub-County, Kenya. It only considered farmer groups which were registered under the Ministry of Gender, Children and Social Development (MGCSD) and were in existence from 2013 to 2016. The four year study period was chosen to ensure availability of group records needed as reference points and source of some of the data for the study. This is because smallholder farmers may not have kept records for many years. Additionally, farmers were more likely to remember events that happened in the last four years hence ensuring accuracy of information and data they gave.

The study was also limited to per capita value of grains sold (PCVCS) collectively by a farmer group as an indicator of marketing performance. Some groups lacked some records; this gap was addressed by ensuring that at least five members represented each group in the interviews to provide relevant information.

1.7 Definition of terms

Smallholder farmer – this is a farmer whose cultivated land is less than 5 acres

Farmer group – this is a primary-tier formal association of smallholder grain farmers at the community level who have common collective production and marketing activities.

Community Based Organization (CBO) – this is a secondary-tier formal association of different farmer groups to form an umbrella grains marketing body.

Institutional buyer – this refers to organizations or companies that buy grains in bulk, either on spot or under contracts, from farmers.

Marketing performance– this is the extent to which a smallholder grain farmer group has been able to mobilize collective action as indicated by the per capita value of grains sold (PCVCS) collectively by group members from 2013 to 2016.

Social capital – this is the level of trust, closeness and sharing a common vision among members within a farmer group and level of linkages of the group to external actors.

CHAPTER TWO
LITERATURE REVIEW

This section contains a review of literature on agricultural markets and farmer group collective action in agricultural marketing. The review has been used to inform the conceptual framework and methodologies selected for this study.

2.1 Agricultural markets and marketing

In the real world, markets rarely function perfectly as postulated by neoclassical economists and often markets are seen as part of the problem instead of a means to the solution. Existence of imperfect agricultural markets, especially in Sub-Saharan Africa, bars smallholder farmers from exploiting all the potential benefits of agricultural commercialization (Barrett, 2008). In developing countries, rural agricultural markets are usually thin (low volumes transacted) or at times fail due to high transaction costs and risks associated with participation. Regardless of the challenges facing these markets, Kassam *et al.* (2011) argue that improving market access is still an important way to help smallholder farmers earn a better living through creating employment opportunities, and better incomes.

Marketing of agricultural produce in developing countries follows few marketing channels before the product reaches the ultimate consumer. Most of them tend to be short and with limited value addition as majority of smallholders sell directly to local markets or through farmer-groups or intermediate traders (Kang'ethe, 2011; Farm Radio International, 2012)

2.2 Rationale for collective action in agricultural marketing

Collective action arises when individuals work together as a group to achieve a shared objective or solve shared problem. Farmer group collective action is a widely recognized catalyst for agriculture and rural development in Africa. In a study in Central Kenya, Place *et al.* (2004) points out that it is highly unlikely to find a development organization or a government programme aiming at rural development that does not attempt to work through group organization. In a review of aquaculture farmer organizations in Asian region Kassam *et al.* (2011) concluded that effective collective action empowers individual smallholders to increase returns from market transactions. This is done through linkages to buyers and enhanced bargaining power to overcome entry barriers to markets (Ngigi *et al.,* 2010; Njera *et al.,* 2012). Farmer groups also offer a good platform to share information leading to lower transaction costs (Mukundi *et al.,* 2013). Collective action also aids in cushioning members

from the risks associated with weak and rapidly changing rural agricultural markets (Place *et al.*, 2004; Njera *et al.*, 2012; Fischer and Qaim, 2014).

However, in some instances collective action efforts have been overwhelmed by the failure to address inherent problems in rural agricultural areas like seasonality in production and marketing, dispersed populations and weather related risks leading to problems of asymmetric information and unsuccessful incentives for collective action (IFAD, 2016). Additionally, failure to address free-rider problem through ensuring enforcement of rules, cohesion and solidarity explains a high proportion of failed cases of collective action (Thorp *et al.,* 2005; Doss and Meinzen-Dick, 2015).

2.3 Farmer groups

Bernard *et al.* (2008b) distinguish farmer groups into two categories: the first as community and livelihood oriented groups which are mainly involved in social issues. Secondly, as market oriented groups which aim at overcoming barriers in accessing inputs, and commercializing sale of output. There is a multitude of market oriented groups in Kenya. Majority of these groups focus on a particular crop like grains, tea, coffee, and vegetables, and livestock like chicken and fish (Ouma and Abdulai, 2009; Shiferaw *et al.,* 2009).

Valentinov (2004) argues that relatively slow managerial decision making in farmer groups makes their governance relatively more expensive in terms of transaction costs as compared to investor-owned firms. Additionally, in most cases farmer groups have to involve all members in any decision making; especially in relation to business transactions. This is because interpersonal relations are the foundation of their internal transactions. The better the personal relationship between members, the more flexible, smooth and fast will be the process of planning, coordination, communication and reaching a collective consensus decision (Valentinov, 2004). To lower decision making associated transaction costs in farmer groups, social capital can help facilitate cooperation, relationships and trust among members of these groups unlike the investor-owned firms (Beugelsdijk and Van, 2005).

To study barriers faced by actors in markets and firms in an industry, structure-conduct performance framework is often used. Francesconi and Wouterse (2011) conclude that collective action of Farmer Based Organizations (FBOs) in Ghana failed when their structure and conduct are misaligned as it leads to problems in accessing external credit and sometimes to internal cohesion problems. Most of the studies have also found similar findings on the

role of groups but mixed results on the structural and conduct characteristics explaining differences in groups' performance.

2.4 Theoretical framework

The theoretical framework applied in this study is drawn from the structure-conduct-performance (SCP) paradigm which is a pillar of the classic industrial organization theory (Edwards *et al.,* 2006). The SCP paradigm was the brain child of Havard school of thought and was pioneered by Joe Bain in 1959 as described in his book 'industrial Organization' (Edwards *et al.,* 2006; Waldman and Jensen, 2016).

The SCP model has been commonly adapted as an analytical framework from an industrial firms' point of view as it relates to a market's or an industry's structure, conduct and its performance (Edwards *et al.,* 2006; Waldman and Jensen, 2016). Waldman and Jensen (2016) pointed out that, structure looks into factors that are relatively stable over time like the degree of concentration in the market, market entry barriers, and product differentiation. On the other hand, conduct accounts for the behavior of agents or firms in the market in setting prices, collusion, and their research and development capacity. The structure and conduct then influences the industry's performance which is measured by comparing results for firms across the industry like the levels of efficiency or profits for each firm (Edwards *et al.,* 2006).

Following Bain (1959), this study adapted and applied SCP framework to analyze the performance of grain farmer groups as opposed to its common application for industrial firms and particular product markets. In this case, structure referred to the internal characteristics of the group that were relatively stable over time, while conduct referred to the different approaches and practices that a group used to enhance collective marketing of grains. Value of grains sold collectively by a farmer group was explored as a proxy for performance to test the structure-conduct-performance (SCP) hypothesis.

To test the SCP hypothesis, Edwards *et al.* (2006) specification of the basic form of the SCP model was adopted as represented in *Equation 2.1* below.

$$Performance = f(X, Z) \quad \textbf{Equation 2.1}$$

Where: X – is a set of structure and conduct variables; Z – are other categories of variables that could influence performance

2.5 Conceptual framework

2.5.1 Performance

A key concern in application of SCP hypothesis in empirical work is how to measure performance. There appears to be no consensus on how to best measure the performance of organizations hence in most cases performance has to be operationalized. The choice of the indicator of performance obviously depends on the data availability, the nature of firms and desired aggregate level of analysis of the target firms. In earlier applications of SCP for industries, profits have often been used as an indicator of organizational performance. However, quantitative measures like profit are hard to come by especially for farmer groups which do not keep accurate costs and returns records to aid computation of profits. Therefore, this study focuses its attention on more quantitative and qualitative measurable indicators of incidences of collective action as identified in literature. Following the approach adopted by Raya (2014) and Ragasa and Golan (2014), this study also took facilitation of collective marketing as a key indicator of a farmer group's performance. In particular, the study used a quantitative measure of the value of grains sold collectively through a group as the indicator of performance.

2.5.2 Structure and Conduct

Earlier studies, Chambers and Cook (2007); and Francesconi and Wouterse (2011) base the structure of farmer cooperatives' on the diversity of socio-economic preferences and perceptions stated by members of these groups. On the other hand, Varughese and Ostrom (2001) based structure of farmer cooperatives on the diversity of group members' socioeconomic and membership characteristics. The latter approach is adopted for this study. It was hypothesized that group members' stated and observed socio-economic characteristics about their groups may be a more precise measure for structure than stated preferences which may never occur. Raya (2014) as well as Fischer and Qaim (2014) argue that groups structure varies in terms of their size, members gender, how the group was formed, age, and timing of proceeds.

To distinguish the conduct of rural producer organizations, Ragasa and Golan (2014) and Ampaire *et al.* (2013) used the existence of written formal rules, level of leadership training, democracy in leadership and other internal practices. However, few empirical studies have attempted to specifically show the relationship between structural and conduct aspects of a farmer group and their influence on its performance. This is a gap this study sought to

address by adopting some of the variables used in other studies while incorporating new variables under conduct and structure.

Figure 2.1 shows a diagrammatic representation of the conceptual framework of the SCP approach to the study of marketing performance of smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya. The choice of variables was based on author's conceptualization and insights gained from literature review. From the diagram, the dependent variable was farmer group performance, whose indicator is a group's per capita value of grains sold (in an oval shape at the bottom). The heavy arrows in the diagram show that specific farmer group characteristics determine a group's structure, a group's structure determines its conduct, and conduct determines the group's performance. A group's structure can also influence performance directly, also shown by a heavy arrow. At the mid-right, it is shown that social capital is embedded within a group and it has direct impact on a group's structure, conduct and performance. The thin dotted arrows, to the left, show how there can be feedback effects of conduct on structure and performance on structure and performance.

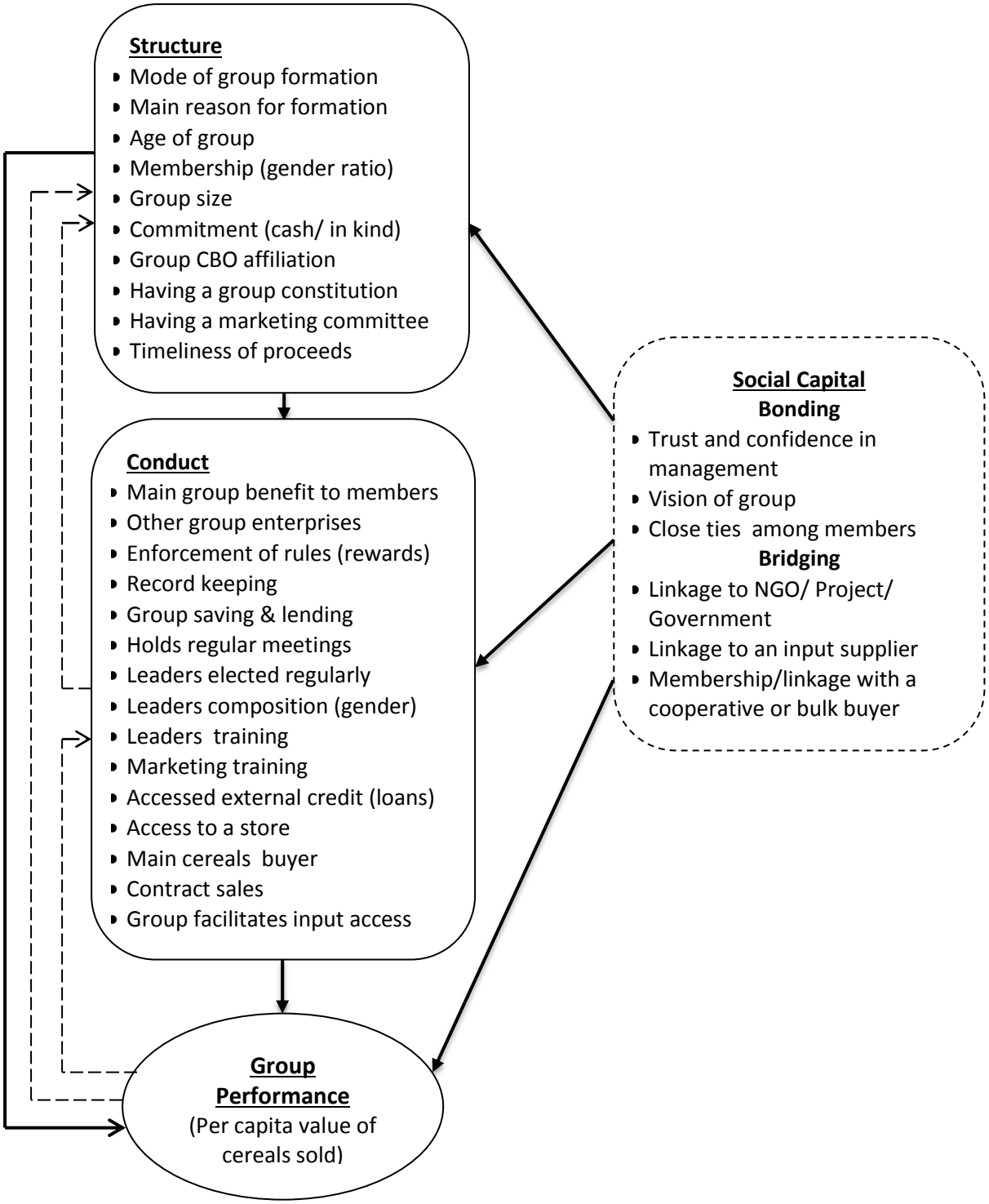

Figure 2.1: Conceptual framework of interaction between a group's social capital, structure, conduct and performance

CHAPTER THREE
METHODOLOGY

3.1 Study area

The study was conducted in Tharaka North and Tharaka South Sub-Counties, Kenya. It is located between latitudes $0^{o}30'S$ and $0^{o}10'N$ and longitudes $37^{o}40'E$ and $38^{o}20'E$ (Regional Center for Mapping of Resource for Development [RCMRD], 2016). The constituency has five County Assembly Wards namely Marimanti, Gatunga, Mukothima, Nkondi and Chiakariga, and covers an area of 1,513 KM^2. The population is 130,098 people with 65% of the population living below the poverty line (Kenya National Bureau of Statistics [KNBS], 2010).

According to Tharaka Nithi County Integrated Development Plan [TCIDP] (2013), most of the County Assembly Wards in the constituency lie in the lower altitude of about 600m above sea level. These areas are classified as semi-arid and they experience erratic rainfall. The constituency has a bi-modal rainfall pattern with the annual rainfall ranging from 200mm to 800mm. The temperatures range between 22°C – 36°C, at times they can be as high as 40°C. The short rains of October to December are more reliable than long rains which fall between the April and June (TCIDP, 2013).

The constituency is endowed with a number of perennial rivers which include Kathiita, Kithinu, Ura, Thingithu, Thanantu and Thangatha which originate from Mt. Kenya and Nyambene hills. The region also has low, hilly and sandy marginal low-lands with moderate forest cover. Soils in most of the areas in the constituency are characterized by well drained and fertile, deep red loam soils (Kaimenyi, 2012).

Most of the areas in the constituency are semi-arid region with 65% of the population living below the poverty line (KNBS, 2010) and rain-fed agriculture and livestock farming forms the main source of livelihood (Kaimenyi, 2012). According to KNBS (2010), 98.2% percent of households in Tharaka-Nithi County engage in crop farming. Most of the residents in the area are small scale farmers with average land holdings of 2.9 hectares. Drought tolerant grain crops like green grammes, sorghum and cowpeas are the most common among majority of farmers in the area. However, the constituency has a great potential in dry land irrigation agriculture and fishing which are virtually unexploited (Tharaka Nithi County Profile, 2015). Livestock production involves keeping of sheep, goats, and cattle, and bee keeping. Other

economic activities include mining of building bricks, sand and ballast in some small parts of the constituency.

Given the importance of grain farming in the region, farmer group collective action to enhance production and marketing of grain crops among other crops is very common in the area given that they are not only food crops but also cash crops. This is evidenced by presence of over 500 registered self-help groups operating the area. The constituency is also characterized by over 10 Non-Governmental Organizations (NGOs) like World Food Programme (WFP) and Rural Initiatives Development Programme (RIDEP) which seek to enhance grains production and marketing through farmer groups (TCIDP, 2013). The farmer groups, NGOs and government programmes are networked with a variety of resources flowing among them.

Marimanti town is the main trading center in the constituency and it reports the highest business activities during market days on Thursday. Road networks, schools, grains storage facilities and health facilities are inadequate and most of the existing ones are in poor condition (Kaimenyi, 2012; TCIDP, 2013).

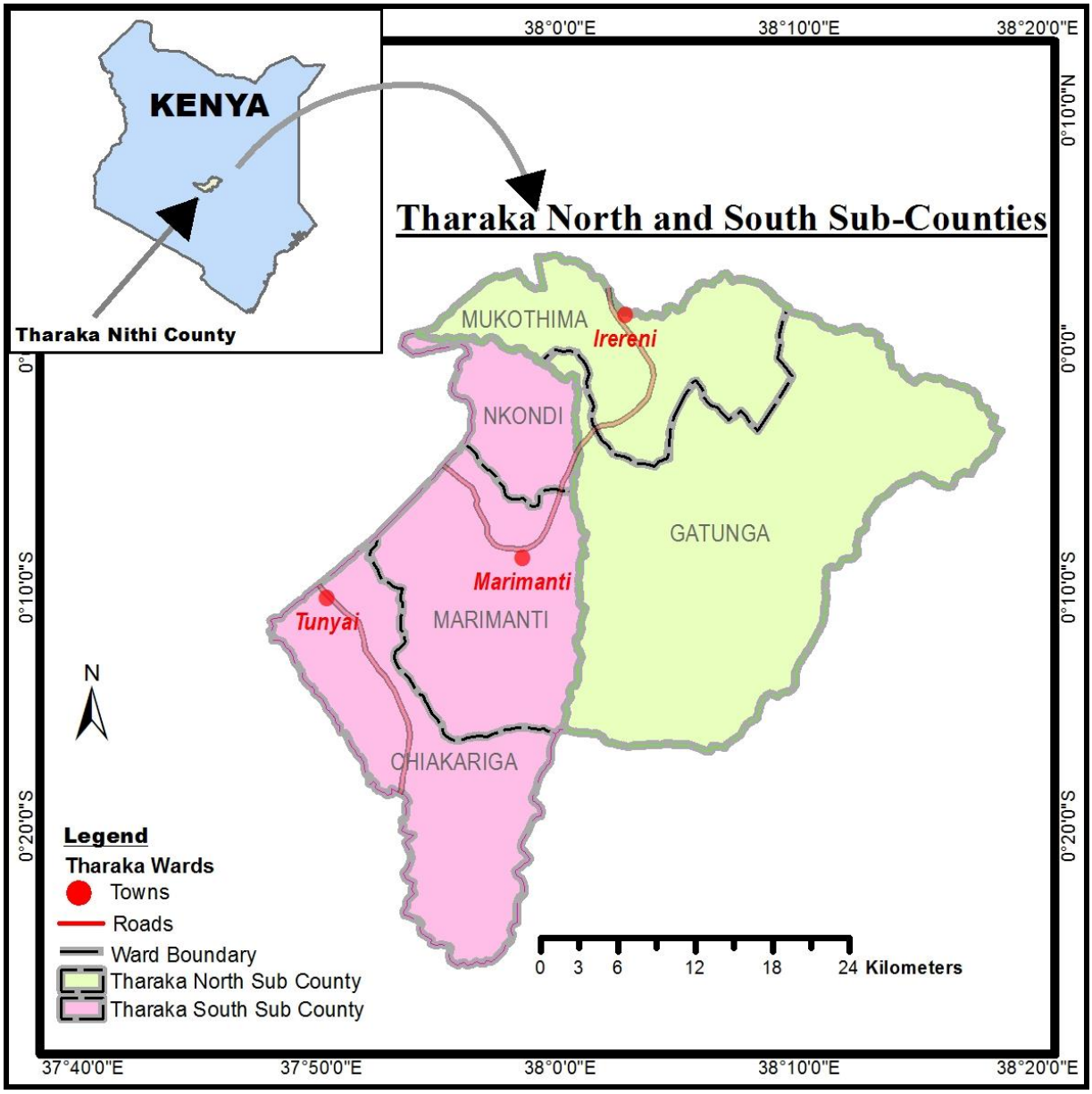

Figure 3.1: Map of Tharaka North and Tharaka South Sub-Counties, Kenya

Source: Regional Center for Mapping of Resource for Development [RCMRD] (2016)

3.2 Research design

3.2.1 Sampling procedure

Lists of all farmer groups registered with the Ministry of Gender, Children and Social Development (MGCSD) in Tharaka North and Tharaka South Sub-Counties was obtained for Tharaka South Sub-county office. The lists contained 273 smallholder grain farmers groups operating in Tharaka North and Tharaka South Sub-Counties five County Assembly Wards namely: Marimanti, Gatunga, Mukothima, Nkondi and Chiakariga.

Simple random sampling using a table of random numbers was used to select a sample from a population of 273 smallholder grain farmers groups in Tharaka North and Tharaka South Sub-Counties, Kenya.

3.2.2 Determination of sample size

The employed sample size for the identified target population was scientifically computed using a formula developed by Taro Yamene in 1973 and adopted by (Israel, 1992; Polonia, 2013). This formula is used when the sampling design is a simple random sample without replacement. According to the MGCSD Tharaka South Sub-County, 2015, the area had a population 273 registered smallholder grain farmer marketing groups that have been in existence for at least four years.

A total population of 273 farmer groups and a 95% confidence interval were used to compute the sample size. The sample size computation took two steps as shown in *Equation 3.1* and *Equation 3.2.*

$$n_0 = \frac{N}{1 + N(e)^2} \quad \text{.....} \quad \textbf{\textit{Equation 3.1}}$$

Where: n_0 was the initial sample size; N was the population size; e was the acceptable error (0.05). Therefore:

$$\boldsymbol{n_0} = \frac{273}{1 + 273(0.05)^2} = 162.26 \cong 163 \text{ Farmer groups}$$

A given sample size provides proportionately more information for a small sample than for a large sample (Israel, 1992; Polonia, 2013). Therefore, the sample size (n_0) was adjusted with the finite population correction factor as shown in *Equation 3.3.2.*

$$\boldsymbol{n = \frac{n_0}{1+\frac{(n_0-1)}{N}}}$$ ……..…… ……. ***Equation 3.2***

Where: *n* was the adjusted sample size; *N* was the population size.

$$\boldsymbol{n} = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} = \frac{163}{1 + \frac{(163 - 1)}{273}} = 102.30 \cong \textbf{103 Farmer groups}$$

Therefore, the adjusted sample size was 103 farmer groups.

3.3 Methods of data collection

The target for 103 farmer groups was not met since empirical data was drawn from a sample of 100 smallholder grain farmers groups in Tharaka North and Tharaka South Sub-Counties. These were the groups that were still in operation, had sold grains collectively at least once between 2013 and 2016 and gave complete information. This is because, first despite the existence of 273 farmer groups in the records provided by the Ministry of Gender, Children and Social Development (MGCSD) in Tharaka Tharaka South Sub-County, majority of these groups did not exist on the ground and others were dormant. This made it even harder to get the sampled 100 groups. As a result, only the 100 groups which met the criteria of interest and had complete information were sampled and considered for analysis. General observation during the survey indicated that majority of the dormant farmer groups only existed for a short period mainly to enjoy some project benefits and faced off thereafter. Some of these groups still revived when a new project in need of farmer groups was introduced. Dormancy of some groups could also be because some of them formed under herd behavior where farmers just want to belong in a group because their peers were in one too.

A leader or a contact person for each group was contacted prior to visiting their respective groups to confirm their group's willingness to participate in the study. Face to face interviews were used to collect quantitative and qualitative data from each farmer group. Respondents' feedback was recorded in a structured questionnaire partially adopted from World Bank's Social Capital Assessment Tool (SOCAT) at organization levels (World Bank, 2011). A pilot survey was conducted to test the robustness of the questionnaire to yield the expected information before the final questionnaire was developed and used. This addressed any issues on time taken to collect data from a group, accuracy, misinterpretations and ambiguity.

During the actual survey, the respondents representing each group included both leaders and members, with each group having between five (5) and twelve (12) participants. This helped reveal the consensus views of group members. Data relied on recall and reference was made to actual records kept by the groups for year 2013 to 2016. Data available in the groups' records included quantities and prices of grains sold, group finances like loans and table banking, membership and nature of trainings received. For likert scale questions that required the consensus view of the group members, colored cards were given to each representative to write their views; the most popular view (mode) was recorded as the consensus view of the group members. This provided group profile information to delineate a group's internal characteristics, networks and relationships between the group and other institutions operating in Tharaka North and Tharaka South Sub-Counties. Specifically, the profile assessed the group's origin and development, quality of membership, institutional capacity (leadership, participation, group culture, marketing of grains logistics), social capital and institutional linkages.

Interview for each farmer group was guided by a moderator and one observer who worked collaboratively. The moderator's main role was to facilitate the interview by asking the questions, probing key issues and systematically focusing the interview to the main issues of interest. The observer's main role was to record data into the questionnaire.

3.4 Methods of data management and analysis

The collected data was cleaned, sorted, coded and entered into a template designed using Statistical Package for the Social Sciences (SPSS). Stata12, SPSS and Microsoft Office Excel software were used to do statistical and mathematical analysis of the data using both descriptive and empirical statistics. To cluster and characterize the farmer groups cluster analysis, principal component analysis (PCA) and descriptive statistics were used. To carry out Social Network Analysis (SNA) for grain farmer groups' and linkages with different actors in the value chain, UCINet software was used. Principal component analysis (PCA) was used to measure the levels of social capital by generating separate indices for bonding and bridging social capital. To understand the factors influencing farmer group marketing performance and effects of social capital on performance, data was analyzed using a Random effects model - cross-sectional time-series feasible generalized least square regression (REM-FGLS) and informed by literature. The data, measures applied, and descriptive statistics are further specified under each analyzed objective. The results were presented in paper format; where each objective was presented using a section specific introduction, literature review, methodology, results, discussion and references as shown from chapter four to chapter seven of this document.

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CHAPTER FOUR

CHARACTERIZATION OF SMALLHOLDER GRAIN FARMER GROUPS

4.1 Introduction

Collective marketing through farmers' groups has increasingly become an important avenue for improving smallholder farmers' access to better paying markets. However, these groups tend to vary in performance, as well as in internal structure and conduct. Ochieng (2014) argues that identifying the distinguishing characteristics across farmer groups can help in explaining their diversity and differential levels of performance. This has attracted different approaches of groupings and characterization of farmer groups in literature.

Organizing observations into sensible groupings is among the fundamental approaches of understanding and learning (Jain, 2010). Cluster analysis is one of the formal study approaches that can be used to group objects based on some intrisic, observed or measured characteristics or similarity (Jain, 2010; Goswami *et al.*, 2014). This helps to explore and structure data into some meaningful groupings. Goswami *et al.* (2014) argue that multivariate statistical techniques like Principal Component Analysis (PCA) and cluster analysis can conveniently be adopted for clustering.

Cluster analysis has been widely adopted to characterize different study units. Cluster analysis is a multivariate data analysis approach for dimension reduction, summarizing large data sets and organizing observed data into fewer meaningful structures (Goswami *et al.*, 2014). It is concerned with similarity (homogeneity) of subjects placed in a given group (cluster) and their difference (heterogeneity) to profiles of subjects placed in other groups (Rosie, 2007). Cluster analysis approach is adopted when there is no a priori hypothesis of knowing which clusters different subjects in a dataset fall into (Jarmer, 2010). Goswami *et al.* (2014) argues that it is assumed that subjects fall into distinct groups but there is no prior judgment to partition the subjects into specific clusters hence the need to apply cluster analysis. Rosie (2007) adds that the grouping assumption is based on commonalities between the different sets of selected independent variables. However, the key concern is how to best select the variables to be used in clustering and the number of groupings to be generated.

4.2 Literature review

This section provides a review of cluster analysis approaches that have been adopted in literature and the application of each particular approach. Additionally, empirical evidence on

approaches used in characterization of farmers and farmer groups has also been reviewed. The review informs characterization and grouping approaches selected for this study.

4.2.1 Clustering approaches

Cluster analysis is a widely adopted approach in characterization of entities (Petrovici and Gorton, 2005; Tuma *et al.,* 2009; Ochieng, 2014). The clusters are based on the conceptual consideration of relevant variables to be selected. Therefore the clusters are highly dependent on the included variables (Rosie, 2007).

There exist a number of approaches to cluster analysis. It can be hierarchical or partition (non-hierarchical) clustering. Hierarchical clustering is deterministic and represents all pairwise distances. It assigns each observation to a cluster and then it repeatedly joins the nearest clusters by re-estimating the distance between them for 1 to n to finally generate one large cluster and a hierarchical tree (dendrogram) (Schonlau, 2004). On the other hand, non-hierarchical clustering forms a grouping of a set of observations, into a pre-determined number of clusters, using an iterative algorithm that optimally fits each observation into a given cluster (Jain, 2010). Schonlau (2004) added that in hierarchical clustering a graph like dendrogram is used to visualize how the clusters are formed while in non-hierarchical clustering, like K-means algorithm, dendrogram graphs are not present. Therefore, non-hierarchical clustering is suitable for few observations since each observation has to be displayed as a leaf in the dendrogram graph whereas for large observations, hierarchical clustering is more suitable due to its simplicity and fast execution (Davidson, 2002; Schonlau, 2004).

K-means approach is a popular non-hierarchical method that randomly assigns each observation into a class 1 to K where K is the maximum iteration (Davidson, 2002). Further the centroid is calculated which is one of the K 'means'. The distance from the centroid to each of the observations is then calculated. Then each item is assigned to the nearest centroid and then a new group mean is generated based on categorization (Rosie, 2007). In K-means algorithm, the data analyst has to specify the number of clusters to be generated during the analysis say; K-mean clustering, K=3 to show each observation will be assigned to any set of the three (3) categories (Schonlau, 2004). Schonlau (2004) adds that the number of clusters to be specified depends on the analyst's expertise on the subject matter and the visual insight gained from the cluster tree.

Cluster analysis uses Euclidean distance as the most common measure of distance between observations and it is suitable if all the selected clustering variables are of the same type (Rosie, 2007). Where data is mixed, such that it includes continuous, binary and categorical measurement, gower distance is used to capture the associated mixed (Green *et al.,* 2011).

Principal Component Analysis (PCA) is another approach used to reduce the dimension. However, PCA is used to put together similar variables, instead of the study subjects, into homogeneous components which are heterogeneous to each other (Wu, 2012). Therefore, for this study, PCA clustering approach would not have been appropriate to generate the intended meaning of putting farmer groups into few categories capturing all the variables in each category.

4.2.2 Empirical evidence on characterization approaches

In a study of smallholder farmer groups in central Africa, Ochieng (2014) used cluster anaysis to sort the groups according to their marketing performance. In addition, Ochieng (2014) used t-test and chi-square test to compare specific attributes of high and low performing groups. Ouma *et al.* (2013) also used cluster analysis to identify and characterize typologies for smallholder pig farmers in Uganda. Three clusters of smallholder pig farmers were generated based on their social economic, institutional and value chain domains.

Goswami *et al.* (2014) appled both principal component analysis (PCA) and cluster analysis to identify and group farm household typologies based on their levels of income and diversity of the sources of income. Goswami *et al.* (2014) used 17 variables to generate five principle components identified using PCA and further incorporated the five clusters from PCA results into their cluster analysis to come up with four clusters that optimally represented the farming households. Karacaören and Kadarmideen (2008) also combined both PCA and cluster analysis approach.

To ground PCA and cluster analysis approaches, general descriptive statistics incorporating measures of central tendencies (mean, median and mode) and analysis of variance (ANOVA) tests have also been widely adopted in social sciences to characterise study units (Karacaören and Kadarmideen, 2008; Ouma *et al.,* 2013; Goswami *et al.,* 2014; Ochieng, 2014). However, descriptive statistics cannot be used independently unless there is a priori knowledge of which specific cluster a study unit should fall into. Given that there was no a priori way of placing different farmer groups into clusters, it was therefore essential to use cluster analysis.

4.3 Methodology

4.3.1 Clustering farmer groups

Choice of clustering approach

Cluster analysis was adopted to group and characterize farmer groups into homogeneous groups. This helped in identifying different farmer group categories, characterized by maximal within-cluster homogeneity and between cluster-heterogeneity (Rosie, 2007). This is an approach for segmenting different types of players in a market that was advocated by (Tuma *et al.,* 2009), and has been adopted by Petrovici and Gorton (2005) and Ochieng (2014).

Lloyd's algorithm K-means cluster analysis was selected because it allows larger data sets and it shows relations between all variables selected in partitioning the observations into set number of clusters (Goswami *et al.,* 2014). The K-median cluster analysis which uses medians, instead of means, to generate the group centers at each step was also used. However, the generated groups were much skewed hence the results of the K-means were retained.

Specification of the clustering equation

The main objective of clustering is typically expressed as an objective function to increase the proximity of points to the nearest cluster centroid. This is done by reducing the squared distance of each point to the centroid. As a result, the objective function and the proximity (distance) measure have to be specified. In this case, K-means measure of distance was used. In K-means the sum of squared error (SSE) is used in the objective function to show the most optimal clusters shown by the cluster with the smallest SSE. The K-means uses a non-linear transformation (a mapping) to move to higher dimensional space as shown in *Equation 4.1* (Ding and He 2004).

$$x_i \rightarrow \phi(x_i) \quad \textbf{\textit{Equation 4.1}}$$

Where: x_i *is* observed variables data matrix for subject *i* and ϕ is a constant.

The clustering objective function is as shown in *Equation 4.2* adopted from (Ding and He 2004).

Minimization of K-means cluster objective function

$$\min J_K(\phi) = \sum_i \|\phi(X_i)\|^2 - \sum_k \frac{1}{n_k} \sum_{i,j \in C_k} \phi(X_i)^T \phi(X_j), \quad \textbf{Equation 4.2}$$

Where: $\phi(.)$ is the first term which is a constant for a given mapping function and it can be ignored, $(x_1, \cdots, x_n) = X$ is the observed variables data matrix, C_k centroid of cluster, n_k is the number of points in C_k and T is the desired transformation.

The sampled 100 farmer groups were put into three (3) different categories using clusters analysis by K-means. Both quantitative (continuous) and qualitative (categorical) variables were used as the clustering variables to generate homogeneous groups in terms of performance. Gower measure of distance in cluster analysis was incorporated to distinctly capture associated mixed effects of quantitative and qualitative variables used to cluster. These quantitative variables were: group per capita value of grains sold 2013-2016, group age, membership fee amount, periodic contributions amount, table banking amounts, number of other group enterprises other than grain marketing, leadership training score, amount of loans received, number of contract for grains sales, record keeping index, internal practices index, level of bonding social capital, and level of bridging capital. The qualitative variables used were: group location by ward, specific CBO a groups belongs to, main benefit received by members, group access to a store, and a group's main grains market.

Cluster output differences were further explored using analysis of variance (ANOVA) and Chi square for statistically significant difference and association tests respectively. This enabled identification of group characteristics that reliably distinguish the clusters and those that were similar across the clusters. Cluster means, standard deviations and percentages were also computed.

Structure and conduct characteristics of farmer groups were used to describe the distinct attributes of groups in the three clusters. This also aided in understanding what could be the major drivers of performance of the relatively homogeneous groups in terms of performance.

4.3.2 Generating scores and indices

To generate scores and indices, each farmer group was asked whether it accessed seed, pesticides and fertilizer for each of the year running from 2013 to 2016. The responses were captured as binary variables, which takes 1 for "accessed" and 0 for "did not access". The

binary variables were then analyzed using Principal Component Analysis (PCA) to generate a single weighted score for each group. The three comprised the major purchased input in production of grains in study area.

Viloria (2010) argues that to achieve control of an enterprise's processes of any enterprise, keeping financial and physical records is essential. Systematic record keeping is an important aspect of group management as it creates transparency, tracks a group's progress including: members' details, activities, revenues and costs, and assets owned (Catholic Relief Services [CRS], 2007). Record keeping practices in the farmer groups, also measured using binary responses (1 if kept or 0 if did not keep a particular record), were also analyzed using PCA to generate a single weighted score for each group. Specific records incorporated in the score were: minutes; members register; list of assets; training records; invoices; delivery notes and receipt books; members' contribution records; financial statements (income and expenditure) and group activity records. These records captured those directly related to grains marketing and other necessary operational records for a group.

A likert scale with five pre-coded items (1 if strongly disagree; 2 if disagree; 3 if neutral; 4 if agree; 5 if strongly agree), for ranking 8 statements on participation, organization culture and organizational capacity, was used to generate the score for internal practices in each farmer group. Participation statements gauged the members' participation in internal and external meetings and in decision making. Organization culture statements were used to indicate if activities in the group were done as per a group's rules, if there were theft cases in the group and if the group had conflict resolution mechanisms. Organizational capacity was indicated by the ability to learn from past mistakes and make clear plans for the future. These statements are as shown below.

a. Participation

- Members attend internal group meetings?
- Members attend external meetings with other organizations?
- Both members and leaders participate in decision making?

b. Organizational culture

- Procedures are carried out as stated in the rules of the group?
- There are is theft of group property or supplies?
- There are conflict resolution mechanisms within the group?

c. Organizational capacity

- The group reflects on and learns from previous experiences?
- The group develops specific plans for the future (instead of reacting to opportunities as they present themselves)?

Principal Component Analysis (PCA) was used to analyze the scores from each statement and generate a single score for internal practices for each group. Principal Component Analysis (PCA) multivariate statistical techniques were used to reduce the number of variables in the data sets to a lower dimension to reveal simplified structures that underlie them. That is, PCA created uncorrelated indices or components from an initial set of *n* correlated variables. Each index score was a linear weighted combination of the initial variables (Wu, 2012). This is demonstrated in a model using a set of variables X_1 to X_n in *Equation 4.3.*

Model specification:

$$\begin{array}{ccccccccc} \boldsymbol{PC_1} & = & \boldsymbol{b_{11} * X_1} & + & \boldsymbol{b_{12} * X_2} & + & \ldots & + & \boldsymbol{b_{1n} * X_n} \\ \vdots & & \vdots & & \vdots & & \ldots & & \vdots \\ \boldsymbol{PC_m} & = & \boldsymbol{b_{m1} * X_1} & + & \boldsymbol{b_{m2} * X_2} & + & \ldots & + & \boldsymbol{b_{mn} * X_n} \end{array} \quad \ldots\ldots\ldots\ldots\ldots\ldots \textbf{\textit{Equation 4.3}}$$

Where: b_{mn} represents the weight (coefficients for the PCA rotated components) for the m^{th} component and the n^{th} variable.

Statistical Package of Social Analysis (SPSS) software was first used to measure sample adequacy was measured using Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sampling Adequacy. The KMO value should be greater than 0.5 for a satisfactory factor analysis to proceed, while a significant Bartlett's Test value indicates that there some relationships between the variables included in the analysis (Field, 2005; Yong and Pearce, 2013). Additionally, communalities after extraction should probably be above 0.5 (Field, 2005; Yong and Pearce, 2013). Field (2005) added that, the average communality should be above 0.6 for sample size greater than 250, in this case the sample size was 400 observations. Table 4.1 indicates that the sample was adequate to run a PCA multivariate statistical analysis shown a KMO value of 0.662 while the Bartlett's Test of Sphericity was also significant with a p-value = 0.000.

Table 4.1: KMO and Bartlett's Test of sample adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy:		0.662
	Approx. Chi-Square:	428.543
Bartlett's Test of Sphericity	Degrees of Freedom:	28
	Significance:	0.000

The average communality (6.365/8=0.796) is greater than 0.6 (Table 4.2). For example, over 65% of the variance in *members attend group internal meetings* is explained while over 90% of the variance in *there are conflict resolution mechanisms* is explained. This further show that all the variables were robust enough to be included in the analysis therefore PCA was suitable for further analysis.

Table 4.2: Communalities extraction values of the eight internal practices indicators

	Initial	Extraction
Members attend group internal meetings	1.000	0.652
Members attend external meetings	1.000	0.878
Members participate in decision making	1.000	0.764
Group procedures follow set rules	1.000	0.710
There is theft of group property	1.000	0.892
There are conflict resolution mechanisms	1.000	0.903
Group learning from past experiences	1.000	0.790
Group plans for the future	1.000	0.776

Extraction Method: Principal Component Analysis.

The PCA matrix was then rotated using orthogonal varimax (Kaiser off) technique to standardize the coefficients, and components with eigenvalues of greater than one were selected as they accounted for the most variance (Goswami *et al.*, 2014). The scores for the index were then predicted based on rotated factors. The conbach's alpha (α) was computed to check whether the selected observations were related to one latent factor using the 'scale reliability coefficient' which should preferably be above 0.5 in order to accept (Nelson, 2007; Wu, 2012). In this case, the scale was 0.5389 (Table 4.3) hence the internal practices variables were considered good and hence adopted. The reliability of the coefficients is further supported by the weak correlation (below 0.5) with each other as shown in Table 4.4.

Table 4.3: Internal practices indicators conbach's alpha (α) for scale reliability

Test scale = mean (unstandardized items)	
Average inter-item covariance:	0.0961
Number of items in the scale:	8
Scale reliability coefficient:	0.5389

Table 4.4: Pairwise correlation of variables used to measure the internal practices of groups

	Attend internal meetings	Attend external meetings	Decision making participation	Procedures as per rules	Theft of group property	Conflict resolution	Learning from experience	Plan for the future
Attend internal meetings	1							
Attend external meetings	0.2389	1						
Decision making participation	0.2285	0.1591	1					
Procedures as per rules	0.3136	0.2299	0.4427	1				
Theft of group property	-0.0326	-0.0061	-0.1298	0.0081	1			
Conflict resolution	-0.1582	-0.0255	-0.0615	-0.0629	0.1993	1		
Learning from experience	0.1019	0.2251	0.1196	0.1424	0.1805	0.1643	1	
Plan for the future	0.1633	0.2222	0.1943	0.2734	0.1898	0.0822	0.4482	1

4.3.3 Description of variables

Table 4.5: Description of variables, their measurement and expected signs

Variable	Description	Measurement and codes	Expected sign
	Dependent variable (Time varying): 2013 -2016		
PCVCS	Per capita value of grains sold (monetary) $=\left[\frac{Total\ value\ of\ cereals\ sold\ in\ year\ t}{Number\ of\ group\ members\ in\ year\ t}\right]$	Kenya shillings (KES)	
	Time invariant (stock) variables		
FORMODE	*Formation mode.* Mode of group formation	1 = Common need 2 = Government 3 = NGO initiative	+ -
CMKT_FORM	*Main reason of formation.* It was grains marketing or other reasons	1 = Grains marketing 0 = Otherwise	+
CMKT_BNFT	*Main benefit to members.* Whether main benefit was grains marketing or other benefits	1 = Grains marketing 0 = Otherwise	+
CBO_AFFIL	*Group CBO affiliation* The CBO a farmer group has affiliated itself with	1=None 2=Tharaka Cereals A. 3=Marimanti Cereals 4=GAKIUMA Cereals 5=Kianda Cereals	
MONT_CONT	*Monthly monetary contribution amount.* The total amount of money each group member contributes monthly	KES	+ -
TB_BANK_AMT	*Table banking monetary amount.* The total amount of money each group has in circulation in its table banking	KES	+ -
LEAD_MF_RAT	*Leaders' male female ratio.* Ratio of the number of males to female members in leadership	Number males/ Number females	+ -
DEM_GOV	*Democratic governance.* Group has a written code of conduct or constitution which is understood	1 = Yes 0 = No	+

Variable	Description	Measurement and codes	Expected sign
	and adhered to		
WARD	*Ward located.* The administrative ward a farmer groups is located	Dummy	+ -
REC_KEEP	*Record keeping.* (Yes/No) Keeping records for minutes, group members, transactions, finances, contributions, participation in activities and trainings	Index	+ -
INT_PRAC	*Internal practices.* (Likert scale) 1) Attending internal meetings 2) Attending external meetings 3) Participation in decision making 4) Theft in the group 5) Conflict resolution mechanisms 6) Learn from past experiences 7) Make future plans *Likert items used:* 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree.	Index	+ -
TRN_LEAD	*Trained leaders.* Number of top leaders with leadership training (chairperson, vice chairperson, secretary, vice secretary and treasurer).	Score	-
TRN_MKT	*Trained in Marketing.* Some farmer group members had received training in marketing, post-harvest handling, value addition, tendering and procurement	Score	+
MKT_COMT	*Marketing committee.* Group has a marketing committee	1 = Yes 0 = No	+
TIME_PROC	*Timeliness of proceeds.* Timeliness of proceeds from group grains sales	1 = Mostly received immediately 0 = Mostly delayed	-
STORE_ACC	*Group store.* Access to a common group store	1 = Yes 0 = No	+
OTHER_ENT	*Other group enterprises*. Number of other commercial group	Number	+ -

Variable	Description	Measurement and codes	Expected sign
	enterprises		
BOND_CAPIT	*Bonding social capital.* (Likert scale) Level of social capital (Trust, common ties and group vision) *Likert items used:* 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree.	Index	+
BRIDG_CAPIT	*Bridging social capital.* Direct, indirect or no linkage to NGOs, Projects, Government departments and farmer CBOs	Index	+
	Time variant (flow) variables: 2013 -2016		
GRP_AGE	*Group age.* Number of the years the group has existed since registration	Number of years	-
MEMB_MF_RAT	*Members' male female ratio.* Ratio of the number of males to female members of a group	Number males/ Number females	+ -
CREDIT_ACC	*Credit access*. Monetary amount of external credit accessed by the group	KES	+
SEED_ACC	*Seed facilitation.* Group facilitated access to seeds	1 = Yes 0 = No	+
PEST_ACC	*Pesticide facilitation.* Group facilitated access to pesticides	1 = Yes 0 = No	+
FERT_ACC	*Fertilizer facilitation.* Group facilitated access to fertilizer	1 = Yes 0 = No	+
MKT_OUT	*Main market outlet.* Main market outlet the group sold to in each year like institutional buyers (farmer CBOs, schools and companies); or middlemen and local market	1 = Institutional buyers 0 = Other buyers	+

4.4 Results and discussion

4.4.1 Clustering of farmer groups

Cluster analysis placed the farmer groups into three (3) categories mainly distinguished by marketing performance which was measured by the average per capita value of grains (PCVCS) over a period of 4 years (2013-2016). The first, here in, referred to as the *high performing* had 31 groups. The second, the *average performing* had 55 groups, and the lastly, the *low performing* had 14 groups as shown in Table 4.6 and in annex Table 0.1. The naming of the clusters was based on the PCVCS which was one among the many variables used in clustering the groups. The choice of the cluster naming criteria was based the easily observable significant difference in the PCVCS (the proxy for performance) across the clusters. The cluster with the highest mean was referred to as the high performing, followed by the average performing and then the low performing groups.

Table 4.6: Clustering of farmer groups

Groups	Frequency	Percent	Cumulative
High performing	14	14	14
Average performing	55	55	69
Low performing	31	31	100
Total	100	100	

The cluster differences in the mean PCVCS are as shown in Table 4.7. There was a relatively wide difference in farmer group cluster performance where high performing groups had an average PCVCS of KES 22,441 compared to average and low groups which had KES 1,523 and KES 52, respectively.

Table 4.7: Farmer groups Per Capita Value of Grains Sold (PCVCS) from 2013 to 2016

		Farmer group clusters		
	OVERALL	High	Average	Low
Variable	N=100	N=31	N=55	N=14
PCVCS_2013	7,046.13	21,005.84	958.20	52.23
	(18,850.68)	(29,567.24)	(1,866.10)	(179.87)
PCVCS_2014	4,383.11	12,115.97	1,133.21	27.84
	(10,860.65)	(17,042.66)	(2,209.10)	(103.01)
PCVCS_2015	9,537.18	28,181.36	1,441.15	59.50
	(31,713.51)	(52,789.48)	(2,466.94)	(79.04)
PCVCS_2016	10,239.13	28,461.45	2,557.68	66.82
	(30,137.14)	(49,818.70)	(2,955.31)	(128.37)
PCVCS Average 2013-2016	7,801.39	22,441.16	1,522.56	51.60
	(19,811.02)	(31,173.36)	(949.00)	(48.35)

Note: In parenthesis is the standard deviation

4.4.2 Characterization of grain farmer groups by structure and conduct

1. Characterization by farmer groups' structure

Table 4.8 shows that the administrative location of a farmer-group had no significance (χ^2=8.17, p=0.42) relationship with its performance. However, it was noted that majority of the farmer-groups were located in Mukothima ward, which was the largest ward and home to Tharaka Cereals Growers Association (TCGA) which is the largest CBO.

Table 4.8: Distribution of farmer groups by selected qualitative structure attributes

	Farmer group clusters				Pearsons Chi square	
Variable	High N=31	Average N=55	Low N=14	Percent	Chi-value	P-value
Model						
Group's administrative location -ward					8.17	0.42
Mukothima	20	34	12	66		
Gatunga	6	8	1	15		
Marimanti	2	4	1	7		
Chiakariga	1	8	0	9		
Gatue	2	1	0	3		
Group's CBO affiliation					31.23***	0.00
None	1	14	9	24		
Tharaka Cereals Growers A.	27	25	3	55		
Marimanti Cereals Growers	2	4	1	7		
GAKIUMA Cereals Growers	1	8	0	9		
Kianda Cereals Growers	0	4	1	5		
Group's formation mode					3.56	0.47
Government	1	1	0	2		
NGO	1	6	0	7		
Founders initiative	29	48	14	91		
Group's top 3 reason for formation					23.69	0.48
Access credit – Table	9	18	8	35		
Welfare services	3	7	3	13		
Collective grain marketing	5	5	1	11		
Group's top 3 main benefits					24.21	0.15
Access credit – Table	11	19	7	37		
Agric. skills & capacity	9	8	1	18		
Collective grain marketing	5	10	1	16		
Having a group constitution					1.67	0.43
No	0	2	0	2		
Yes	31	53	14	98		
Having a grain marketing committee					0.70	0.71
No	14	29	8	51		
Yes	17	26	6	49		
Timeliness of sales proceeds					2.19	0.34
Mostly immediately	19	42	10	71		
Mostly delayed	12	13	4	29		

Note: *** represents significance level at 1%.

There was significant (χ^2=31.23, p=0.00) relationship between performance and the grains marketing Community Based Organizations (CBOs) that a farmer-group belonged to. Majority of high performing groups (87%) were affiliated to TCGA. On the other hand, majority of low performing groups (64%) were not affiliated any CBO. These results were in line with consensus view of most of the groups that TCGA was the most influential and proactive CBO in securing better prices for its members. Pairwise correlation test results indicated a strong correlation (0.61) between administrative location (ward) of a group and CBO affiliation of the group. This suggests that the ward a group comes from could have significant influence on the CBO a farmer group decided to join. This could be attributed to factors like distance to the CBO's store location.

Majority of the farmer groups, 91%, were formed under founder members initiative while NGO and government initiatives accounted for 9%. However, a group's formation mode had no significant (χ^2=3.56, p=0.47) association with performance clusters. This shows that founder members of farmer groups in Tharaka North and Tharaka South Sub-Counties had their own diverse motives of forming groups. This could include forming a group to solve a common problem or just mere herd behavior.

The top three reasons for formation of the groups were table banking (35%), welfare services (13%) and collective grains marketing (11%). The main reason for formation of different farmer groups had no significant (χ^2=23.69, p=0.48) association with performance clusters. This can also be shown in Figure 4.1 by the top three benefits enjoyed by members in majority of the groups; table banking (37%), agricultural skills (18%) and capacity building and collective grains marketing (16%). The main benefit of the farmer groups had no significant (χ^2=24.21, p=0.15) association with performance clusters. Ayieko, Bett, and Kabuage (2014) had similar findings where access to credit from groups was the main economic activity in majority of chicken farmer groups in Makueni, Kenya. This could be because one of smallholder farmers' main challenge is accessing low interest credit, at favourable terms of payment; a gap farmer groups try to bridge. The findings concur with those of Fischer and Qaim (2012; 2014) who argue that farmer groups' activities are highly diversified and the groups serve a bigger purpose that goes beyond collective marketing.

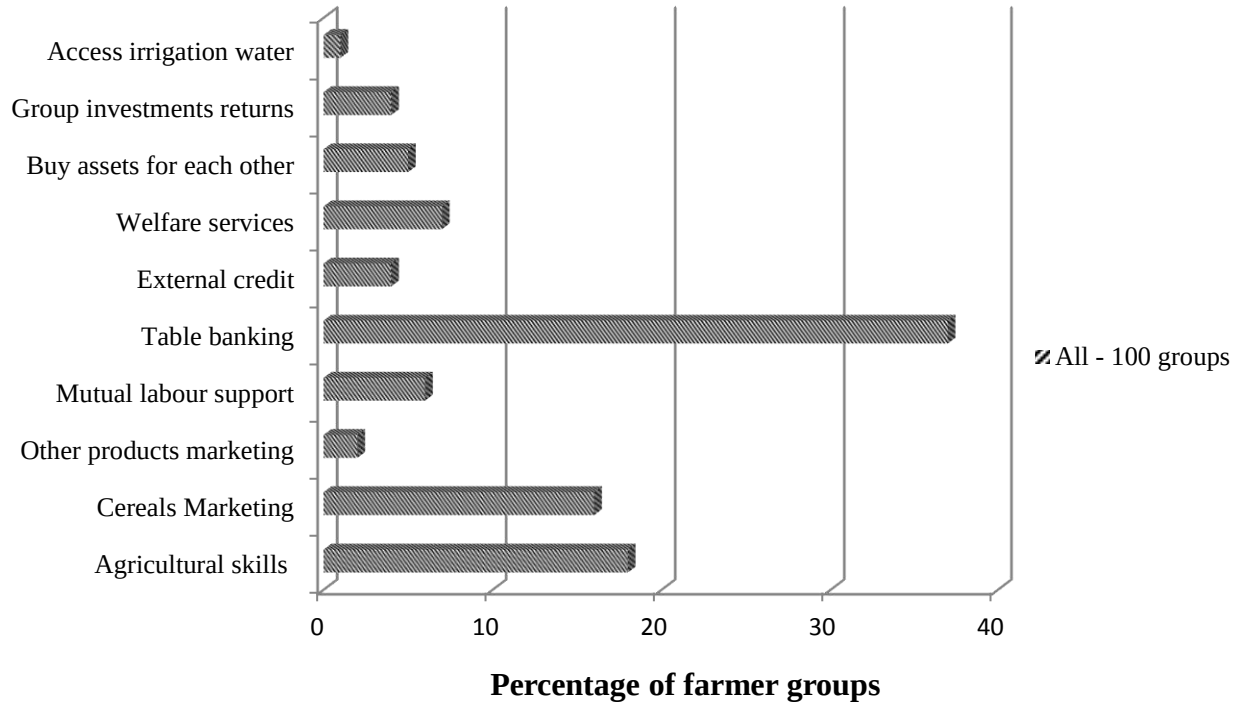

Figure 4.1: **Main farmer group benefits**

Overall, 51% of the farmer groups did not have grain marketing committees. Additionally, existence of grain marketing committees in some groups had no significant (χ^2=0.70, p=0.71) association with cluster performance. This could be because most of the groups' marketing committees could have been dormant or just did little with regard to lobbying for more lucrative markets and mobilizing collective marketing of grains. Additionally, conflicts of interest among the committee members could also have contributed to the weak influence of having a committee on group performance.

Timeliness of payment of proceeds from sales had no significant (χ^2=2.19, p=0.34) association with cluster performance. Most farmer groups (71%) mostly experienced delays in payment of proceeds from grains sales. The delay in payments could be attributed to the different types of buyers a group sold to. Most groups pointed out that middlemen and local market buyers paid immediately in cash while institutional buyers like World Food Programme (WFP) and East Africa Breweries Limited (EABL) mostly delayed payments for weeks. However, the institutional buyers were more preferred as they paid a higher price and bought in bulk.

It was also noted that 98% of the farmer groups had a group constitution or by-laws to guide their activities. Having a group constitution had no significant (χ^2=1.67, p=0.43) association with cluster performance. This could be attributed to the existing requirement by the Ministry of Gender, Children and Social Development (MGCSD) that a constitution or list of by-laws was a prerequisite for a group to be registered under the ministry. Since, all the groups studied in this research were registered under the MGCSD; it was therefore a plausible explanation for the relatively high number of groups with a group constitution or written by-laws. Additionally, the groups could also have had additional unwritten rules developed overtime to complement their by-laws and govern the internal operations.

Table 4.9 presents a summary of selected quantitative farmer group structure attributes. Farmer group age was not significantly (F=0.19, p=0.83) different across the three clusters. Majority of the groups (76%) were less than 10 years old, while the overall mean age for all groups was 8.5 years. This could be because farmer group collective action in Tharaka North and Tharaka South Sub-Counties could have gained popularity in the last 10 years.

Table 4.9: Distribution of farmer groups by selected quantitative structure attributes

		Farmer group clusters				
	OVERALL	High	Average	Low	ANOVA	
Variable	**N=100**	**N=31**	**N=55**	**N=14**	**F-test**	**P-value**
Group Age	8.58	8.58	8.85	7.50	0.19	0.83
	(7.29)	(6.76)	(7.87)	(6.33)		
Membership fee	1,715.20	3,189.36	1,203.64	460.71	3.24**	0.04
amount (KES)	(4,093.64)	(6,606.69)	(2,112.33)	(610.23)		
Members male	1.02	1.07	0.73	2.07	1.20	0.31
to female ratio	(2.91)	(1.47)	(2.06)	(6.37)		
Leaders male to	0.83	1.15	0.69	0.66	1.73	0.18
female ratio	(1.18)	(1.20)	(1.11)	(1.32)		

Note: ** represents significance level at 5%; Figures before parenthesis are means;
In parenthesis is the standard deviation

Majority (93%) of the farmer groups charged a membership fee. A similar situation is also observed by Ayieko *et al.* (2014) among chicken farmer groups in Makueni, Kenya. The amount charged across groups in Tharaka North and Tharaka South Sub-Counties ranged from a minimum of KES 50 to a maximum of KES 30,000. The amount was also significantly (F=3.24, p=0.04) different across the groups at 5% significance level as shown

in Table 4.9. The mean membership fee for all the groups was KES 1,715. This was way lower than that for groups in cluster one which had a mean of KES 3,189. Cluster two and three followed with a mean of KES 1,204 and KES 461 respectively. Evidently high performing groups charged a relatively higher membership fee. The high and varying levels of membership fee could be because farmer groups used valuation of group investments as the basis for deciding the membership fee. This means that high performing groups had relatively higher investments in table banking and other group enterprises.

Gender heterogeneity was captured by the ratio of male to females in the groups. The overall male to female ratio was a mean of 1.02 with a standard deviation of 2.91. Though not significantly ($F=1.20$, $p=0.31$) different across the clusters, male to female members were relatively equal for high performing groups shown by an average ratio of 1.07. On the other hand, average and low performing groups had an average ratio of 0.73 and 2.07 respectively. This differs with Ayieko *et al.* (2014) who found out that chicken farmer groups in Makueni, Kenya had women as the majority members. This shows that both men and women were attracted to being members of collective grain marketing groups. This could be due to their business orientation unlike pure table banking or merry-go-round groups. Gender heterogeneity was further captured by the ratio of male to female leaders. Though not significantly ($F=1.73$, $p=0.18$) different across the clusters, male leaders were relatively more for high performing groups shown by an average ratio of 1.15. Average and low performing groups had an average ratio of less than 1, at 0.69 and 0.66 respectively. This indicated that majority of the leaders were women in average and low performing groups.

2. Characterization by farmer groups' conduct

Table 4.10 shows that the number of other group enterprises, apart from collective selling of grains, was an important distinguishing conduct characteristic across the farmer group clusters. On average, majority of the groups (43%) had one other enterprise. The most common enterprises were tree nurseries, poultry and goat keeping. The number of other enterprises was significantly ($F=5.76$, $p=0.00$) different across the groups at a 1% significance level. Majority of high performing groups had one to four other enterprises and only 2 groups had no other enterprise. Average groups had between zero and two other enterprises while most of the low performing groups had none or one other enterprise. The number of enterprises was mainly influenced by the main reason for a group's formation, capital base and need to diversify or specialize.

Table 4.10: Distribution of farmer groups by selected quantitative conduct attributes

		Farmer group clusters				
	OVERALL	**High**	**Average**	**Low**	**ANOVA**	
Variable	N=100	**N=31**	**N=55**	**N=14**	**F-test**	**P-value**
Number of other enterprises	1.05 (0.88)	1.45 (0.85)	0.93 (0.88)	0.64 (0.63)	5.76***	0.00
Leaders training	9.59 (6.12)	12.84 (6.46)	7.84 (5.44)	9.29 (5.22)	7.53***	0.00
Marketing training	1.82 (1.39)	2.00 (1.24)	1.91 (1.51)	1.07 (1.00)	2.48*	0.09
Log table banking amount	68,999.40 (121,218.80)	86,285.48 (127,404.30)	64,850.91 (129,140.70)	47,020.71 (62,142.68)	0.85	0.43
Monthly contribution amount	362.70 (659.55)	295.81 (420.53)	438.73 (821.62)	212.14 (202.45)	0.89	0.42
Input access Index	0.74 (0.57)	0.84 (0.63)	0.70 (0.54)	0.65 (0.58)	0.76	0.47
Internal practices Index	6.52 (0.91)	6.35 (0.96)	6.64 (0.87)	6.43 (0.97)	1.05	0.35
Record keeping Index	-0.50 (0.22)	-0.53 (0.14)	-0.48 (0.27)	-0.55 (0.03)	0.86	0.42

Note: *, *** represents significance levels at 10% and 1% respectively; Figures before parenthesis are means; In parenthesis is the standard deviation

To enhance leaders' performance, training in relevant fields is essential (Ampaire *et al.*, 2013). Training of 5 key leaders namely: chairperson, vice chairperson, secretary, vice secretary and treasurer was considered. To estimate the level of leaders training in a group, important trainings that were considered in the scoring were: roles of a leader in a specific leadership position, group dynamics, finance management and record keeping. A score was generated with the maximum being 20 if a group had all its 5 key leaders trained in all the 4 selected training areas. The level of training was significantly (F=7.53, p=0.00) different at 1% significance level across the farmer groups. On average, all the groups' had a score of 9 out of 20, with a standard deviation of 6. High performing groups had the highest score at an average of 12, while low and average performers had a score of 9 and 7, respectively.

A group's training in marketing was also estimated. To estimate the level of a group's training in marketing, four important trainings were considered. These trainings were: value addition, post-harvest handling, grains procurement and tendering process. The maximum

score was 4 if a group had received all the 4 trainings. The level of training in marketing was significantly (F=2.48, p=0.09) different at 10% significance level across the farmer groups. On average all groups had received two trainings, high and average performing groups had two marketing trainings while low performers had one. The main trainers were NGOs and government institutions linked to the groups.

Table banking was a common practice in most of the farmer groups in Tharaka North and Tharaka South Sub-Counties. All the 87 groups that practiced table banking offered both saving and interest charged loans services to their members. The average interest rate was at a fixed 10% on borrowed money usually for a short period of time of about 1 to 3 months. The average table banking amount in circulation for all 100 groups studied was KES 68,999 and varied from a maximum of KES 800,000 to a minimum of KES 1,000. High performing groups had the highest average with KES 86,285 in circulation while average and low performers had a mean of KES 64,851 and KES 47,021 respectively. The amount was however not significantly (F=0.85, p=0.43) different across the clusters. The importance of table banking across the groups stems from their main reason for formation and the need for group members to access low interest credit with favorable terms of payment.

Majority of the farmer groups made periodic contributions mostly during their meeting days ranging from as low as KES 20 to as high as KES 4,800 per person per month. These contributions aided to add to the table banking kitty. The average monthly contribution amount for all the groups was KES 363. The amount was however not significantly (F=0.89, p=0.42) different across the clusters.

Farmer group collective access to high-value inputs namely seed, pesticides and fertilizer from 2013 to 2016 varied across the groups with seed being the most accessed input. Majority of the farmer groups (68%) accessed seed while pesticide and fertilizer access was quite low by only 4% and 7% respectively for the four year period. However, the access to the inputs was not significantly (F=0.76, p=0.47) different across the clusters.

Farmer group internal practices were measured based on: participation in meetings and decision making; organizational culture like following set rules; and organizational capacity in making future plans. The average score for all the groups was 6.52. However, the groups internal practices were not significantly (F=1.05, p=0.35) different across the clusters with

the high, average and low performing groups scoring an average of 6.35, 6.64 and 6.43, respectively.

Record keeping was a relatively common practice among all farmer groups in Tharaka North and Tharaka South Sub-Counties. Minutes and members contributions were the most kept records by the groups at 98% and 84% respectively, while activity records were the least kept by only 5% of the groups. Record keeping was however not significantly (F=0.86, p=0.42) different across the clusters.

Selection of leaders is a necessary activity that any democratic institution has to undertake (Ramdwar, Stoute and Ganpat, 2014). Table 4.11 shows that 84% of farmer groups in Tharaka North and Tharaka South Sub-Counties held elections at least once every three years while the rest appointed their leaders. There was a statistically significant (χ^2=16.51, p=0.09) relationship between groups' frequency leaders selection and performance across the clusters. About half of high performing groups selected their leaders every three to five years while low performers mostly did it every year to two years. It was also found out that the frequency of elections in the groups was as stated in their by-laws or constitution and at times when the groups needed to replace poorly performing leaders before the set election period.

Table 4.11: Distribution of farmer groups by selected qualitative conduct attributes

	Farmer group clusters					
	High	Average	Low		Pearsons Chi	
Variable	N=31	N=55	N=14	Percentage	Chi-value	P-value
Frequency of leaders elections					16.51*	0.09
Never selected leaders	1	3	0	4		
Every year	6	17	8	31		
Every 2 years	9	23	3	35		
Every 3 years	12	11	2	25		
Every 4 years	0	1	0	1		
Every 5 years	3	0	1	4		
Access external credit (2013-2016)					1.85	0.40
No	22	45	12	79		
Yes	9	10	2	21		
Keeping financial records					9.88***	0.01
No	14	40	5	59		
Yes	17	15	9	41		

Note: *, *** represents significance levels at 10% and 1% respectively.

Table 4.11 shows that access to external credit was not a common practice among farmer groups in Tharaka North and Tharaka South Sub-Counties. Only 21% of the groups accessed external credit from 2013 - 2016. The low access to external credit could be because table banking services were widely available in the groups. These could have reduced the need for a group to borrow from external lenders since members were able to mobilize funds internally to help finance group activities. On the other hand, low access to external credit by the groups could have been amplified by relatively stringent borrowing terms and conditions from formal lending institutions like banks and Savings and Credit Cooperatives (SACCOs). However, there was no significant (χ^2=1.85, p=0.40) relationship between groups' access to external credit and performance across the clusters.

Keeping financial records was an important practice for any collective business activity (Catholic Relief Services [CRS], 2007). Majority of the groups (59%) do not keep financial records. There was evident significant (χ^2=9.88, p=0.01) association between keeping financial records and cluster performance. The high, average and low performing groups had 55%, 27% and 64% of the groups respectively that kept financial records.

For smallholder grain farmers groups to bulk commercially profitable amounts of grains, access to a grains store is important (Common Agricultural Policy Regionalised Impact [CAPRi], 2007). Food and Agriculture Organization [FAO] (2014) found out that, community grains stores, commonly referred to as grain banks in Kenya, boosted collective grain marketing among smallholder grain farmers. This study measured access to a group grains store with whether a group had a common group store or not and the time taken to the store. Table 4.12 shows that, there was no significant (χ^2=0.53, p=0.77) relationship between groups' access (had a store) to grains store and performance across the clusters. Majority of the farmer groups (84%) had a common grains store either hired (permanent or temporary facility) or owned (permanent or temporary facility). Additionally, it took less than one hour to walk from a groups' meeting point to the store for majority of the farmer groups (76%) which had access to a grains store.

Terms of store use: whether on a temporarily lease, long-term lease, temporally owned or permanent owned store had a significant (χ^2=10.83, p=0.09) association with farmer groups' cluster performance, at 10% significance level. Majority of the farmer groups (30%) owned a permanent store. Most high performing groups had long term lease or owned a permanent

store, average groups owned a permanent or temporally store while low performers owned a permanent store or leased temporarily.

Table 4.12: Distribution of farmer groups by selected qualitative conduct attributes

	Farmer group clusters					
	High	Average	Low		Pearsons Chi square	
Variable	**N=31**	**N=55**	**N=14**	**Percentage**	**Chi value**	**P-value**
Access to a grains store					0.53	0.77
No	4	9	3	16		
Yes	27	46	11	84		
Terms of use of group store					10.83*	0.09
Leased temporarily	3	11	3	17		
Long term lease	12	10	0	22		
Own temporary	4	13	3	20		
Own permanent	8	12	5	25		
Contract sales (2013-2016)					11.33***	0.00
No	17	43	14	74		
Yes	14	12	0	26		
Group main grains market					48.38***	0.00
Local markets	1	6	10	17		
CBO	6	18	1	25		
Middlemen	14	24	3	41		
WFP	4	0	0	4		
Schools	0	1	0	1		
CGA/SAIOMA	2	2	0	4		
EABL	1	0	0	1		
Imara	3	4	0	7		
Main reason for market preference					46.87***	0.00
Easily met conditions	0	8	2	10		
Buys in bulk	5	5	1	11		
Highest price	14	17	0	31		
Nearest	1	6	6	13		
No other alternative	0	7	3	10		
Pays immediately in cash	9	8	0	17		
Others (Fixed price, standard weights)	2	4	2	8		

Note: *, *** represents significance levels at 10% and 1% respectively.

Majority of the farmer groups (74%) reported not having made any sales under contracts for the four year study period (Table 4.12). However, there was a significant (χ^2=11.33, p=0.00)

association between contract sales and cluster performance, at 1% significant level. The few that sold through contracts were more concentrated among the high performing groups with 54%. The average groups took the other 46% while low performing groups had no group that sold under contracts. Selling under contracts was highly dependent on the specific markets a group chose to sell to. The main contract buyers were East Africa Breweries Limited (EABL) which contracted sorghum farmers through CBOs and World Food Programme (WFP) which entered into buying contracts with CBOs mainly for green grammes and sorghum.

There was evident significant (χ^2=48.38, p=0.00) association between the main grains markets for farmer groups for 2013-2016 and cluster performance, at 1% significant level. Majority of high performing groups sold their grains to CBOs, middlemen and institutional buyers like WFP and Imara limited. Only one high performing group sold to the local market. Average groups sold mainly to the CBO, middlemen and local markets, while majority of the low performing groups (71%) sold their grains in the local markets as shown in Figure 4.2.

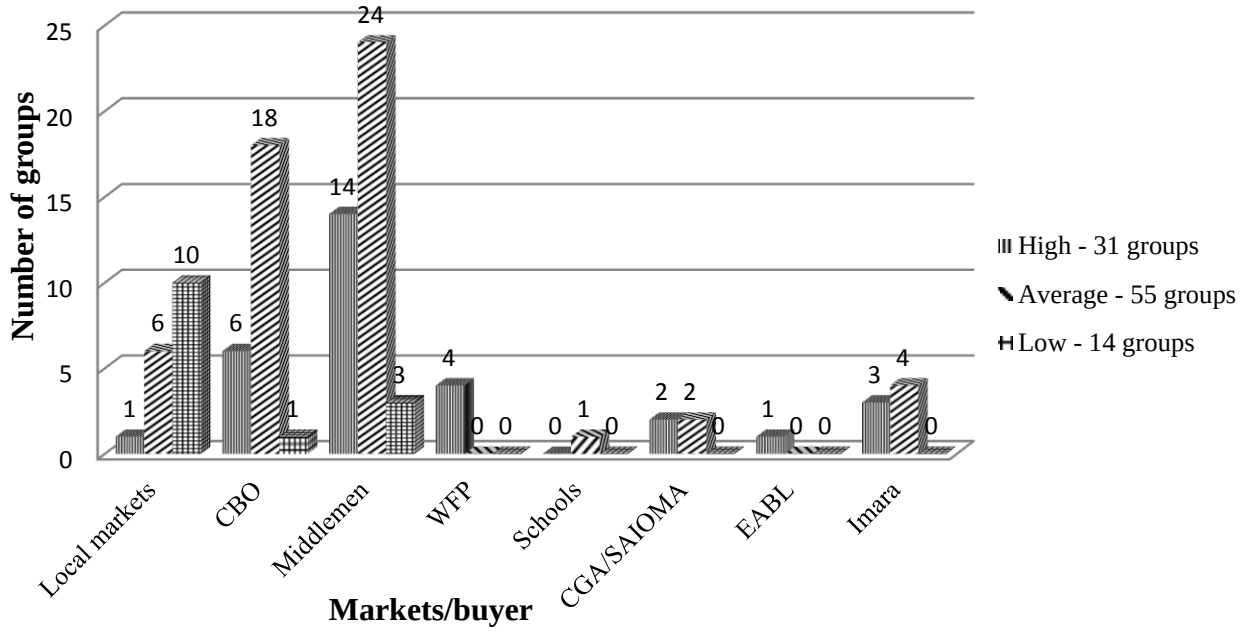

Figure 4.2: Farmer groups' main grains markets by clusters

The market offering the highest price, immediate payment in cash, and nearest to a farmer groups grains aggregation point were the major determinants of the preferred market by the groups. These reasons had a statistically significant (χ^2=46.87, p=0.00) association with cluster performance at 1% significant level. The high and average performing groups mainly preferred markets offering the highest price and those paying immediately in cash. The low

performing groups' choice of markets was based on nearness and lack of an alternative market.

4.5 Summary, conclusion and recommendations

4.5.1 Summary

In summary, it was observed that farmer groups are rarely specialized in one activity; however, they served diverse purposes to their members other than grains marketing. This included table banking and welfare functions to members. The groups differed significantly in their structure and conduct aspects like in affiliation to a farmers' CBO, membership fee, number of other running group enterprises, level of leadership and marketing training, frequency of leaders' elections, keeping financial records and contract marketing to institutional buyers. The groups were also relatively similar in terms of age, main benefit to members, having a group constitution and marketing committees, table banking and access to a grains store. High performing groups took a significant lead in most of the indicators attributed to better performance.

4.5.2 Conclusion

1. Farmer groups served diverse purposes to their members where reciprocity and welfare motives played a big role in farmer group collective action.
2. High performing groups were relatively more commercially oriented than average and low performing groups.

4.5.3 Recommendations

1. Support actors can help grain farmer groups to shift from being welfare groups and be more commercially oriented through offering them relevant trainings in leadership, collective marketing, and financial record keeping.
2. The groups should be encouraged to sell to institutional buyers under contract marketing.
3. **Future research:-** Future research can consider comparing farmer groups based on the transaction costs groups incur during marketing and other activities.

4.6 References

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CHAPTER FIVE
FARMER GROUP SOCIAL NETWORKS

5.1 Introduction

Sociologists generally agree that power (ability to influence and be in control) is a vital characteristic of social network structures. Networks in this case refer to a set of relationships or linkages between groups, individuals, institutions or organizations (Dershem and Bokuchava, 2016). Hanneman and Riddle (2005); Dershem *et al.* (2011); Dershem and Bokuchava (2016); argue that an actor's influence and power is not an individual feature, but it stems from relations with others. Additionally, the authors assert that organizations are important, but the networks and alliance structures that connect an organization together with the organization's individual strengths are more essential. Pastor *et al.* (2010) noted that the specific strengths that networks bring together include; ability to provide leadership and mobilize people, having a particular expertise, access to different resources and donors which are all needed to bring large scale social change.

Since early the 1990's, many farmer groups have been formed in Kenya. Majority of the groups have forged linkages with individuals and organizations in pursuit of different goals usually to give their members' more value for their membership. For example, producer marketing groups (PMGs) in Kenya present new opportunities for smallholder farmers through vertical and horizontal linkages of grain production and marketing (Shiferaw *et al.*, 2009). Barham and Chitemi (2009) argue that there is a concerted effort by different partner agencies to link farmer groups to other chain actors in order to forge new business partnerships and improve their marketing performance. It is posited that grain farmer groups in Tharaka North and Tharaka South Sub-Counties are no exception with majority being part of a network of various chain actors involved in farmer group collective action. In an attempt to explain the existence and nature of social networks between farmer groups and other actors, social network analysis (SNA) has been adopted by many researchers.

Social network analysis can help inform network actors, like extension educators and development partners working with farmer groups, on resources that flow among them (Chaudhary and Laura, 2015). This can contribute to reducing duplication of services, and enhancing the actors' service delivery and impact through the groups. Given the need to inform the actors working with groups, it was essential to map and obtain metrics about the

structure and characteristics of sharing resources and information among grain farmer groups and support actors in Tharaka North and Tharaka South Sub-Counties, Kenya.

5.2 Literature review

This section provides a review of social networks literature. It specifically captures power in social networks and measures of power and centrality in the networks. The review informs choice social network of measures of power and centrality selected for this study.

5.2.1 Power in social networks

Social Network Analysis (SNA) and the concept of centrality have been widely adopted as approaches to study power (Hanneman and Riddle, 2005; Dershem and Bokuchava, 2016). These approaches were developed and incorporated in UCINet software by Linton Freeman. Additionally, Hanneman and Riddle (2005) argue that the network approach emphasizes that power is essentially relational. They further argue that the way an actor is embedded in a relational network offers both opportunities and constraints, depending on how strategically positioned one is. Actors in more favourable structural relation positions are those with fewer constraints and more opportunities (Dershem, *et al.,* 2011). This means that, such actors will attract more attention, have greater influence and more bargaining power for better exchanges than from actors in less favourable positions.

5.2.2 Measures of power and centrality

Freeman and Bonacich proposed various measures of centrality and power (Hanneman and Riddle, 2005). Bonacich's approach is more widely adopted as it is an improvement of Freeman's approach by extending the idea of degree of centrality. Bonacich argued that both power and centrality were dependent on not only the number of connections an actor has with other actors but also the number of connections those other actors have with other set of actors (Hanneman and Riddle, 2005). The more the connections an individual's neighbours have in the neighbourhood, the more central the individual is. Dershem and Bokuchava (2016) argue that the lesser the connections of actors in the neighbourhood, the more powerful the individual is. Therefore, actor X's centrality and power is simultaneously dependent on the centrality and power of the actors X is connected to.

Actors with many linkages with others are likely to have more opportunities and alternatives than those with fewer linkages. High intensity of connectedness allows an actor to enjoy a

higher ‘degree of centrality’ (Dershem *et al.,* 2011). As a result, they are likely to be at an advantageous position, with more power, wider access to resources and less dependency on any single actor (Hanneman and Riddle, 2005). Degree of centrality refers to the number of ties an individual has with other actors in a network (Dershem and Bokuchava, 2016). An individual’s degree of centrality ‘normalized’ corresponds to the observed degree of centrality for the individual, divided by the maximum number of relations for that individual. This is multiplied by 100 to get the percentage (Hanneman and Riddle, 2005).

Another advantageous position is in being between other actors referred to as ‘betweenness centrality’. This means that, for other actors to communicate or share resources they have to do it through the linking actor between them (Dershem *et al.,* 2011; Dershem and Bokuchava, 2016). This refers to the level to which an individual lies along the shortest path, most direct route, from one individual to another, adjusted for the number of other possible shortest paths (Dershem and Bokuchava, 2016). This shows the extent of power for a given actor or individual to play a brokerage role as a liaison, consultant, coordinator or gatekeeper (Hanneman and Riddle, 2005; Dershem and Bokuchava, 2016).

Actors who can easily reach other actors in the shortest distance or can also be reached by many actors at the shortest path lengths are in more favoured positions (Dershem and Bokuchava, 2016). This is a structural advantage referred to as ‘closeness centrality’ which can be translated to signify more power (Hanneman and Riddle, 2005). Closeness centrality takes into account the distance of an actor to all other actors in the network. Hanneman and Riddle (2005) argue that an actor could be tied to many other actors but those actors could be disconnected from the entire network as a whole. In such a scenario, this actor could be relatively central; however, it is only in a given local neighborhood. There are several approaches to measure closeness centrality, however, Freeman’s geodesic path distance is the most common (Newman, 2005).

Geodesic distance refers to the number of shortest steps or paths from one node to another in a network (Dershem and Bokuchava, 2016). Distance is measured by ‘farness’ given by sum of distances from each ego (actor) to all others in a network. The farness output scores can be converted to ‘nearness’ by taking the reciprocal of farness (Newman, 2005). The ‘nearness’ scores can further be standardized using Freeman’s normalizing which involves dividing maximum observed distance plus 1 with the minimum possible distance for a network of a similar connection and size (N-1) (Hanneman and Riddle, 2005).

Hanneman and Riddle (2005) recommend using measures of centrality (degree, closeness and betweenness) rather than measures of power as they show how close an actor is to the 'center' of action in the network. Recent studies Dershem *et al.* (2011); Dershem and Bokuchava (2016) in a study of agricultural alliances in Armenia and Georgia have also adopted this approach. This is because more central positions tend to be more advantageous due to higher power.

This study evaluated farmer groups' network positions in terms of their influence and its relation to their performance, therefore a combination of Freeman's and Bonacich's centrality measures were preferred and adopted for this study. Social network analysis including both scores and maps were used because visualization is essential to display, explore and understand organizations' complex network relations data matrices (Williams and Hummelbrunner, 2010; Dershem and Bokuchava, 2016). This also involved measuring their structural characteristics using standardized metrics.

5.3 Methodology

Social Network Analysis (SNA) was done using UCINet software. The SNA structured linkages (ties) between smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties and actors supporting or working with farmer groups. Social network analysis is an approach that combines both qualitative and quantitative techniques to structure sets of relationships, understand characteristics and measure the connections of individuals, groups and organizations (Cross, Borgatti and Parker, 2002; Dershem and Bokuchava, 2016). Keast and Brown (2005); Williams and Hummelbrunner (2010) argues that SNA offers techniques to assess the network structures, visualize, and simulate the relationships. Microsoft Office Excel software was used to show ranking of the actors in terms of the resources they offer to grains farmer groups in Tharaka North and Tharaka South Sub-Counties. This provided a grasp of the position of the individual groups in the entire network of actors and the information and resources that circulate among them.

To establish social networks of grain farmer groups in Tharaka North and Tharaka South Sub-Counties, linkages (ties) in to Non-Governmental Organizations (NGOs), projects, government institutions, and membership or linkage with farmers Community Based Organizations (CBOs) or bulk buyers were considered. Both direct and indirect ties were taken into account, including membership ties, information relations, communication ties and business cooperation. The score was given as a zero (0) for no linkage, 1 for direct linkage

and 2 for indirect linkage. Additional information included the nature of services and products that flow among the actors and the leading actors in offering the resources.

5.3.1 Quantitative analysis of two mode networks

The analysis was based on a dataset of primary-tier level farmer groups in three clusters (high, average and low performing) and the actors (organizations and individuals) they were linked with directly or indirectly. The data took a 2-mode structure since the matrix was not square (equal rows and columns) and the rows and columns were different modes (individuals on columns not the same as the names in the rows). As a result it was important to generate 2-mode network maps and also run a bipartite function (Borgatti, 2009). This function was to make the matrix square and add mode 2 rows to mode 1 and vice versa, in order to run various analytical measures using UCINet software.

Important network typology UCINet metrics are inclusiveness, centralization, network diversity and network fragmentation operationalized in software (Borgatti, Everett and Freeman, 2002). Inclusiveness has a maximum of 100% if each network member has at least 1 (one) connection such that there are no isolated members (Dershem and Bokuchava, 2016). Dershem and Bokuchava (2016) add that a centralized network is one where a few members, like one or two, have the most influence of power. This means there is little decentralization or distribution of power and influence among the network members. Network diversity refers to the number and diversity (types) of core actors in a network. Lastly, network fragmentation refers to the potential risk of a network to split into smaller disconnected network units if one or more network members leave or become in active (Dershem and Bokuchava, 2016). This is measured using Borgatti's fragmentation measure, where the higher the score, the higher the risk of a fragmentation making the network less sustainable (Borgatti *et al.,* 2002).

5.3.2 Generating social network maps

The degree of centrality measure was selected to determine the node sizes in the 2-mode network maps. This was because it clearly visualized how powerful or central an actor was given the number of direct and indirect ties with other actors (Hanneman and Riddle, 2005; Dershem *et al.,* 2011). Different colors for the ties (arrows) linking nodes (actors) were used to distinguish indirect and direct linkages. The network pattern selected for the maps was 'spring embedding network pattern'. It was selected as it 'fits' nodes that are closely connected to each other in the network and not distantly connected to each. This network visualization uses an algorithm that makes the network map appear more organized and

easier to understand (Dershem *et al.*, 2011). This made the network maps more informative by visualizing the most important institutions supporting farmer groups in aspects like capacity building, market linkage and capital assets. The levels of ties for each farmer group were also visualized and the results were related to their performance relative to others.

The network analysis in this study involves the flow of resources from support actors to farmer groups. Farmer groups with larger nodes were in highly favourable positions as they had more connections with supporting institutions, as well as being and more centrally placed than others. Such farmer groups had access to a variety of resources and services which include trainings and capacity building, tools and equipment, inputs and market linkage services.

5.3.3 Description of variables

Table 5.1: Description of variables, their measurement and expected signs

Variable	Description	Measurement and codes
Dependent variable (Time varying): 2013 -2016		
PCVCS	Per capita value of grains sold (monetary) $=\left[\frac{Total\ value\ of\ cereals\ sold\ in\ year\ t}{Number\ of\ group\ members\ in\ year\ t}\right]$	Kenya shillings (KES)
	Social network (Linkages indicators)	
SOC_NET	*Social network nature* Direct, indirect or no linkage (tie) to NGOs, Projects, Government departments and farmer Community based Organization (CBOs) 0=No linkage 1=Direct linkage 2=Indirect linkage	Code
ORG_NAME	*Organization name* Name and code of organization linking or linked to by other organizations For example: a farmer group, NGOs, Projects, Government departments and farmer CBOs. *(Use provided names and codes for organizations)*	Code

Variable	Description	Measurement and codes
RELATION	*Nature of relationship* Farmer group's nature of relationship with organizations it linked with between January 2015 and January 2016 1= Communication 2= Collaboration 3= Partnership 4= Membership 5= Not directly linked	Code
EXPERT_RESO	*Experts and resources* Rank of each organization on its importance to a farmer group with regard to the resources (services and products) provided by the organization to the group. 1= Crop production information 2=Training in marketing 3= Field exposure visits 4= Provision of tools and equipment 5= Provision of farm inputs (e.g. seeds, fertilizer) 6= Linkage to buyers and markets 7= Others (specify)	Number
ORG_START_LINK	*Organization to start linkage with* List organizations that the group would like to start relationship with. *(Use provided names and codes for organizations)*	Codes

5.4 Results and discussion

5.4.1 Networks metrics

Social network diagrams and centrality scores were put in three clusters namely: high performing groups, average performing groups and low performing groups. The performance was based on the Per Capita Value of Grains Sold (PCVCS) by each farmer group for a period of four years, that is, 2013 – 2016. Every actor, farmer groups, Non-Governmental Organizations (NGOs), projects, government institutions, farmer Community Based Organizations (CBOs) and individual bulk buyers, in the social network maps was represented by a node connected to other nodes using arrows if there was a direct or indirect linkage.

Network diversity: Overall, the results showed that the grain farmers' marketing groups were networked, directly or indirectly, with diverse types of support from non-farm actors, including NGOs, Projects, government institutions. In addition, farmers' groups were organized into two levels, whereby the primary-tier groups joined to form a secondary-tier umbrella organizations referred to as farmers CBOs in the region.

Inclusiveness: The overall network inclusiveness for farmer groups was 92% showing that only 8% (8 groups) groups had zero connections with other actors in the network. Five of the unconnected groups were average performing groups cluster while the other three were low performing groups. The unconnected actors were displayed on a list to the left of each network map as shown in Figure 5.1, Figure 5.2, Figure 5.3 and Figure 5.4. Majority of the groups had 3 to 4 connections with the highest having 9 connections. However, communication and linkages were basically one-way, running from farmer-groups to support actors. This concurs with the findings of Dershem and Bokuchava (2016) in an evaluation of agricultural alliances in Georgian and Armenia observed a similar situation where most information sharing was one-way, in addition to not being mutually reciprocated.

Network sustainabilty: Table 5.2 shows the network's fragmentation centrality for all the farmer groups and support actors was estimated at 12.20%, implying that, overall, the network was relatively stable. It was also an indication that, the network would fragment at 12.20% if central network members were to leave. This was quite low suggesting that cohesion was relatively stable and that non of the 100 farmer-groups or 28 support actors working the groups was likely to cause a big network fragmentation impact incase it were to leave or become dormant. Tharaka Cereals Growers Association (TCGA) and the Ministry of

Agriculture (MoA) were the key actors whose dormancy or leaving the overall network would leave majority of the actors disconnected from the network at 23.70% and 18.10% repsectively. However, if the networks were to be separated by farmer group cluster, the mean fragmentation score was significantly different across the clusters at 1% significance level at a mean of 12.30%, 12.20% and 11.90% for high, average and low performing groups. This adds to showing that low performing groups had relatively few connections and low centrality.

All the 28 support actors were connected to at least one other actor in the overall network. Overall centrality results show that: Nkatha a bulk buyer; Agmark, and Institute of Culture and Ecology (ICE) both local NGOs; and Kenya Plant Health Inspectorate Services (KEPHIS) had the least linkages (most peripheral) to grains farmer groups in Tharaka North and Tharaka South Sub-Counties. The farmer groups also had minimal linkages with the Ministry of Gender, Children and Social Development (MGCSD) despite the fact that they were all registered under the ministry during their inception. The few linkages with the MGCSD were shown by the relatively small centrality degree scores in annex Table 0.5 and nodes in Figure 5.1, Figure 5.2 and Figure 5.3. The few linkages with these five actors could be because they offered few services and products directly related to grains production and marketing.

Table 5.2: Social networks measures of centrality descriptive statistics

	Social network centrality measures of all farmer groups – 100					
	Degree		Closenes	Betweenness	Power	Fragmentation
	Degree	nDegree	FreeClos	nBetweennes	nPower	Frag.
Beta method Standard					0.995/MaxEigen	
Beta parameter:					0.066	
Centralization		23.66%				
Network Centralization Index				37.27%		
Fragmentation						12.20%
Mean	3.740	0.015	0.342	0.499	0.640	0.124
Minimum	0.000	0.000	0.143	0.000	0.000	0.108
Maximum	10.000	0.039	0.410	3.857	1.805	0.237
Standard Deviation	2.541	0.010	0.069	0.693	0.481	0.013
ANOVA F-test across the 3 clusters	14.64*** (0.00)	14.57*** (0.00)	13.00*** (0.00)	6.52*** (0.00)	9.81*** (0.00)	2.56* (0.08)
	High performing farmer groups - 31					
Centralization		18.95%				
Network Centralization Index				25.11%,		
Mean	5.484	0.022	0.382	0.840	0.909	0.123
Minimum	2.000	0.008	0.319	0.031	0.251	0.122
Maximum	10.000	0.039	0.410	3.857	1.773	0.137
Standard Deviation	2.593	0.010	0.028	0.823	0.508	0.005
	Average performing farmer groups – 55					
Centralization		19.25%				
Network Centralization Index				33.75		
Mean	3.164	0.013	0.334	0.384	0.565	0.122
Minimum	0.000	0.000	0.143	0.000	0.000	0.108
Maximum	9.000	0.035	0.407	3.348	1.805	0.152
Standard Deviation	2.007	0.008	0.068	0.594	0.411	0.007
	Low performing farmer groups – 14					
Centralization		8.41%				
Network Centralization Index				15.12%		
Mean	2.143	0.009	0.284	0.194	0.335	0.119
Minimum	0.000	0.000	0.143	0.000	0.000	0.108
Maximum	8.000	0.031	0.407	1.620	1.192	0.122
Standard Deviation	2.349	0.009	0.088	0.442	0.413	0.006
	Actors linked to farmer groups - 28					
Mean	13.357	0.053	0.312	3.481	0.838	0.129
Minimum	1.000	0.004	0.244	0.000	0.014	0.122
Maximum	65.000	0.256	0.488	38.127	4.363	0.000
Standard Deviation	19.345	0.076	0.054	9.035	1.284	0.024

Note: *, *** represents significance levels at 10% and 1% respectively.

5.4.2 Degree of centrality and power

As shown in Table 5.2, the overall Freeman's network centralization (coefficient of variation) was low at 23.66% with a mean of 0.015 for all the farmer groups. This shows that the overall network was not largely dominated by a single actor. However, the variation was relatively higher than that for specific clusters at 18.95% (mean of 0.0216), 19.25% (mean of 0.0126), and 8.41% (mean of 0.0085) for high, average and low performing groups respectively. The Ministry of Agriculture (MoA) and TCGA had the highest dominance; however, their dominance was lowest among the low performing groups.

Bonacich's measure of centrality and power gave similar results. As shown in annex Table 0.2, Table 0.3 and Table 0.4, the overall mean power for all farmer groups being 0.6395 while the clusters had 0.9093, 0.5651, and 0.3349 for high, average and low performing groups respectively. The network centralization and mean power results also show there was some relative homogeneity in degree of centrality within clusters; however, they were quite different from cluster to cluster. The centrality degree and power difference across the clusters was statistically significant at 1% significance level as also shown in Table 5.2.

High performing groups had the most ties with other actors as shown by the relatively higher mean for degree of power compared to the other clusters. Result of Freeman's centrality degree showed that four of the top five groups were from the high performing groups' cluster, while one was from average groups cluster. The five toped in the number of linkages with actors offering training, implements, inputs and markets, they were thus probably the most central, influential and informed groups.

Ministry of Agriculture (MoA), Rural Initiatives Development Programme (RIDEP), Tharaka Cereals Growers Association (TCGA), World Food Programme (WFP) and Cereals growers Association (CGA) were the most central actors (neighbours they link to were more connected) supporting farmer groups. Analysis using Bonacich's centrality showed that RIDEP, WFP, MoA, TCGA and CGA were the most powerful (neighbours they linked with were less connected) as shown in annex Table 0.5, Figure 5.1, Figure 5.2 and Figure 5.3. In the figures, the relative power of actors in indicated by its node; the larger the size of nodes, the more powerful the actor.

5.4.3 Betweenness centrality

Highly connected actors, whether farmer groups, CBOs, buyers, NGOs or Government institutions; had relatively high scores for betweenness centrality. The results of the network maps concur with the betweenness centrality score as actors with high scores also had the largest node sizes. The top 5 farmer groups were Njuki Youth, Tharaka Poultry Rearing and Maendeleo B from high performing groups cluster, and Gatethia A. and Runkurunu from average performing groups cluster as shown in annex Table 0.2 and Table 0.3.

As shown in Table 5.2, the overall network betweenness centralization index was 37.27%. The betweenness centrality was relatively low and understandable as majority of the connections in the networks can be made directly without any intermediaries hence there cannot be high 'betweenness'. The three clusters were also relatively homogenous in the degree of betweenness centrality as compared to the overall network which had all the groups and support actors. The more equally distributed betweenness within the clusters was shown by the network centralization index values at 25.11%, 33.75%, and 15.12% for high, average and low performing groups respectively. The cluster index values were relatively lower than the overall index for all the 100 groups, however, the variation in betweenness across the clusters was statistically different at 1% significance level (Table 5.2).

Ministry of Agriculture (MoA), TCGA, RIDEP, CGA and WFP enjoyed the highest betweenness centrality. These actors served the highest brokerage roles mainly as consultants, liaison and coordinators for resource sharing between the farmer groups and other actors in the networks. These five actors were therefore the most influential as they had the highest betweenness centrality relative to that of the other 23 support actors. Dershem and Bokuchava (2016) also observed a similar situation where a few actors dominated the brokarage roles and 'anchoring' the entire networks. These few actors in Tharaka North and Tharaka South Sub-Counties also served the 'anchoring' role in binding together the other actors including farmer groups in the entire social network.

Ministry of Agriculture (MoA) mainly acted as a coordinator and also gave the governments' approval for projects and development activities from different stakeholders wishing to work with farmers and farmer groups in Tharaka North and Tharaka South Sub-Counties. TCGA which was one of the main farmers' CBO served a liaison role as it connected the lesser connected farmer groups with buyers and service providers. RIDEP, CGA and WFP which

are NGOs served a liasion function and also consultants to the farmer groups and other development partners in the region.

5.4.4 Closeness centrality

Three high performing groups, one average performing group, and one low performing group were the most close farmer groups to other actors shown in annex Table 0.2, Table 0.3, Table 0.4. Majority of the most peripheral farmer groups were mainly among the low performing groups' cluster. Similar to other measures of centrality MoA, TCGA, RIDEP, CGA and WFP were still the prominent actors in the closeness centrality scores as shown in annex Table 0.5.

Overall, descriptive statistics on closeness centrality show that, there was a relatively high inequality in farmer groups' closeness centrality across the three clusters with a mean of 0.382, 0.334 and 0.284 for high, average and low performing groups respectively. The cluster inequality was confirmed by closeness centrality scores which were statistically different at 1% significance level as shown in Table 5.2. However, the farmer groups in each cluster were relatively homogenous in closeness centrality shown by the low variations within the clusters.

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Non-involved members

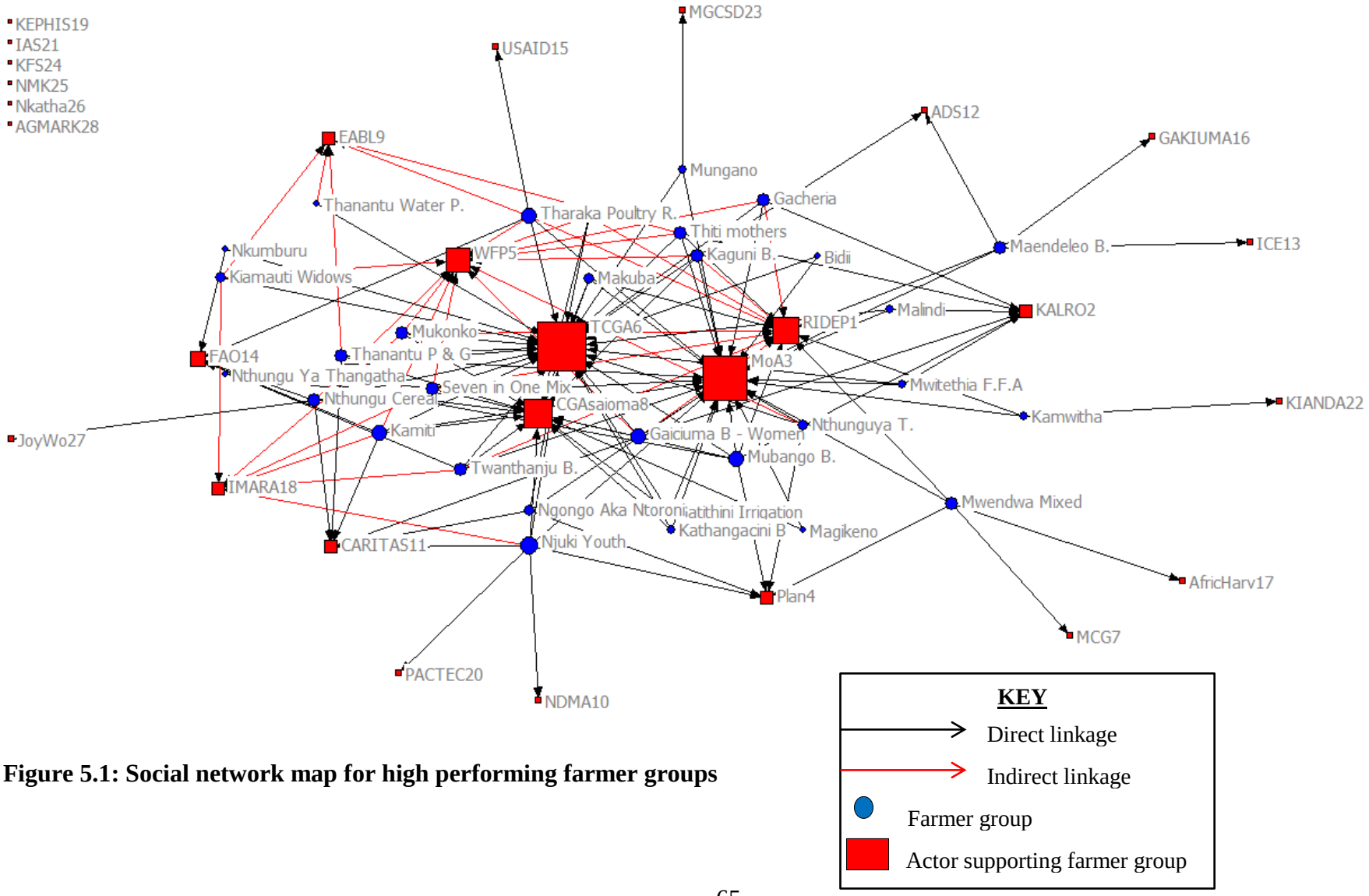

Figure 5.1: Social network map for high performing farmer groups

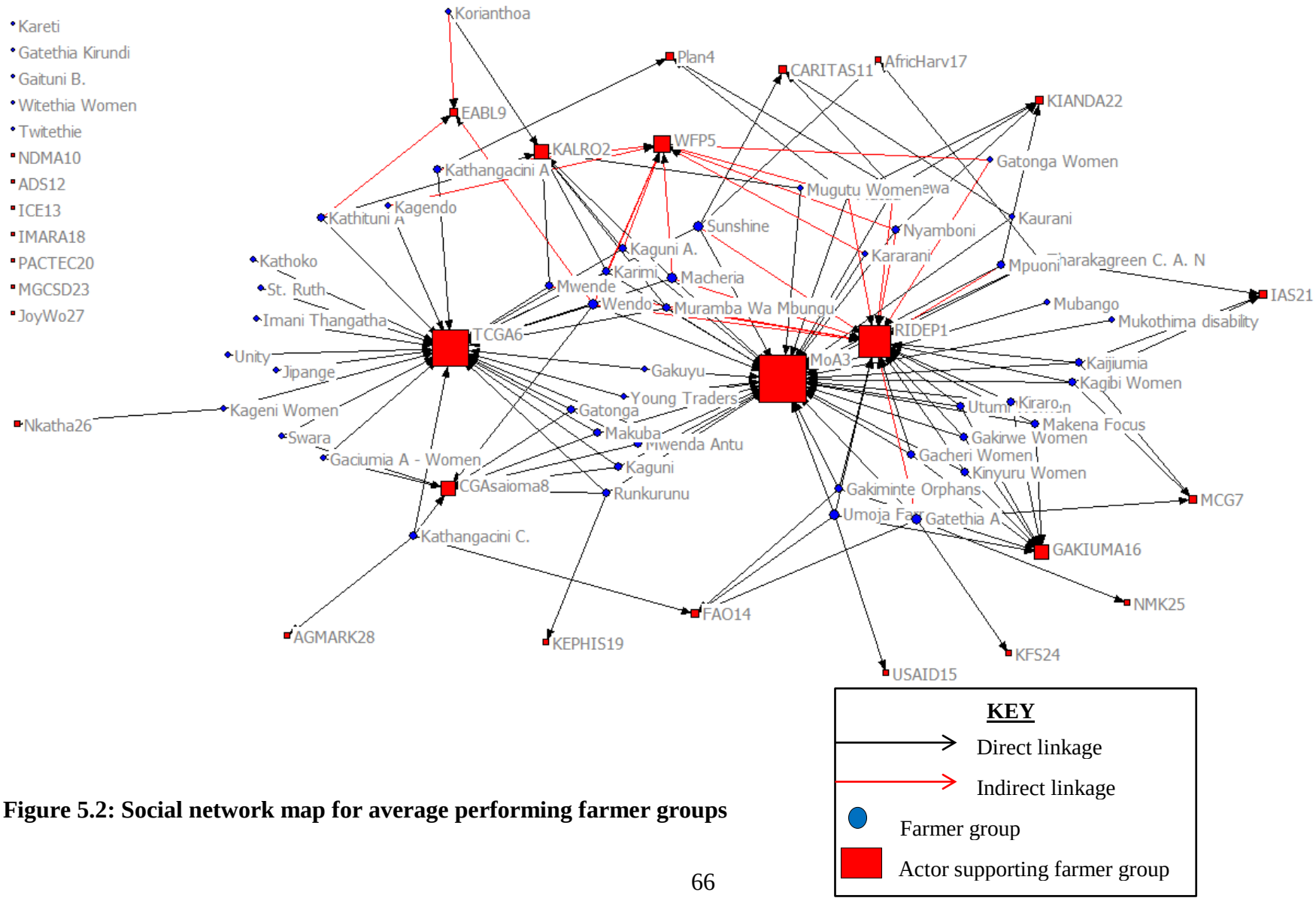

Figure 5.2: Social network map for average performing farmer groups

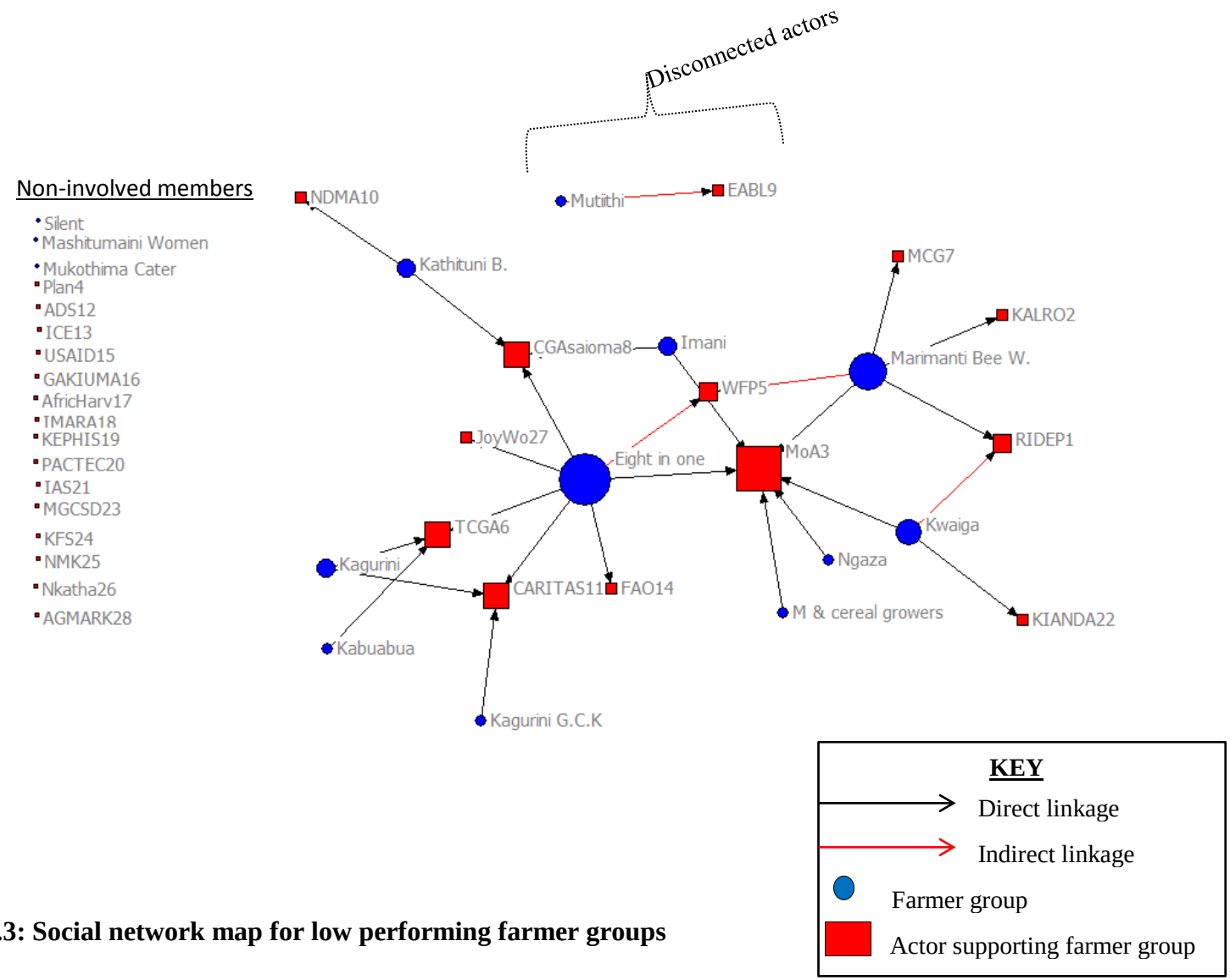

Figure 5.3: Social network map for low performing farmer groups

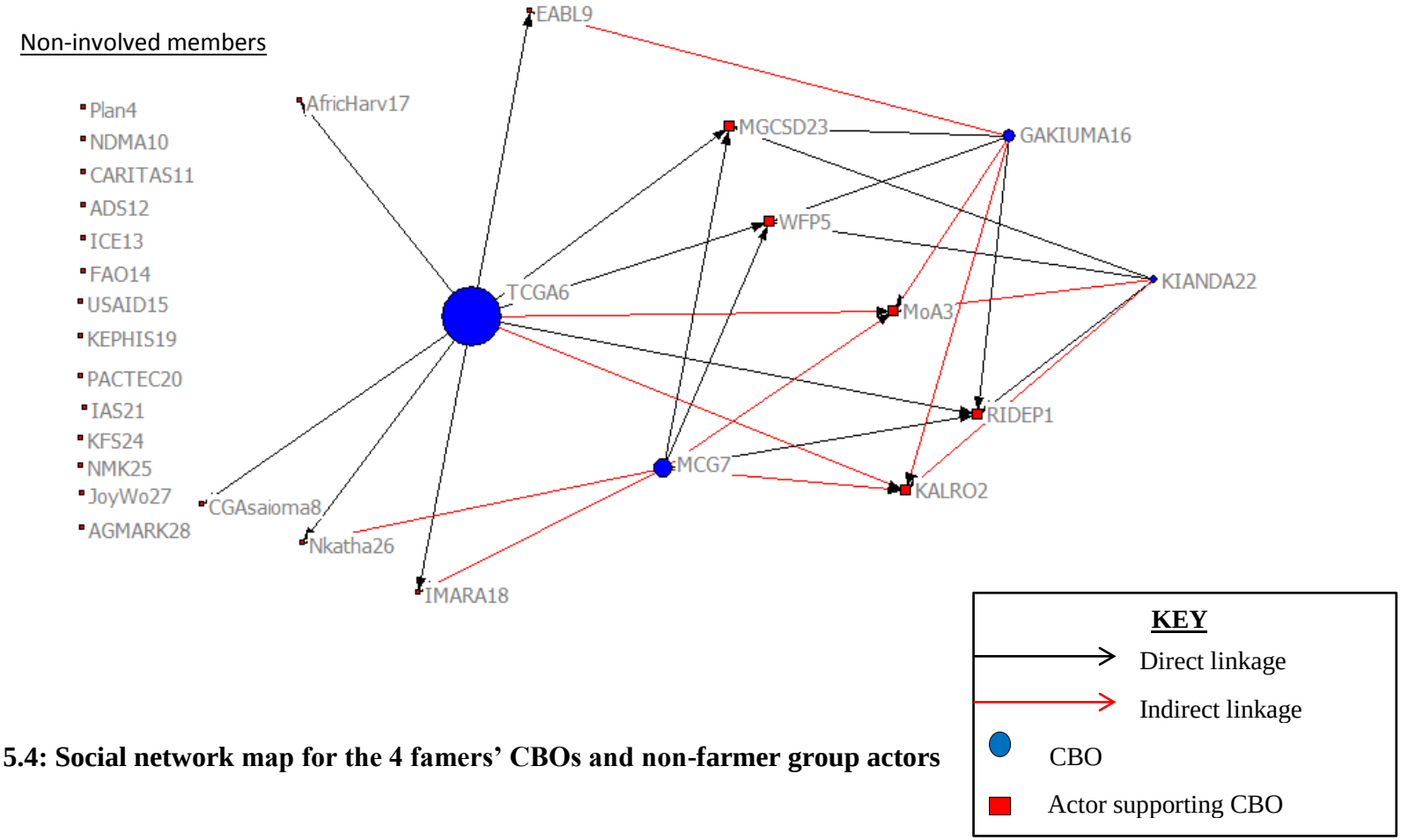

Figure 5.4: Social network map for the 4 famers' CBOs and non-farmer group actors

5.4.5 Lead support actors in resource provision to farmer groups

All the measures of centrality and power explained in sub-section 5.4.1 to 5.4.4 indicated that high performing groups were relatively more networked than average and low performing groups. The key driver for these linkages was to access diverse resources and services of interest to the groups. This concurs with Popp *et al.* (2013) who argued that creation of inter-organizational networks creates opportunities to add value to an organization through accessing external resources. As shown in Figure 5.5 and Figure 5.6, farmer groups obtained different services and products from the different support actors. Crop production information had (73%), training in marketing (71%), field visits (40%), tools and equipment (50%), farm inputs (58%), buyer linkage trainings (58%) and sold to institutional buyers (42%).

Rural Initiatives Development Programme (RIDEP) took a lead in offering marketing trainings, field visits, and tools and equipment to the farmer groups. Ministry of Agriculture (MoA) took a lead in offering crop production information and farm inputs like seed and fertilizer. Tharaka Cereals Growers Association (TCGA), one of the farmers' CBOs, took a lead for linking farmer groups to buyers and also being an institutional buyer of grains for the groups. This concurs with the centrality measures results where RIDEP, MoA and TCGA took a lead across the three measures of centrality.

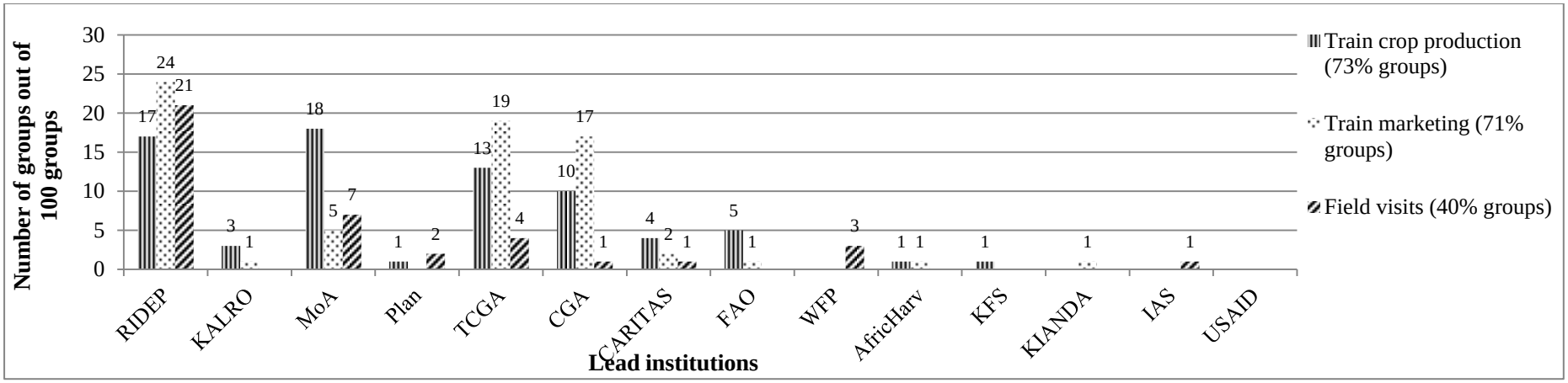

Figure 5.5: Participation of groups on trainings and capacity building offered by support actors

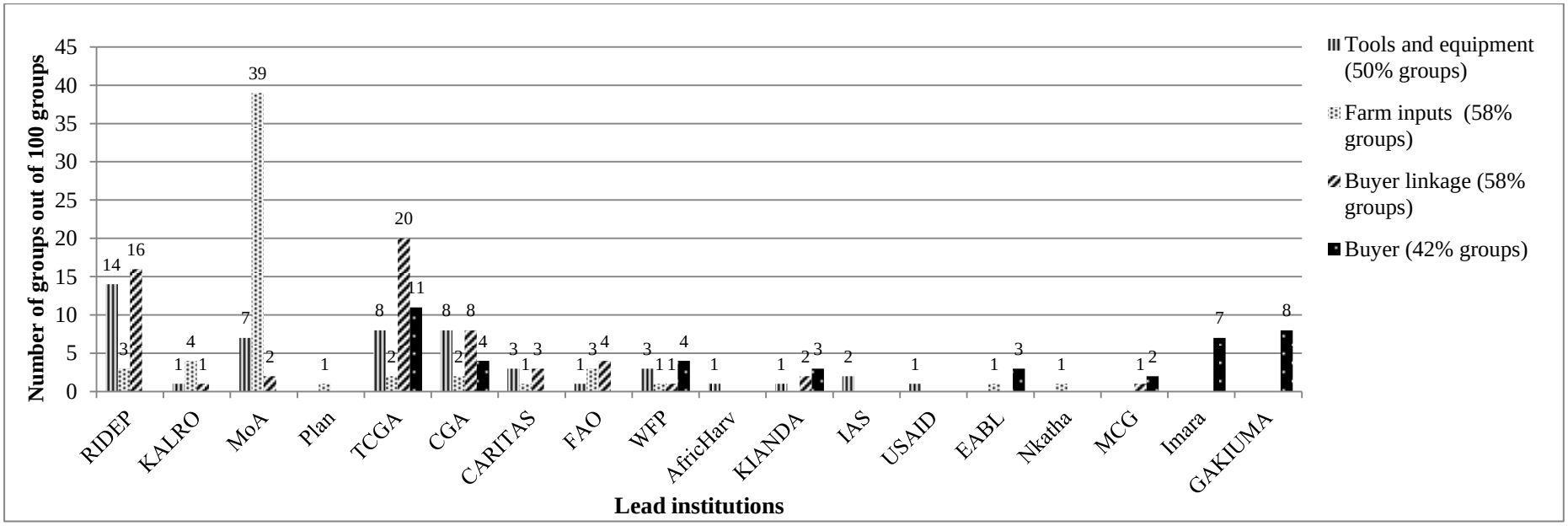

Figure 5.6: Participation of groups on equipment, inputs, buyers and buyer linkage offered by support actors

5.5 Summary, conclusion and recommendations

5.5.1 Summary

Grain farmer groups were essentially receivers of most of the services and products as shown by the one way arrows in the network maps. Most market information on available markets, training and skills sharing were mainly one-way; coming from the NGOs and government institutions to the farmer groups. The most prominent, powerful and beneficial support actors to the farmer groups were TCGA one of the farmers' CBOs, WFP, RIDEP, MoA and CGA. The 'anchoring' role in the networks was mainly done by CBOs which served a market linkage role and a collaborative advocacy role with development partners supporting collective group action. However, there was a weaker representation of buyers across the networks compared to other support actors. Generally, high performing groups were significantly more linked with different support actors, like to TCGA which was the most influential farmers' CBO, compared to the average and low performing groups.

5.5.2 Conclusion

1. Only one of the farmers' CBOs, TCGA, had relatively high power and influence in the networks.
2. The high performing groups had better access to trainings, implements, inputs and better paying markets due to being at better linkages positional advantages compared to the average and low performing groups.

5.5.3 Recommendations

1. The farmers' CBOs can be encouraged to reach out for more farmer groups, especially average and low performing groups, to join in order to enhance their bargaining power.
2. There is need for market linkage forums for farmer groups to meet potential and existing buyers in order to create an opportunity to negotiate better deals, enter into contracts and even linkage to other service and input providers linked to the buyers.
3. **Future research: -** Future research can consider exploring farmer group networks in a wider perspective including their development, evolution and impact.

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CHAPTER SIX
FARMER GROUP SOCIAL CAPITAL

6.1 Introduction

The availability of bridging social capital (linkages) to institutions and individuals has been known to improve their access to resources and opportunities giving them an added advantage to perform better than those without (Lawal *et al.*, 2009). Liang *et al.* (2015) adds that the availability of trust, close connections, reciprocity and cooperation among market agents could also add to strengthening their gains from services and goods produced.

Social capital has attracted diverse definitions, interpretations, forms and methods of measurement. Sander (2015) defined social capital as the total value of social networks (the people one knows) and the inclinations that arise from the networks to do things for others (norms and reciprocity). This creates value for the connected people in the networks and also for bystanders (free riders) as well. Dill (2015) adds to Sander's definition that social capital is social resources including networks for cooperation, support and mutual trust. Organization for Economic Co-operation and Development (OECD) (2001) has a similar definition where social capital refers to networks and shared norms and values that enhance cooperation and understandings within or among groups. What is common across all the definitions is issue of networks, cooperation and close social cohesion. Additionally, it shows social capital is embedded in social networks and groups of people with close connections (Lewis and Chamlee-Wright, 2008).

There is a general consensus among economists that the traditional types of capital; human, financial, natural and physical capital; partially determine the economic growth and performance of an individual or an institution (Lawal *et al.*, 2009; Dill, 2015). This is because these types of capital overlook the way economic actors interact and organize themselves to spur higher economic performance (Dill, 2015). This missing link is what Lawal *et al.* (2009) refers to as social capital. They also argue that, like any other type of capital, social capital can also be accumulated over time. Nilsson, Svendsen and Svendsen (2012) add that, some network resources like social capital, though not visible to the naked eye, could have some economic impact on the enterprises that are part of the networks.

Fischer and Qaim (2014) further argue that linking smallholder farmer groups to emerging high-value chains, umbrella bodies and supporting organizations have been viewed as pillars

to strengthen their performance and enhance their sustainability. This not only provides opportunities for efficient information flows and capacity building but also offers a bridge for the groups to forge effective business relations in emerging markets (Fischer and Qaim, 2014; Ochieng, 2014).

6.2 Literature review

This section provides a review of social capital literature. History of social capital, its dimensions and embeddedness has been discussed. Additionally, the role of social capital in organizations has also been reviewed. The review informs methodologies applied to analyze social capital in this study.

6.2.1 Dimensions and Embeddedness of social capital

Conceptualization that economic behaviours are embedded in social capital was popularized by Granovetter (1985). Granovetter (1985) perceived and distinguished between structural and relational embeddedness of social capital. Nahapiet and Ghoshal (1998) define structural embeddedness as the presence of impersonal linkages or network ties among actors either people or units. Relational embeddedness is defined as the personal relationships people have developed between each other over time and whose key facets include trust and feelings of closeness. This is what Lewis and Chamlee-Wright (2008) refer to as bonding social capital in relatively small and homogeneous groups of people with a shared common identity and norms of reciprocity.

Trust and shared goals are important in governing repeated face to face interactions among members of a group. Structural embeddedness gives rise to bridging social capital which contributes to social change as people with different social structures cooperate and share resources (Lewis and Chamlee-Wright, 2008).

Granovetter (1985, 1992) argues that transaction cost economics and rational choice theory are not sufficient to explain people's participation in markets as they ignore their involvement in social networks which dissuade them from behaving opportunistically. On this view, Granovetter (1992) adds that there is need for research that considers how people's economic actions are influenced by and in turn influence social networks. However, a key concern in literature has been how to define, identify and measure social capital.

6.2.2 Role of social capital in organizations

Social relations tend to exist among people in an organization. Therefore, the influence of social relations on an organization's activities has been the main theme in most studies on social capital. How social capital influences an organization's conduct, structure and institutions have been one of the key questions of social theory. There is a broad consensus in literature that social capital is a valuable asset which holds a promise for explaining the performance at various levels (Granovetter, 1992; Moran, 2005). However, social capital is not as separable from an organization as financial capital or physical capital nor is it as mobile as human capital. But, it is firmly bound within the firm's organization, strategy and development (Nahapiet and Ghoshal, 1998; Walker, 1998). As a result social capital can be a firm's long lasting source of competitive advantage (Adler and Kwon, 2002). Consequently the influence of social capital on performance of individuals, small groups, large organizations and nations has attracted wide scholarly attention over the years (Walker, 1998; Moran, 2005; Popp *et al.*, 2013).

Popp *et al.* (2013) concluded that social capital, especially trust, creates opportunities to be more innovative and work collaboratively to solve complex issues for mutual gain of the actors. When a group of people trust each other, it is easier for them to engage in collaborative activities for mutual gain and at lower transaction costs (Nilsson *et al*., 2012). Nilsson *et al.* (2012) also add that, though agricultural markets may exist in different parts of the world, there are always strong connections among collective action members with regard to collection of agricultural products. Coleman (1990) noted that social capital's influence comes from closed networks of personal relations that foster collective action among individuals in a group. This is because such individuals are able to reinforce their norms of exchange, easily monitor each other, and enforce sanctions. This helps to create cohesion, constrain exploitative behavior, reduce uncertainty in exchange and promote cooperation.

Different types of capital in farmer groups and other organizations are said to influence performance. Literature shows social capital is one of the important types of capital in an organization. However, social capital has been relatively overlooked yet it could also explain the differences in performance among farmer groups. Additionally, very little is known about the level of bonding and bridging social capital within the farmer groups involved in collective grains marketing in Tharaka North and Tharaka South Sub-Counties, Kenya. Therefore, to fill this knowledge gap, this paper provides an analysis of the levels of social

capital among grains marketing farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya.

6.3 Methodology

6.3.1 Indicators of social capital

Three indicators of level of relational, cognitive and structure were used to proxy bonding social capital for a farmer group. A likert scale with five pre-coded items (1 if strongly disagree; 2 if disagree; 3 if neutral; 4 if agree; 5 if strongly agree), for ranking 6 statements, was used to measure the level of bonding social capital in each group in terms of the three indicators. Each group member was expected to give a view of what they believed was the status of the group in terms of the social capital statements. Each member wrote their view (score based on the likert items) on a card and the consensus view was taken as the view of the majority of the members. There were two statements to measure the level of trust between members and their leaders, while an extra statement captured aspects of changes in the level of trust in each group over a period of the last three years as at the time of the survey. Upon explaining what a vision was, the members were asked to give their rank on how they felt members shared into the vision of the group. Finally, coming from the same locality (village) and having close relatives within the same group were used as indicators of close connections. The statements are as stated below.

a. Trust

- Members in this group trust the leaders with making decisions that are for members benefit?
- Members in this group trust the leaders with the groups' assets and members' money?
- Trust in the last three (3) years has improved?

b. Group vision

- Majority of the group members understand where they would like to see the group achieve in the next 10 years?

c. Close connections

- Majority of the group members are close relatives?
- Majority of the group members come from this village?

Different proxies were used to estimate the level of bridging social capital in smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya. The proxies were: linkage (ties) to Non-Governmental Organizations (NGOs), Projects, government

institutions, and membership or linkage with a farmers Community Based Organization (CBO) or bulk buyer. These ties were direct or indirect including membership ties, information relations, communication ties and business cooperation. The score was zero (0) for no linkage, 1 for direct linkage and 2 for indirect linkage. Indirect linkage referred to where a group got assistance or resources from a given support actor only through another actor. On the other hand, direct linkage referred to where a group and a support actor worked together as a formal team or informally and actively pursued opportunities of mutual gain either through a collaboration, partnership and membership. Direct linkage was therefore considered better than indirect linkage.

6.3.2 Analytical framework

Based on literature review and conceptual framework the selected variables were adequate to capture the key levels of social capital in the farmer groups. To measure the levels of social capital separate indices for bonding and bridging social capital were generated using Principal Component Analysis (PCA). The PCA multivariate statistical techniques were used to reduce the number of variables (score for each statement) in the data set to a lower dimension to reveal simplified structures that underlie it. That is, PCA creates uncorrelated indices or components from an initial set of *n* correlated variables. Following Wu (2012) each index component was a linear weighted combination of the initial variables. This is demonstrated in a model using a set of variables X_1 to X_n in *Equation 6.1*.

Model specification:

$$\begin{array}{ccccccccc} PC_1 & = & b_{11} * X_1 & + & b_{12} * X_2 & + & \ldots & + & b_{1n} * X_n \\ \vdots & & \vdots & & \vdots & & \ldots & & \vdots \\ PC_m & = & b_{m1} * X_1 & + & b_{m2} * X_2 & + & \ldots & + & b_{mn} * X_n \end{array} \quad \ldots\ldots\ldots\ldots \textbf{Equation 6.1}$$

Where: b_{mn} represents the weight (coefficients for the PCA rotated components) for the m^{th} component and the n^{th} variable.

First, Statistical Package of Social Analysis (SPSS) software was used to measure sample adequacy was measured using Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sampling Adequacy. The KMO value should be greater than 0.5 for a satisfactory factor analysis to proceed, while a significant Bartlett's Test value indicates that there some relationships between the variables included in the analysis (Field, 2005; Yong and Pearce, 2013). Additionally, communalities after extraction should probably be above 0.5 (Field, 2005;

Yong and Pearce, 2013). Field (2005) added that, the average communality should be above 0.6 for sample size greater than 250, in this case the sample size was 400 observations. Table 6.1 indicates that the sample was adequate to run a PCA multivariate statistical analysis shown a KMO value of 0.570 while the Bartlett's Test of Sphericity was also significant with a p-value = 0.000. The average communality (5.064/6=0.844) is greater than 0.6 (Table 6.2). For example, over 71% of the variance in *members trust leaders decisions* is explained while over 98% of the variance in *members understand group vision* is explained. This further show that all the variables were robust enough to be included in the analysis therefore PCA was suitable for further analysis.

Table 6.1: KMO and Bartlett's Test of sample adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy:		0.570
	Approx. Chi-Square:	343.782
Bartlett's Test of Sphericity	Degrees of freedom:	15
	Significance:	0.000

Table 6.2: Communalities extraction values of the six bonding capital indicators

	Initial	Extraction
Members trust leaders decisions	1.000	0.714
Members trust leaders with assets	1.000	0.793
Trust has improved in last 3 years	1.000	0.968
Members understand group vision	1.000	0.988
Members are close relatives	1.000	0.772
Members come from same village	1.000	0.829
Extraction Method: Principal Component Analysis.		

Then, a pairwise correlation test was carried out to check whether the variables were correlated. All the variables had a correlation score of below 0.5 showing weak correlation between the variables as shown in Table 6.3.

Table 6.3: Pairwise correlation test for indicators of bonding social capital

	Trust leaders decisions	Trust leaders with	Trust improved	Vision	Close relatives	Close village
Trust leaders decisions	1					
Trust leaders with assets	0.4677	1				
Trust improved	0.3679	0.2659	1			
Vision	0.2040	0.1505	0.0986	1		
Close relatives	-0.0349	-0.0299	-0.1469	0.1517	1	
Close village	-0.0704	0.0220	0.0020	0.1240	0.3784	1

Then, all the six variables were included in the PCA matrix which was rotated using orthogonal varimax (Kaiser off) technique to standardize the coefficients. Components with eigenvalues of more than one were selected as they account for the most variance. The scores for the index were then predicted based on rotated factors. The conbach's alpha α was computed to check whether the selected items were related to one latent factor using the 'scale reliability coefficient' which should preferably be above 0.5 in order to accept (Nelson, 2007; Wu, 2012). In this case it was 0.5211 hence all the six bonding capital variables were accepted for further analysis as shown in Table 6.4.

Table 6.4: Bonding social capital indicators conbach's alpha (α) for scale reliability

Test scale = mean (unstandardized items)	
Average interitem covariance:	0.1889
Number of items in the scale:	6
Scale reliability coefficient:	0.5211

6.3.3 Description of variables

Table 6.5: Description of variables, their measurement and expected signs

Variable	Description	Measurement and codes
	Dependent variable (Time varying): 2013 -2016	
PCVCS	Per capita value of grains sold (monetary) $=\left[\frac{Total\ value\ of\ cereals\ sold\ in\ year\ t}{Number\ of\ group\ members\ in\ year\ t}\right]$	Kenya shillings (KES)
	Social capital indicators	
BOND_CAPIT	*Bonding social capital.* (Likert scale) Level of social capital: - Trust - Common ties - Group vision *Likert items used:* 1=strongly disagree 2=disagree 3=neutral 4=agree 5=strongly agree	Index
BRIDG_CAPIT	*Bridging social capital.* Direct, indirect or no linkage to NGOs, Projects, Government departments and farmer CBOs	Index

6.4 Results and discussion

The results for bonding and bridging social capital characteristics of farmer groups in the three clusters are shown in Table 6.6. Analysis of variance (ANOVA) F-test results were used to test if there was significant difference across the three clusters of farmer groups. Cluster means and standard deviations were also computed.

Table 6.6: Farmer groups' level of bonding and bridging social capital

	Farmer group clusters					
	Overall	**High**	**Average**	**Low**	**ANOVA**	
Variable	**N=100**	**N=31**	**N=55**	**N=14**	**F-test**	**P-value**
Cognitive bonding social	3.65 (0.73)	3.74 (0.77)	3.62 (0.71)	3.57 (0.76)	0.37	0.69
Structural bonding social	2.67 (1.22)	2.53 (1.12)	2.79 (1.29)	2.46 (1.18)	0.66	0.52
Relational bonding social	5.45 (0.76)	5.60 (0.88)	5.44 (0.65)	5.18 (0.85)	1.51	0.23
Bonding social capital	3.76 (1.72)	3.52 (1.59)	3.94 (1.80)	3.55 (1.71)	0.69	0.50
Bridging social capital	0.56 (0.51)	0.88 (0.60)	0.44 (0.38)	0.35 (0.45)	10.49***	0.00

Note: *** represents significance level at 1%; Figures before parenthesis are means; Standard deviation is in parenthesis.

6.4.1 Bonding social capital

Analysis of variance (ANOVA) F-test results show that cognitive (having a shared and well understood group vision); structural (close connections in a farmer group like coming from the same village and having close family members); and relational (trust among members and leaders in the group) bonding social capital were not significantly different across the three clusters. The three indicators of bonding social capital were further combined using PCA to show the overall level of bonding social among the farmer groups. Analysis of variance results for bonding social capital further confirm that there was no significant ($F=0.69$, $p=0.50$) difference across the three clusters as shown in Table 6.6.

The level of a shared vision was relatively above average for majority of the groups with an overall mean of 3.65. Most of the groups disagreed that they had close connections in the group with the mean for all groups being 2.67. Level of trust in leaders' decisions, trusting leaders with group assets and a rise in level of trust in the group over the last four years was also not significantly different across the three clusters. This shows that farmer groups in Tharaka North and Tharaka South Sub-Counties had relatively the same level of bonding social capital despite the variation in marketing performance. Bonding social capital is therefore like a necessary condition before any meaningful collective action takes place. The findings concur with Pretty *et al.* (2011) who pointed out that success in collective agricultural activities stems from developing bonding social capital among farmers with a common interest.

6.4.2 Bridging social capital

Bridging social capital relatively distinguishes the three clusters of grains farmer groups in Tharaka North and Tharaka South Sub-Counties as it was significantly (F=10.49, p=0.00) different as shown in Table 6.6. The average score for all the groups was 0.56. This was way lower than that for high performing groups which was 0.88 while that for average and low performing groups was lower than the overall mean at 0.44 and 0.35 respectively as shown in Figure 6.1.

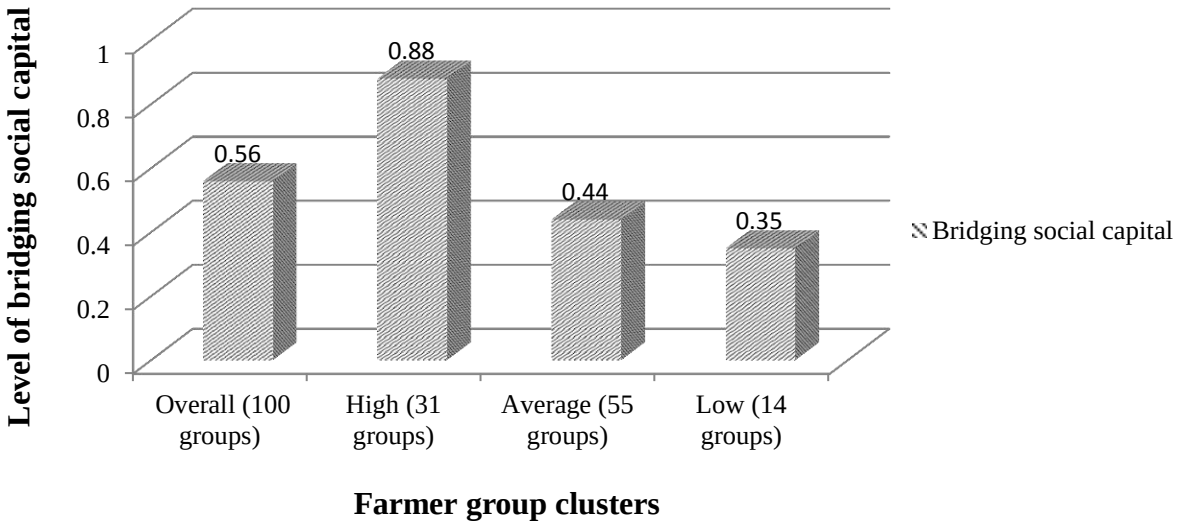

Figure 6.1: Farmer group's level of bridging social capital

The high score for high performing groups could be due to the relatively high direct and indirect linkages with NGOs, projects, government institutions, bulk buyers and membership

to farmers CBOs. Majority of the high performing farmer groups had a direct linkage with the Ministry of Agriculture (MoA), Tharaka Cereals Growers Association (TCGA) one of the farmers Community Based Organization (CBO) and Rural Initiatives Development Programme (RIDEP) a Non-governmental Organization (NGO). These organizations were said to foster linkages with bulk grain buyers, and enhance access to inputs and trainings. This shows that having strong bonding social capital backed up with an equally strong bridging social capital fosters more collective action in relation to collective marketing of grains as compared to having strong bonding capital with weak bridging social capital. This makes bridging social capital like a sufficient condition for success in fostering higher performance in collective marketing. The results concur with Pretty *et al.* (2011) who concluded that for people to gain the most from social capital there is a need for a balanced mixture of bonding, bridging and linking social capital. This also agrees with Van and Adekunle (2012) who concluded that bridging social capital can strengthen farmers' access to knowledge, resources and adoption of agricultural innovations. However, the findings differ with Ruben and Heras (2012) who argue that if bridging social capital is stronger than bonding social capital, collective action in agriculture become more feasible.

6.5 Summary, conclusion and recommendations

6.5.1 Summary

To sum up, farmer groups in Tharaka North and Tharaka South Sub-Counties have relatively strong bonding social capital. This is shown by relatively similar and high level of relational, cognitive and structure dimensions of bonding social capital. This could be because most of the groups were founded and bound by the principle of mutual trust and reciprocity. Bridging social capital measured by external linkages with different actors was statistically different across the three farmer group clusters. High performing groups had the highest average score (0.88), followed by average groups (0.44) and then low groups had the least (0.35).

6.5.2 Conclusion

1. Bonding social capital is the foundation of any meaningful collective action. As a result, farmer groups were similar in terms of having relatively equal and strong bonding social capital regardless of their success in fostering collective action.
2. High levels of bridging social capital embedded within a group with strong bonding social capital fosters higher performance in terms of collective marketing of grains.

6.5.3 Recommendations

1. Groups can further be strengthen their bonding social capital through focusing on building more internal cohesion in form of trust among members and leaders, working as a team to achieve a shared vision and abiding by set group rules.
2. To strengthen bridging social capital across all the farmer groups, it is important for the groups to spread their tendrils and link with new actors along the value-chain, especially with those that link them to new lucrative markets.
3. **Future research: -** Future research can consider measuring the change in the level of bridging and bonding social capital in the farmer groups and compare its effects with the effects from other forms of capital in the groups like physical and financial capital.

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CHAPTER SEVEN
SOCIAL CAPITAL, STRUCTURE, CONDUCT AND GROUP PERFORMANCE

7.1 Introduction

Effective market-oriented farmer groups have long been considered as essential pillars to commercializing agriculture among smallholder farmers. As a result, there has been a continued interest by governments, donor agencies, and researchers to promote farmer based collective action as economic engines to enhance smallholder farmers' access to more lucrative markets at lower transaction costs (Fischer and Qaim, 2012; 2014). The groups are valued for their potentials to foster collective action and social capital useful in linking smallholder farmers to lucrative markets (Magreta *et al.*, 2010).

In Kenya, farmer groups date back to the early 1990s when the government introduced them as a participatory horizontal approach for farmers to come together and freely discuss their issues, reach a consensus and come up with solutions to matters affecting them (Kitetu, 2005). Additionally, these groups provided forums to disseminate extension services to many farmers while offering peer monitoring to limit fall back on technology (Kitetu, 2005). Tolno *et al.* (2015) argues that indeed farmer groups are still important institutions as they not only offer avenues to offer extension services, but also hold a potential to unlocking smallholder farmers access to better paying markets and contribute to reducing poverty.

Literature has documented success and failures of primary-tier farmer groups. Differentials in performance across groups are attributed to differences in individual farmer group characteristics (Verhofstadt and Maertens, 2013). VredesEilanden Country Office [VECO] East Africa (2015) notes that interventions to help farmer groups are highly specific to the nature of the groups, products, markets and value-chains they participate in. It is important for development partners to understand success and failures of groups in order to create successful and sustainable farmer groups especially for developing countries like Kenya (VECO East Africa, 2015). Therefore, development partners need to be informed on the specific areas and challenges, for different kinds of farmer groups, which need intervention.

7.2 Literature review

This section provides a review of literature on measures of farmer group performance and factors influencing group performance. It also contains a review on the role of social capital in organizational performance. The review provides a basis for selected social capital,

structure and conduct variables, and methodologies used to analyze farmer group performance in this study.

7.2.1 Measuring farmer group performance

There exists a wide range of indicators to measure the performance of smallholder farmer groups. In a study in Kenya, Place *et al.* (2004) argue that measuring outputs and direct benefits of groups is an important step as it is what directly determines their welfare benefits to members. Place *et al.* (2004) further conclude that standardization of measures of performance is difficult due to the dynamic nature of groups in Kenya. Hence, the choice of groups and proxy measures of performance matters in explaining differentials in achievements of groups. Verhofstadt and Maertens (2013) concluded that the diversity in the way farmer groups facilitate production and collective marketing of produce is an important indicator of their differences in performance. Ochieng (2014) used volume of sales, member's share of volumes bulked for sale under collective marketing and participation in contract farming as indicators of group marketing performance. Ragasa and Golan (2014) used three proxies to measure performance of Rural Producer Organizations (RPOs): RPO facilitated access to inputs, facilitated joint marketing of members produce, and facilitation of technical guidance to members.

This study focused on marketing performance of grain farmer groups; therefore, value of grains sales was used as a measure of performance. However, sales volume bias due to advantages of group size was addressed by use of a group's per capita value of grains sold (PCVCS) as the measure of performance.

7.2.2 Social capital and organizational performance

Studies have identified a number of positive impacts of social capital on group performance. Liang (2015) conclude that relational (trust among group members), structural (close connections) and cognitive (having a shared vision) dimensions of social capital had a positive influence on the economic performance of farmer cooperatives. Popp *et al.* (2013) adds that trust is a lubricant that smoothens cooperation between actors in a network, and at higher levels, trust can enhance network effectiveness. Lawal *et al.* (2009) also concluded that social capital positively influenced credit access and performance of cocoa farmers in Nigeria. Moran (2005) also asserts that both relational and structural embeddedness of social capital had a positive and significant effect on managerial sales performance and product

innovation in the marketing and delivery of the products to customers. Nilsson, Svendsen and Svendsen (2012) argue that even though it is not easy to measure social capital, it should be included in calculations on economic performance of organizations. The key question hence remains: what is the relative influence of relational, structural and cognitive embeddedness of social capital (bonding social capital) and bridging social capital on a farmer group's performance?

7.2.3 Factors influencing farmer organizations' performance

A number of other studies which have investigated performance at group level have specifically targeted particular types of groups. Most of them used the extent to which the groups' had been able to mobilize collective action through provision of agribusiness services to their members as the proxy for performance.

In Yogyakarta Province Indonesia, Raya (2014) measured the performance of collective action in chili marketing through the percentage of chilies marketed collectively from the total farmer's production. The author found that the amounts sold increased with the age of the group and ability of a group to assist members to access inputs at a lower cost. In a study of farmer groups in Tanzania, Barham and Chitemi (2008) reported similar findings where more mature (age) groups perfomed better. Barham and Chitemi concluded that male-dominated groups performed better than female dorminated groups. Fischer and Qaim (2014) examined the determinants of intensity of smallholder farmers' participation in groups for banana sector groups in Kenya. They conclude that previous benefits received by a member through the group positively influenced their intensity of participation, while timing of proceeds from collective sales and group size had a negative influence.

Ampaire *et al.* (2013) among others analyzed the percentage of members who had sold some of their produce through their Rural Producer Organization (RPO) in Uganda. The authors concluded that the size of the RPO and democracy in leadership positively influenced performance. In addition, poor enforcement of internal controls, and distance to bulking sites had a significant negative effect on effectiveness of group sales. Barham and Chitemi (2008) conclued that strong internal institutions are enabling factors for farmer group marketing performance.

Ragasa and Golan (2014) concluded that external linkages to other organizations and membership commitment through cash contributions had significant positive influence on

RPO performance. However, Barham and Chitemi (2008) found bonding and bridging social capital had no significant influence on farmer group performance. Proximity to past conflict areas reduced the RPO's performance.

Despite, there being a number of studies that have investigated group performance some gaps and challenges still exist. These include how to choose the most appropriate proxy for farmer group performance and secondly, how to best measure independent variables. To maintain consistency while, at the same time, making the analysis more robust, this study chose farmer groups located in the same region and whose marketing of grains was one of their core activities. Additionally, similar variables, new variables and different proxies were incorporated to explore the effects of group heterogeneity. To achieve more robust findings, the sales and some variables were measured across four years to capture the dynamics of time effect on performance. Finally, the volume of sales adjusted to the per capita value of grains sold (PCVCS) collectively was used as the proxy for performance.

In order to inform development partners on the groups' progress, what is working and which pit falls to avoid, this paper sought to evaluate the relative influence of grain farmer groups' structure, conduct and social capital on their marketing performance.

7.3 Methodology

7.3.1 Measuring group marketing performance

The study investigated marketing performance and factors influencing the performance of 100 smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties over a period of 4 years (2013-2016). The outcome variable (performance) was the per capita value of grains sold (PCVCS) by each farmer group for a span of the four (4) years. The PCVCS was obtained by multiplying the physical quantities of each product (assorted grains including: green grams, sorghum, maize, cowpeas and beans) by its selling price and then adding up all the sales incomes and dividing the total value by the number of group members for each year. To reduce group size bias, yearly value of grains sold for each group was divided by the number of group members in each year to generate the PCVCS per year. The PCVCS was highly skewed where some groups reported relatively high figures in thousands while others reported small figures close to zero. To create a close to normal probability distribution of skewed variables and to aid in making the relationship between variables more linear, it is important to transform them (Cohen *et al.*, 2013). Cohen *et al.* (2013) add that, transforming skewed variables helps in making them better fit the assumptions underlying the

regression and also generates more accurate statistical inference. Therefore, a log value of the PCVCS for each of the four years was generated and used as the measure of group performance.

7.3.2 Clustering and generating indices

Cluster analysis was used to place the farmer groups into three (3) categories mainly distinguished by performance. The first, here in, referred to as the *high performing* had 31 groups. The second, the *average performing* had 55 groups, and lastly, the *low performing* had 14 groups.

Principal component analysis (PCA) was used to generate index scores for: internal group practices, record keeping, bonding social capital, and bridging social capital based on a farmer group's linkages with different support actors.

7.3.3 Analytical model for the panel data

Since there was bound to be heterogeneity in these groups, panel data techniques were adopted as they took into account such heterogeneity by capturing differences within and between the groups. Panel data combines both time series and cross-section observations hence giving more informative data, more variability, less variables collinearity, more degrees of freedom and higher efficiency (Hsiao, 2007; 2014). This provided a better view of the dynamics of change across the farmer groups due to better detection and measuring of effects which cannot be observed in pure cross-section or time series data (Hsiao, 2007). This also concurs with Fischer and Qaim (2012) who recommended use of panel data to analyse collective action marketing performance as it helps address issues of endogeneity and self - election bias which is difficult with cross-sectional data.

Wooldridge (2010) and Schmidheiny and Basel (2015) contend that the main reason for using panel data in many applications is to allow the unobserved effect (omitted explanatory variables), that is, ε_i to be correlated to the observed explanatory variables. If such unobserved effects are constant over time, estimators in panel data allow for consistent estimation of the effect of the unobserved variables. Wooldridge (2010) argues that if the cross-sectional units N are believed to be random drawings from a larger population, then Random Effects Model (REM) is considered to be appropriate. Further, if the sample size N is large and time periods T is small then REM estimators are more efficient than Fixed Effects Model (FEM).

The analysis used 100 cross-sectional units and 4 time periods (4 years). Therefore, there were a total of 400 observations (N = 400). This was a balanced panel as each sampled farmer group had 4 observations. The dependent variable (log PCVCS) was expected to be positively or negatively related to the selected explanatory variables.

Time fixed effects which affect all the individuals (farmer groups) in the same way were captured in the model using dummy variables for each time period. This was to control for unexpected variations or unobserved past events that may have an effect on the dependent variable. Since there was a fixed number of time period and individuals $N \to \infty$, both the random effects and fixed effects estimators were assumed to be consistent using time dummy variables under the conditions specified in *Equation 7.1*.

Given the nature of the data, Error Components Model (ECM) also referred to as random effects Approach was adopted. This is shown in the ECM model adopted from (Schmidheiny and Basel, 2015) as shown in *Equation 7.1*.

$$y_{it} = \alpha + \delta_t + x_{it}^{'}\beta + z_i^{'}\gamma + c_i + u_{it}, t = 1,...,T, \quad \text{..... } \textbf{\textit{Equation 7.1}}$$

Where: ***i*** a randomly drawn sample (unit) from a population denoted as i =1,…,N; $\boldsymbol{y_{it}}$ observed outcome; $\boldsymbol{\alpha}$ is the intercept (constant); $\boldsymbol{\delta_t}$ dummy variables for time fixed effects; $x_{it}^{'}$ is a K-dimensional row vector of observed (covariates) time-varying explanatory variables; $\boldsymbol{\beta}$ is a K-dimensional column vector of parameters; $z_i^{'}$ is time-invariant observed explanatory variables excluding the constant; $\boldsymbol{\gamma}$ is a M-dimensional column vector of parameters; $\boldsymbol{c_i}$ is individual-specific unobserved heterogeneity and $\boldsymbol{u_{it}}$ is the random (idiosyncratic) error term; and ***t*** are time periods where t = 1,…,T

7.3.3.1 Assumptions of the Random Effects Model (REM)

The assumptions of REM were based on (Wooldridge, 2010; Schmidheiny and Basel, 2015). The first assumption is that the individual-specific effect is a random variable which is uncorrelated with any explanatory variable of the past, current and the future time periods of the same individual.

RE1: unrelated effects

$$E[c_i | X_i, z_i] = 0 \quad \text{..... Equation 7.2}$$

Where: E are effects, c_i is an individual-specific effect, X_i are time varying explanatory variables of individual *i* and z_i is time-invariant observed explanatory variables excluding the constant.

However, if the FEM had been adopted this assumption would have been violated because the variable c_i is omitted and potentially correlated with the other explanatory variables. This would make the α, β and γ biased and inconsistent.

The second assumption is that the individual specific effect has constant variance

RE2: Effect Variance

$$V[c_i | X_i, z_i] = \sigma_c^2 < \infty \quad \text{(homoscedastic)} \quad \text{..... Equation 7.3}$$

$$V[c_i | X_i, z_i] = \sigma_{c,i}^2 (X_i, z_i) < \infty \quad \text{(heteroscedastic)} \quad \text{..... Equation 7.4}$$

Where: V is variance, c_i is an individual-specific effect, X_i are time varying explanatory variables of individual *i*, z_i is time-invariant observed explanatory variables excluding the constant, σ_c^2 is constant variance and ∞ is infinity.

Lastly, the random (idiosyncratic) error term u_{it} is assumed to be uncorrelated with the individual specific effects. That is, it is uncorrelated with any explanatory variable of the past, current and the future time periods of the same individual. This is a strong assumption as it rules out use of any time lagged dependent variables.

RE3: Strict Exogeneity

$$E\left[u_{it} \middle| X_i, z_i, c_i\right] = 0 \text{ (mean independent)} \quad \text{..... Equation 7.5}$$

Where: E are effects, u_{it} is the random (idiosyncratic) error term, X_i are time varying explanatory variables of individual i, z_i is time-invariant observed explanatory variables excluding the constant and c_i is an individual-specific effect

7.3.3.2 Fittness of the Random Effects Model (REM)

To compare between the Random effects model – Generalized least square regression (REM-GLS) and the Fixed Effects Model (FEM) and test the robustness of the models, different tests were used as shown in annex Table 0.6 to annex Table 0.7. The different diagnostic tests were used to choose between pooling or not pooling, using FEM or REM-GLS, and check if there was serial correlation or no serial correlation. These tests were: Breusch and Pagan (BP) Lagrangian multiplier, Hausman and Pesaran cross-sectional dependence (Pesaran CD)

Breusch and Pagan (BP) Lagrangian multiplier test was used to test for random effects in the balanced panel data (annex Table 0.9). The null hypothesis in BP test is that the variance of random effect is zero: $Var[u_i]=0$ (Wooldridge, 2010). The result for BP Lagrangian multiplier test for random effects showed that variance (u) was equal to zero (0). This meant that every observation (farmer group) had the same intercept ($\tilde{\alpha} = \alpha + u$), therefore, the data was suitable to run a pooled regression (Baltagi, 2008). Chibar2 was 0.000 and not statistically significant (Probability > chibar2 = 1.0000). Chibar2 refers to the likelihood-ratio (LR) test that is displayed when testing on the boundary of the parameter space. Therefore, the LR test estimated variance component (something that is always greater than zero) was not different from zero. The Breusch and Pagan Lagrangian multiplier test is as shown in *Equation 7.6* below.

$$LogPCVCS[SNum,t] = Xb + u[SNum] + e[SNum,t] \quad \text{..... Equation 7.6}$$

Where: *LogPCVCS* is the independent variable; *X* is the set of explanatory variables; *b* is the coefficient explanatory variables; *SNum* is the serial number for each of the 100 farmer groups across the four time periods; *t* is time periods (year), 2013 to 2016; *u* individual fixed effects; and *e* is stochastic error.

Having confirmed that it appropriate to run pooled regression, data was analysed using FEM and REM-GLS and the results compared. Hausman test was applied in checking whether

there was any significant difference between FEM and REM-GLS estimators (annex Table 0.10). The null hypothesis (H_0) was REM-GLS was more appropriate while the alternative hypothesis (H_1) was the FEM was more appropriate. The P-value of the Chi square distribution was not statistically significant; hence, the results failed to reject the H_0 that the REM-GLS estimators were more appropriate for this analysis. Additionally, REM-GLS overall probability was statistically significant at 0.000 which was far smaller than that of the FEM which was 0.018. This showed that the coefficients in both models were statistically different from zero; however, the REM-GLS model coefficients were more robust. The REM-GLS within R^2 was less superior (0. 0469) than the between R^2 (0.5803), this confirming that the REM was more suitable for this case compared to the FEM.

Diagnostic tests for serial correlation in the residual were carried out. Pesaran cross-sectional dependence (Pesaran CD) test was used to test if the residuals were correlated across entities (Pesaran and Tosetti, 2011). The null hypothesis (H_0) that there was no serial correlation in the model while the alternative hypothesis (H_1) postulated that there was serial correlation. The results failed to reject the H_0 since the probability was very high at 1.8263; showing that there was no serial correlation in the REM-GLS (annex Table 0.11).

Schmidheiny & Basel, (2015) argues that one can never be sure about equicorrelated errors and reccomends reporting cluster-robust errors for the random effects (RE) estimators. The REM constant (α), coefficients of explanatory variables (β) and M-dimensional column vector of parameters (γ) are assumed to be assymptotically efficient estimators and the can be consistently estimated using the cluster-robust covariance estimator which treats each individual as a cluster. Therefore, generalized least squares (GLS) estimators were used for the REM.

The error terms shown by *Sigma_u* and *Sigma_e* were robust. *Sigma_u* which is the standard deviation of individual fixed effects was zero (0). *Sigma_e* is the standard deviation of the stochastic error which changes among individuals and across time was 4.0028. The Rho fraction of variance due to u_i was zero (0). The Stata software syntax for the both the RE and RE models was: *xtreg , re vce(cluster GrpName)* and *xtreg , fe vce(cluster GrpName)* respectively, while the results are as shown in Table 7.4 and in annex Table 0.6 and annex Table 0.7.

Having confirmed that; pooling was appropriate as indicated by the Breusch and Pagan Lagrangian multiplier test, REM-GLS was more robust than FEM as indicated by the

Hausman test, there was no serial correlation as indicated by the Pesaran CD test and that GLS estimators were appropriate.

To get more accurate estimators and capture both within farmer group and across farmer groups heterogeneity, Random effects model - cross-sectional time-series feasible generalized least square regression (REM-FGLS) was adopted for the analysis (Table 7.4, annex Table 0.13). The Stata software syntax for the model was: *xtgls , panels(het) corr(psar1) rhotype(tscorr).* Cross-section autocorrelation [*rhotype (tscorr)*] was computed to smoothen the coefficients. Table 7.4, annex table 0.12 and annex table 0.13 shows the model diagnostics which indicated that the results reported GLS coefficients, 400 observations for 4 time periods, the panels were assumed to be heteroskedastic through use of panel specific first order autocorrelation error structure, the estimated covariances and autocorrelations were 100 and the estimated coefficients were 25. The Wald chi2 was 212.04 with a Prob > chi2 of 0.000.

Finally, the REM-FGLS was selected and used to determine the social capital, structure and conduct factors that influenced marketing performance of smallholder grain farmer groups in Tharaka North and Tharaka South Sub-Counties, Kenya.

7.3.4 Description of variables

Table 7.1: Description of variables, their measurement and expected signs

Variable	Description	Measurement and codes	Expected sign
	Dependent variable (Time varying): 2013 -2016		
PCVCS	Per capita value of grains sold (monetary) $=\left[\frac{Total\ value\ of\ cereals\ sold\ in\ year\ t}{Number\ of\ group\ members\ in\ year\ t}\right]$	Kenya shillings (KES)	
	Time invariant (stock) variables		
CMKT_FORM	*Main reason of formation.* It was grains marketing or other reasons	1 = Grains marketing 0 = Otherwise	+
CMKT_BNFT	*Main benefit to members.* Whether main benefit was grains marketing or other benefits	1 = Grains marketing 0 = Otherwise	+

Variable	Description	Measurement and codes	Expected sign
MONT_CONT	*Monthly monetary contribution amount.* The total amount of money each group member contributes monthly	KES	+ -
TB_BANK_AMT	*Table banking monetary amount.* The total amount of money each group has in circulation in its table banking	KES	+ -
LEAD_MF_RAT	*Leaders' male female ratio.* Ratio of the number of males to female members in leadership	Number males/ Number females	+ -
WARD	*Ward located.* The administrative ward a farmer groups is located	Dummy	+ -
REC_KEEP	*Record keeping.* (Yes/No) Keeping records for minutes, group members, transactions, finances, contributions, participation in activities and trainings	Index	+ -
INT_PRAC	*Internal practices.* (Likert scale) 8) Attending internal meetings 9) Attending external meetings 10) Participation in decision making 11) Theft in the group 12) Conflict resolution mechanisms 13) Learn from past experiences 14) Make future plans *Likert items used:* 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree.	Index	+ -
TRN_LEAD	*Trained leaders.* Number of top leaders with leadership training (chairperson, vice chairperson, secretary, vice secretary and treasurer).	Score	-
TRN_MKT	*Trained in Marketing.* Some farmer group members had received training in marketing, post-harvest handling, value addition,	Score	+

Variable	Description	Measurement and codes	Expected sign
	tendering and procurement.		
MKT_COMT	*Marketing committee.* Group has a marketing committee	1 = Yes 0 = No	+
STORE_ACC	*Group store.* Access to a common group store	1 = Yes 0 = No	+
BOND_CAPIT	*Bonding social capital.* (Likert scale) Level of social capital (Trust, common ties and group vision) *Likert items used:* 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree.	Index	+
BRIDG_CAPIT	*Bridging social capital.* Direct, indirect or no linkage to NGOs, Projects, Government departments and farmer CBOs	Index	+
	Time variant (flow) variables: 2013 -2016		
GRP_AGE	*Group age.* Number of the years the group has existed since registration	Number of years	-
CREDIT_ACC	*Credit access*. Monetary amount of external credit accessed by the group	KES	+
SEED_ACC	*Seed facilitation.* Group facilitated access to seeds	1 = Yes 0 = No	+
PEST_ACC	*Pesticide facilitation.* Group facilitated access to pesticides	1 = Yes 0 = No	+
FERT_ACC	*Fertilizer facilitation.* Group facilitated access to fertilizer	1 = Yes 0 = No	+
MKT_OUT	*Main market outlet.* Main market outlet the group sold to in each year like institutional buyers (farmer CBOs, schools and companies); or middlemen and local market	1 = Institutional buyers 0 = Other buyers	+

7.4 Results and discussion

7.4.1 Group marketing performance

All the 100 farmer groups had sold grains collectively at least once from 2013 to 2016. Only 10% of the groups managed to sell grains in all the four years while 41% sold only once in the four years as shown in Table 7.2. Additionally, there was a general steady rise in the number of farmer groups that sold their grains collectively in the four year study period as shown in Table 7.3. However, only 10 groups managed to sell grains collectively across all the four years of study while 41 sold only once during the same period (Table 7.2). The average Per Capita Value of Grains Sold (PCVCS) was statistically different at 1% significance level across the three farmer group clusters for all the four years. There was a relatively wide difference in farmer group cluster performance where high performing groups had an average PCVCS of KES 22,441 compared to average and low groups which had KES 1,523 and KES 52, respectively.

The average PCVCS for all groups rose from KES 7,046.13 in 2013 with 41 groups to KES 10,239.13 in 2016 with 62 groups (Table 7.3). The average PCVCS for all the groups for the four years was KES 7,801.39. This means that, if the earning from all the farmer groups sales was to be put in one kitty, each of the 2,480 members would have earned an average of KES 7,801.39 for each of the four years. Though the number of groups that sold had rose, the value of grains sold in 2014 was relatively low compared to the other years. This could be due to low harvests experienced in Tharaka North and Tharaka South Sub-Counties that particular year, due to failed rains. High performing groups had the highest average and standard deviation of PCVCS across the four years, followed by average groups and lastly low performing groups with significantly low sales.

Table 7.2: Number of times farmer groups sold grains collectively

Number of times groups sold grains	Number of groups that sold
Once (1)	41
Twice (2)	29
Thrice (3)	20
Four times (4)	10
Total	**100**

Table 7.3: Farmer groups average Per Capita Value of Grains Sold (PCVCS) from 2013 to 2016

		Farmer group clusters					
	OVERALL	**High**	**Average**	**Low**	**Percentage that sold**	**ANOVA**	
Variable	**N=100**	**N=31**	**N=55**	**N=14**	**(N=100)**	F-test	P-value
PCVCS_2013	7,046.13	21,005.84	958.20	52.23	41	9.53***	0.00
PCVCS_2014	4,383.11	12,115.97	1,133.21	27.84	46	13.68***	0.00
PCVCS_2015	9,537.18	28,181.36	1,441.15	59.50	50	5.03***	0.01
PCVCS_2016	10,239.13	28,461.45	2,557.68	66.82	62	10.56***	0.00
PCVCS Average 2013-2016	7,801.39	22,441.16	1,522.56	51.60		256.65***	0.00
Log PCVCS Average 2013-2016	7.36	9.55	7.12	3.43			

Note: *** represents significance level at 1%

7.4.2 Influence of structure, conduct and social capital on group performance

The Random effects model - cross-sectional time-series FGLS regression (REM-FGLS) marginal effects (dy/dx) results were generated and were interpreted at 1%, 5% and 10% significance levels as shown in Table 7.4. The results show the magnitude (dy/dx coefficient) to which specific smallholder grain farmer groups' attributes facilitate their collective action inform of marketing performance. The Random effects model - GLS regression (REM-GLS) model results have also been displayed in Table 7.4 and annex Table 0.13. However, the REM-GLS results were not discussed since the model was considered to be inferior compared to the REM-FGLS. The REM-GLS results were displayed (Table 7.4 and annex Table 0.6) for comparison purposes and to confirm that indeed REM-FGLS had more accurate estimators due to ability to capture both within group and between groups heterogeneity.

To check if there were unobserved time effects across the years, dummy variables here generated for each year a group made sales were generated. The year 2013 was taken as the base. The results show that there were unobserved time effects on the groups' performance as indicated by the rising coefficient values and significance across the years. The year 2015 and 2016 had a significant (dy/dx = 1.470, p=0.000) and (dy/dx = 1.941, p=0.000) respectively and positive effect on group performance. This shows a general rise in performance of the groups across the years. This could be because of internal motivation within a group if in a proceeding year it made good returns; this may have motivated members to sell more in successive years. This was also indicated by the rise in average number of members who participated in collective marketing across the years. This differs with Jiménez *et al.* (2014) who used time firm fixed effects dummies to control for unobserved time-varying heterogeneity in firms which had significant negative influence on performance of banks; explained to be as a result of moral hazard problems. However, in their study Fischer and Qaim (2014) capture unobserved banana farmer group fixed effects using group dummies.

Table 7.4: Comparison of Random effects-FGLS and Random effects-GLS estimators for factors influencing group performance

	Random effects cross-sectional time-series FGLS			Random effects GLS		
Log Per Capita Value of Grains Sold (PCVCS)	**Marginal Effects (dy/dx)**	**Standard Error**	**P-Value**	**Marginal Effects (dy/dx)**	**Robust Standard Error**	**P-value**
2014 _ Time dummy	0.304	0.401	0.447	0.077	0.554	0.890
2015 _ Time dummy	1.470***	0.408	0.000	0.880	0.615	0.152
2016 _ Time dummy	1.941***	0.395	0.000	1.936***	0.566	0.001
Mukothima ward _ Market proximity dummy	-1.803***	0.644	0.005	-2.093***	0.628	0.001
Gatunga ward _ Market proximity dummy	-2.832***	0.873	0.001	-3.060***	0.979	0.002
Marimanti ward _ Market proximity dummy	-1.413*	0.829	0.088	-1.000	0.999	0.317
Gatue ward _ Market proximity dummy	2.157	1.391	0.121	1.845	1.495	0.217
Group age	-0.036**	0.018	0.042	-0.034*	0.018	0.057
Log monthly contribution	-0.028	0.081	0.732	-0.034	0.099	0.727
Formation reason _Grain marketing	-0.891	0.544	0.101	-1.023*	0.584	0.080
Main benefit-Grain marketing	0.718	0.457	0.116	0.849	0.582	0.145
Leaders gender composition (*male-female ratio*)	0.381**	0.166	0.022	0.504**	0.221	0.022
Log loan amount	-0.119**	0.049	0.015	-0.134*	0.070	0.057
Leadership training	0.122***	0.029	0.000	0.137***	0.032	0.000
Marketing committee	0.664**	0.321	0.038	0.742*	0.425	0.081
Access to a group store	0.618	0.407	0.129	0.389	0.378	0.304
Main Buyer _ Institutional	2.253***	0.451	0.000	2.410***	0.579	0.000
Accessed seed 2013-2016	1.282***	0.370	0.001	1.118**	0.568	0.049
Accessed pesticide 2013-2016	3.171**	1.424	0.026	4.169***	0.705	0.000
Accessed fertilizer 2013-2016	-1.028	0.715	0.150	-0.567	0.824	0.491
Record keeping index	0.228	0.497	0.647	0.215	0.651	0.741
Internal practices index	-0.353***	0.127	0.005	-0.324**	0.133	0.015
Bonding social capital index	0.313	0.193	0.105	0.238	0.240	0.322
Bridging social capital index	1.074***	0.293	0.000	0.922***	0.320	0.004
Constant	-0.077	1.754	0.965	0.822	2.071	0.691

Coefficients:	*generalized least*	*Number of*	*400*	*Between R^2*	*0.5803*	*Wald chi2(24)* *535.630*
Panels:	*heteroskedastic*	*Number of groups*	*100*	*Within R^2*	*0.0469*	*Prob > chi2* *0.000*
Correlation:	*panel-specific AR(1)*	*Time periods*	*4*	*Rho*	*0.000*	*Sigma_u* *0.000*
Estimated covariances	*100*	*Wald chi2(24)*	*212.04*	*Mfx y linear prediction*	*4.1718*	*Sigma_e* *4.0028*
Estimated autocorrelations	*100*	*Prob > chi2*	*0.000*			

Note: *, **, *** represents significance levels at 10%, 5% and 1% respectively.

A farmer group located in Chiakariga Ward had a statistically significant probability of making lesser value of grains sales relative to a group from Mukothima (dy/dx = -1.803, p=0.005), Gatunga (dy/dx = -2.832, p=0.001) and Marimanti (dy/dx = -1.413, p=0.088) Wards. Despite there being no clear explanation from literature for this finding, additional field observation and tests offer plausible insights. Correlation test results indicate a strong correlation between a group's location by Ward and membership to specific farmer CBO's. Membership to specific CBO's was also based on proximity to a CBO's main grain store which acted as a grain collection centre for member farmer groups. This explains why farmer groups in Mukothima, Gatunga and Marimanti Wards have a higher probability of selling more which could be due to the added advantage of being served by Tharaka Cereals Growers Association (TCGA) which is the largest and most influential grain farmers CBO in Tharaka North and Tharaka South Sub-Counties. Tharaka Cereals Growers Association (TCGA) being a secondary-tier level umbrella organization was therefore more successful in creating gains for its members. The gains included, offering member farmer groups opportunities to be linked with institutional buyers like World Food Programme (WFP), East Africa Breweries Limited (EABL), Imara Limited and TCGA itself. Such buyers offered better prices than the local middlemen that most farmer groups in Chiakariga, Marimanti and Gatue Wards sold to. Price was therefore a good incentive to sell more collectively. The finding concurs with Muriithi *et al.* (2011) who found out that most farmer groups which participated in collective marketing of French beans were those located near collection centers.

Results revealed that the age of a farmer group had a significant (dy/dx = -0.036, p=0.042) negative influence on its performance with regard to collective marketing of grains. Group age was measured from the time a group was formally registered under the Ministry of Gender Children and Social Development (MGCSD). Younger groups performed better than the older groups. This contradicts the learning curve argument and could be because young groups avoid mistakes made by the older groups. However, this disagrees with Fischer and Qaim (2012) who found that older groups among banana farmers in Kenya performed better. Additionally, most young groups could have been formed with collective grains marketing being a core objective. Therefore, such groups invested a lot in the success of collective grains marketing ventures. However, the main reason for forming majority of the older smallholder farmer groups and their activities were diverse and went beyond collective grains

marketing. Majority of the older groups had table banking and welfare motives taking precedence. This concurs with the findings of Ajani and Mgbenka (2013); Ayieko, Bett and Kabuage (2014) who concluded that indeed farmer organizations played diverse roles including agricultural production, marketing and welfare.

Leadership gender composition measured by the ratio of male to female leaders in a group had a significant (dy/dx = 0.381, p=0.022) positive influence on performance. Results show that high performing groups had relatively higher number of male leaders relative to female leaders. The relatively higher performance for male led groups could be because men tend to be more aggressive in lobbying for higher incomes especially for important household commercial enterprises. This could be because men have relatively lesser household chores in traditional African societies. Therefore, male leaders may have more time to give attention to market search activities for farmer groups they lead. This concurs with Fischer and Qaim (2012) who found out that farmer groups contributed to increased male control over revenues and banana production activities in Kenya. Barham and Chitemi (2009) also found out that gender composition influenced group marketing performance as male-dominated groups tend to perform better. Fischer and Qaim (2012) further argue that time opportunity costs for group participation tend to be relatively higher for women than men, leading to a lower benefit-cost ratio for women.

Access to external credit, measured using amount of loans received, had a significant (dy/dx = -0.119, p=0.015) negative influence on farmer group performance. Results reveal that majority of the farmer groups who took loans spent the money on other enterprises or shared the money among members for personal use. The farmers then made the choice to use the money for either agriculture or activities like building houses, paying school fees and meeting emergency family expenses. Very few groups reported spending their loaned money to finance collective grain marketing activities. This confirms the diverse nature of activities that farmer groups pursued and the variation in priorities depending on what the groups perceived needed more financial attention. The findings concur with Ngozi (2015) that farmers rarely invested borrowed funds for the intended purpose but chose to divert the loans to different activities mostly outside agricultural projects which later affected their repayment capacity.

The results indicated that an increase in the number and diversity of leadership training had a positive and significant (dy/dx = 0.122, p=0.000) influence on farmer groups' performance.

The leadership training included group dynamics, specific roles of different positions, finance management and record keeping. This is because training may enhance internal practices like proper financial management, record keeping and building members support and confidence in the management's capacity. Having confidence in the leadership could have contributed to members identifying more with the group. This may also motivate members to support their leaders when they shared ideas on how to better participate in new markets collectively. However, this contradicts with Ampaire *et al.* (2013) who concluded that training in leadership had a significant and negative influence on rural producer organizations (RPOs) performance.

Having a specific committee to market a farmer group's grains had a significant (dy/dx = 0.664, p=0.038) and positive influence. The positive influence could be due to the committee being a specialized team whose key role was to look for markets which led to a group being more organized and effective in grains bulking logistics, market search, and negotiation of better terms and conditions of payment. Marketing committee leaders could also have been able to maintain strong contacts and credibility with buyers due to more personalized and frequent interactions. This could have created an incentive for the group members to participate in collective grain markets and also an incentive for buyers to engage such groups in buying contracts. This concurs with Garming *et al.* (2013) who investigated the importance of having small marketing committees within a farmer group.

Selling to institutional buyers had a high and significant (dy/dx = 2.253, p=0.000) positive influence on the PCVCS of a farmer group. These institution buyers refer to companies, organizations and government bodies which bought in bulk including World Food Programme (WFP), Imara Limited and East Africa Breweries Limited (EABL). Analysis also indicated a high correlation between selling to institutional buyers and selling under contracts. This was also correlated with better price motive being one of the key concerns for farmers when choosing markets. This shows that institutional buyers mainly bought under contracts and at better prices than that offered by middlemen and in local markets. Therefore, grain farmer groups with more capacity to lobby for institutional buyers for price advantages associated with bulk purchases had a higher probability of performing better. This had a positive incentive for farmers to participate more in collective marketing of grains due to lesser transaction costs which would have otherwise been incurred while looking for markets (Ochieng, 2014). However, this did not come without its own fair share of challenges where

majority of the groups argued that institutional buyers mainly delayed the payments. This discouraged some members who could have otherwise participated in collective grain marketing. At times some members had to sell only a fraction of their grains to the institutional buyers and individually sell the rest in local markets and middlemen for immediate cash needs. This includes cases where a farmer has no cash to meet immediate school fees needs or purchase of other food items. Fischer and Qaim (2014) also argue that resource poor farmers have a high preference for immediate cash payments and delays in payments is likely to reduce the intensity of collective marketing.

There was a significant and positive effect on grain marketing performance of groups that facilitated collective access to improved seed (dy/dx = 1.282, p=0.001) and pesticides (dy/dx =3.171, p=0.026) for its members. This occurred through the group members collectively buying the inputs, or a supporting institution like the Ministry of Agriculture (MoA) and potential buyers offering them for free or at subsidized prices. This was even stronger where a buyer offered such inputs at subsidized prices on condition that the members had to sell their produce to the buyer. The results support the idea that groups that facilitate input access for its members create an important incentive to be committed to farmer group activities (Verhofstadt and Maertens, 2013).

Results indicated that internal group practices index had a significant (dy/dx = -0.353, p=0.005) and negative influence on grain marketing performance. The internal group practices were: the level of participation in meetings and decision making, organizational culture like following of set rules and theft cases, and organizational capacity in making future plans. This shows that majority of the groups relatively disagreed on their groups practicing eight selected positive internal practices expected in a group. This was particularly likely when members were not involved in making key group decisions reducing their trust and confidence in managerial decisions. Additionally, failure to abide by set rules and cases of theft in a group may also have weakened internal cohesion leading to reduced member commitment. Similar findings were reported by Ampaire, *et al.* (2013), who concluded that failure to abide by specified group pratices had a negative influence on the performance of rural producer organizations (RPOs) in Uganda. Barham and Chitemi (2008) asserted that strong internal institutions had the potential to enhance farmer groups marketing performance.

As earlier hypothesized, bridging social capital had significant (dy/dx = 1.074, p=0.000) and positive influence on per capita value of grains sold across the groups. The high performing groups had bigger networks (more connections) relative to the average and low performing groups. As a result, such groups were more integrated into value chains. This offered linked groups opportunities to tap resources like capacity building, trainings and linkage to more lucrative markets. The high positive effect was because linkage to supporting organizations had ripple effects on not only getting better markets but also capacity building to better run the groups and lobbying to encourage collective marketing. This agrees with Kassie *et al.* (2013) who concluded that social networks facilitated farmers' access to credit, information and inputs. With regard to farmer group performance, the findings concurred with Thorgren, Wincent and Örtqvist (2009) who concluded that a bigger network influenced the innovation and performance of small groups when formed through bottom up approach. This created more member commitment, social capital and motivation to participate. A few other studies also made similar findings; that groups with stable external linkages had a higher marketing performance potential (Ragasa and Golan, 2014; Ochieng, 2014).

7.5 Summary, conclusion and recommendations

7.5.1 Summary

The study investigated group structure, conduct and social capital factors that influence grain farmer groups' marketing performance. The performance (average PCVCS) of the groups rose steadily and significantly from KES 7,046.13 in 2013 where 41 percent of the groups participated in collective marketing to KES 10,239.13 in 2016 with 62 percent of the groups. This shows that more and more smallholder farmers were taking up collective selling of grains. Results show that groups that were more successful in collective grains marketing were those which: had a higher proximity to markets, maintained a vast network of support actors including bulk buyers and capacity building institutions, had diverse leadership trainings, were able to facilitate collective access to high-value inputs like seed and fertilizer, and had active grains marketing committees. Nonetheless, structural aspects like group age (older), main reason for formation and conduct aspects like diverting loans to other activities other than grains marketing had a significant negative influence on group performance. It was noted that bonding social capital, while necessary, was not sufficient in facilitating groups' access to better markets. On the other hand, bridging social capital had positive and significant influence on group performance. This underscores that, it is not only the internal strengths of a group *per se* that matters, but also 'who you know' and what they offer.

7.5.2 Conclusion

1. Farmer groups mostly shared external credit among members or diverted the money to other activities other than collective grain marketing.
2. Having a trained leadership and an aggressive group marketing enhanced returns from collective grain marketing.
3. Institutional buyers offered better prices to farmers compared to other buyers like middlemen and local markets.
4. Grain farmer groups linked to many diverse organizations were exposed to wider market horizons for inputs and produce giving them a higher potential to sell more collectively.

7.5.3 Recommendations

1. Farmer groups can be trained on how to spend loans in line with grains production and marketing in order to change the current negative effect external loans have on collective marketing of grains.
2. Capacity building is still necessary to strengthen the management and marketing skills in primary-tier farmer groups. However, capacity building support should be done carefully to avoid creating donor dependency among groups.
3. Contractual marketing of grains with institutional buyers can be encouraged to capture a higher price premium. The contracts can also specify reasonable payment periods.
4. Inter-farmer group collaborations can be encouraged through advocacy activities and linkage forums. This can help groups share experiences, learn from each other and also strengthen their bridging social capital in lobbying for more lucrative markets.
5. **Future research: -** Future studies can consider using shareholders wealth as a measure of performance. Additionally, the level of social capital in farmer groups from Tharaka North and Tharaka South Sub-Counties, Kenya can also be measured after a few years to determine if there is any significant change and its influence on performance then.

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APPENDICES

Appendix 1: Chapter 4 clustering farmer groups

Table 0.1: Farmer group clustering

. cluster Kmean PCVCSavLn GrpAge MembFeeAmt PrdContAmt TblBankAmt OtherEntNum LeadTrain GrpExCrt4yrs GrpCont4yrs RcdIdxPCA_Rotated IntPrcIdxPCA_Rotated Bond_Soc2 nBetweenness Ward MebCBO Benefit1 GrpStorAcc GrpMainMkt, measure (gower) k(3) name (Farmer_group_cluster)

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. tab  Farmer_group_cluster
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Farmer_group_cluster	Freq.	Percent	Cum.
1	31	31.00	31.00
2	14	14.00	45.00
3	55	55.00	100.00
Total	100	100.00	

Appendix 2: Chapter 5 social network measures of centrality
Table 0.2: High performing groups' measures of centrality

	Degree		Closeness	Betweenness	Power	Fragment
Farmer group	**No. of ties**	**nDegree**	**FreeClose**	**nBetweenness**	**nPower**	**Frag.**
Maendeleo_B.	5	0.020	0.353	2.071	0.551	0.137
Makuba A.	4	0.016	0.397	0.455	0.813	0.122
Gaiciuma_B._Women	9	0.035	0.410	1.264	1.773	0.122
Mathina	6	0.024	0.383	0.303	1.440	0.122
Kamiti	9	0.035	0.407	1.134	1.317	0.122
Gacheria	7	0.028	0.399	0.599	1.628	0.122
Gatithini_Irrigation	3	0.012	0.392	0.254	0.523	0.122
Njuki_Youth	9	0.035	0.407	3.857	0.742	0.137
Mwendwa_Mixed	5	0.020	0.355	0.775	0.573	0.122
Nthunguya_T.	5	0.020	0.394	0.420	1.014	0.122
Twanthanju_B.	8	0.031	0.402	0.949	1.292	0.122
Mungano	3	0.012	0.390	1.627	0.425	0.137
Kathangacini_B	3	0.012	0.392	0.254	0.523	0.122
Kamwitha	3	0.012	0.349	0.214	0.541	0.122
Thiti_mothers	8	0.031	0.404	1.244	1.479	0.122
Mukonko	8	0.031	0.385	0.500	1.575	0.122
Ngongo_Aka_Ntoroni	4	0.016	0.394	0.529	0.498	0.122
Thanantu_P_and_G	6	0.024	0.404	1.103	0.708	0.122
Tharaka_Poultry_R.	10	0.039	0.407	2.245	1.769	0.122
Nthungu_Cereals	7	0.028	0.402	1.317	1.092	0.122
Nthungu_Ya_Thangatha	2	0.008	0.321	0.031	0.298	0.122
Magikeno	2	0.008	0.355	0.070	0.326	0.122
Seven_in_One_Mix	9	0.035	0.387	0.660	1.629	0.122
Thanantu_Water_P.	3	0.012	0.319	0.147	0.339	0.122
Bidii	2	0.008	0.387	0.153	0.422	0.122
Mubango_B.	7	0.028	0.407	1.237	0.963	0.122
Malindi	3	0.012	0.392	0.285	0.487	0.122
Mwitethia_F.F.A	3	0.012	0.392	0.285	0.487	0.122
Nkumburu	2	0.008	0.327	0.057	0.251	0.122
Kiamauti_Widows	7	0.028	0.334	0.393	1.035	0.122
Kaguni_B.	8	0.031	0.402	1.611	1.675	0.122
Mean	5.484	0.022	0.382	0.840	0.909	0.123
Minimum	2.000	0.008	0.319	0.031	0.251	0.122
Maximum	10.000	0.039	0.410	3.857	1.773	0.137
Standard Deviation	2.593	0.010	0.028	0.823	0.508	0.005
Variance	6.725	0.000	0.001	0.678	0.258	0.000

Table 0.3: Average performing groups' measures of centrality

	Degree		Closeness	Betweenness	Power	Fragment
Farmer group	**No. of ties**	**nDegree**	**FreeClose**	**nBetweenness**	**nPower**	**Frag.**
Gakiminte_Orphans	4	0.016	0.357	0.301	0.591	0.122
Utumi_Women	3	0.012	0.349	0.156	0.537	0.122
Umoja_Farmers	5	0.020	0.359	0.791	0.602	0.122
Kinyuru_Women	3	0.012	0.349	0.156	0.537	0.122
Gakirwe_Women	3	0.012	0.349	0.156	0.537	0.122
Makena_Focus	3	0.012	0.349	0.156	0.537	0.122
Kiraro	3	0.012	0.349	0.156	0.537	0.122
Gacheri_Women	3	0.012	0.349	0.156	0.537	0.122
Wendo	9	0.035	0.407	1.304	1.805	0.122
Sunshine	6	0.024	0.399	1.344	1.057	0.122
Swara	2	0.008	0.321	0.031	0.298	0.122
Kaguni	3	0.012	0.392	0.254	0.523	0.122
Runkurunu	4	0.016	0.394	1.729	0.526	0.137
Sungura	2	0.008	0.387	0.153	0.422	0.122
Kareti	0	0.000	0.143	0.000	0.000	0.108
Kaguni_A.	5	0.020	0.397	0.388	1.048	0.122
Tharakagreen_C.A.N	4	0.016	0.351	0.814	0.532	0.122
Mpuoni	4	0.016	0.349	0.214	0.832	0.122
Nyamboni	6	0.024	0.357	0.347	1.393	0.122
Kyewa	6	0.024	0.359	0.638	0.907	0.122
Matua	7	0.028	0.359	0.519	1.424	0.122
Kaijiumia	4	0.016	0.351	0.721	0.539	0.122
Kathangacini_A	4	0.016	0.332	0.151	0.790	0.122
Kagibi_Women	4	0.016	0.351	0.721	0.539	0.122
Gatethia_A	7	0.028	0.361	3.348	0.884	0.152
Gatethia_Kirundi	0	0.000	0.143	0.000	0.000	0.108
Mwenda_Antu	3	0.012	0.392	0.254	0.523	0.122
Kathituni_A	4	0.016	0.326	0.240	0.404	0.122
Imani_Thangatha	1	0.004	0.314	0.000	0.198	0.122
Korianthoa	3	0.012	0.259	0.032	0.206	0.122
Kageni_Women	2	0.008	0.316	1.475	0.199	0.137
Gatonga	3	0.012	0.392	0.254	0.523	0.122
Mugutu_Women	2	0.008	0.343	0.072	0.289	0.122
Unity	1	0.004	0.314	0.000	0.198	0.122
Jipange	1	0.004	0.314	0.000	0.198	0.122
Mukothima_disability	1	0.004	0.336	0.000	0.225	0.122
Kathoko	1	0.004	0.314	0.000	0.198	0.122
Gaciumia_A._Women	2	0.008	0.321	0.031	0.298	0.122
Gaituni_B.	0	0.000	0.143	0.000	0.000	0.108
Gatonga_Women	4	0.016	0.304	0.023	1.141	0.122
Mwende	4	0.016	0.376	0.232	0.843	0.122
Witethia_Women	0	0.000	0.143	0.000	0.000	0.108

Makuba B.	3	0.012	0.392	0.254	0.523	0.122
Kaurani	2	0.008	0.341	0.104	0.269	0.122
Young_Traders	2	0.008	0.387	0.153	0.422	0.122
Mubango	1	0.004	0.336	0.000	0.225	0.122
St._Ruth	1	0.004	0.314	0.000	0.198	0.122
Kagendo	3	0.012	0.327	0.038	0.759	0.122
Twitethie	0	0.000	0.143	0.000	0.000	0.108
Muramba_Wa_Mbungu	5	0.020	0.397	0.474	1.067	0.122
Karimi	5	0.020	0.397	0.388	1.048	0.122
Macheria	7	0.028	0.399	0.599	1.628	0.122
Kararani	3	0.012	0.351	0.043	0.786	0.122
Gakuyu	2	0.008	0.387	0.153	0.422	0.122
Kathangacini_C.	4	0.016	0.336	1.588	0.354	0.137
Mean	3.164	0.013	0.334	0.384	0.565	0.122
Minimum	0.000	0.000	0.143	0.000	0.000	0.108
Maximum	9.000	0.035	0.407	3.348	1.805	0.152
Standard Deviation	2.007	0.008	0.068	0.594	0.411	0.007
Variance	4.028	0.000	0.005	0.353	0.169	0.000

Table 0.4: Low performing groups' measures of centrality

	Degree		Closeness	Betweenness	Power	Fragment
Farmer group	**No. of ties**	**nDegree**	**FreeClose**	**nBetweenness**	**nPower**	**Frag.**
Silent	0.000	0.000	0.143	0.000	0.000	0.108
Marimanti_Bee_W.	6.000	0.024	0.363	0.613	1.158	0.122
Kwaiga	4.000	0.016	0.349	0.214	0.832	0.122
Imani	2.000	0.008	0.355	0.070	0.326	0.122
Mango & Cereal_grow	1.000	0.004	0.336	0.000	0.225	0.122
Eight_in_one	8.000	0.031	0.407	1.620	1.192	0.122
Mutiithi	2.000	0.008	0.244	0.000	0.141	0.122
Kabuabua	1.000	0.004	0.314	0.000	0.198	0.122
Kagurini	2.000	0.008	0.322	0.090	0.242	0.122
Mashitumaini_Women	0.000	0.000	0.143	0.000	0.000	0.108
Kathituni_B.	2.000	0.008	0.270	0.110	0.105	0.122
Ngaza	1.000	0.004	0.336	0.000	0.225	0.122
Kagurini_G.C.K	1.000	0.004	0.252	0.000	0.044	0.122
Mukothima_Cater	0.000	0.000	0.143	0.000	0.000	0.108
Mean	2.143	0.009	0.284	0.194	0.335	0.119
Minimum	0.000	0.000	0.143	0.000	0.000	0.108
Maximum	8.000	0.031	0.407	1.620	1.192	0.122
Standard Deviation	2.349	0.009	0.088	0.442	0.413	0.006
Variance	5.516	0.000	0.008	0.196	0.171	0.000

Table 0.5: Measures of centrality for support actors

Support actor	Degree		Closeness	Betweenness	Power	Fragment
	No. of ties	nDegree	FreeCloseness	nBetweenness	nPower	Frag.
RIDEP1	58	0.228	0.392	11.108	4.363	0.122
KALRO2	15	0.059	0.326	1.810	0.970	0.122
MoA3	65	0.256	0.488	38.127	3.376	0.181
Plan4	8	0.031	0.319	0.455	0.463	0.122
WFP5	48	0.189	0.351	3.593	4.219	0.122
TCGA6 – CBO	57	0.224	0.444	30.122	2.969	0.237
MCG7- CBO	5	0.020	0.287	0.125	0.248	0.122
CGAsaioma8	27	0.106	0.359	5.484	1.513	0.122
EABL9	18	0.071	0.316	2.251	1.056	0.137
NDMA10	2	0.008	0.297	0.060	0.057	0.122
CARITAS11	12	0.047	0.329	2.274	0.659	0.137
ADS12	2	0.008	0.297	0.022	0.149	0.122
ICE13	1	0.004	0.266	0.000	0.037	0.122
FAO14	12	0.047	0.332	1.472	0.798	0.122
USAID15	2	0.008	0.298	0.012	0.158	0.122
GAKIUMA16 – CBO	9	0.035	0.281	0.244	0.334	0.122
AfricHarv17	3	0.012	0.298	0.034	0.145	0.122
IMARA18	12	0.047	0.313	0.167	1.014	0.122
KEPHIS19	1	0.004	0.289	0.000	0.035	0.122
PACTEC20	1	0.004	0.295	0.000	0.050	0.122
IAS21	3	0.012	0.268	0.017	0.108	0.122
KIANDA22 - CBO	6	0.024	0.279	0.083	0.396	0.122
MGCSD23	1	0.004	0.286	0.000	0.029	0.122
KFS24	1	0.004	0.270	0.000	0.059	0.122
NMK25	1	0.004	0.270	0.000	0.059	0.122
Nkatha26	1	0.004	0.244	0.000	0.014	0.122
JoyWo27	2	0.008	0.297	0.002	0.153	0.122
AGMARK28	1	0.004	0.256	0.000	0.024	0.122
Mean	13.357	0.053	0.312	3.481	0.838	0.129
Minimum	1.000	0.004	0.244	0.000	0.014	0.122
Maximum	65.000	0.256	0.488	38.127	4.363	0.000
Standard Dev	19.345	0.076	0.054	9.035	1.284	0.024
Variance	374.238	0.006	0.003	81.635	1.648	0.001

Appendix 3: Chapter 7 factors influencing farmer group performance

Table 0.6: Random-effects model generalized least square regression (REM-GLS) Stata results

. xtreg LogPCVCS time14 time15 time16 Mukothima Gatunga Marimanti Gatue GrpAge LogPrdContAmtMonth FormRsn_CMkt Benefit_CMkt LeadMF_Ratio LogLoanAmt LeadTrain MktComt GrpStorAcc Inst_Main_Buyer Seed Pestcide Fertilizer RcdIndexC2_PCA IntPrcIdxPCA2 Bond_Soc2 nbetweenness, re vce (cluster GrpName)

Random-effects GLS regression — Number of obs = 400
Group variable: SNum — Number of groups = 100

R-sq: within = 0.0469 — Obs per group: min = 4
between = 0.5803 — avg = 4.0
overall = 0.2285 — max = 4

Wald chi2(24) = 535.63
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

(Std. Err. adjusted for 99 clusters in GrpName)

LogPCVCS	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
time14	.076862	.5538601	0.14	0.890	-1.008684	1.162408
time15	.8798349	.6148561	1.43	0.152	-.3252609	2.084931
time16	1.936025	.5657968	3.42	0.001	.8270832	3.044966
Mukothima	-2.093028	.6277595	-3.33	0.001	-3.323414	-.8626418
Gatunga	-3.060138	.9785851	-3.13	0.002	-4.978129	-1.142146
Marimanti	-.9999544	.9993935	-1.00	0.317	-2.95873	.9588209
Gatue	1.844625	1.495203	1.23	0.217	-1.085919	4.775169
GrpAge	-.0336375	.0177062	-1.90	0.057	-.068341	.001066
LogPrdContAmtMonth	-.0343901	.0986707	-0.35	0.727	-.2277811	.1590008
FormRsn_CMkt	-1.022538	.5842679	-1.75	0.080	-2.167682	.1226058
Benefit_CMkt	.8487389	.5817277	1.46	0.145	-.2914265	1.988904
LeadMF_Ratio	.5044303	.2209928	2.28	0.022	.0712924	.9375682
LogLoanAmt	-.1339271	.0702452	-1.91	0.057	-.2716053	.003751
LeadTrain	.1365927	.0317084	4.31	0.000	.0744455	.19874
MktComt	.7418199	.4246068	1.75	0.081	-.0903942	1.574034
GrpStorAcc	.3889704	.3783924	1.03	0.304	-.352665	1.130606
Inst_Main_Buyer	2.409598	.5788011	4.16	0.000	1.275169	3.544028
Seed	1.118094	.5680749	1.97	0.049	.0046878	2.2315
Pestcide	4.169356	.7052368	5.91	0.000	2.787117	5.551594
Fertilizer	-.5668795	.823584	-0.69	0.491	-2.181074	1.047316
RcdIndexC2_PCA	.2150294	.650609	0.33	0.741	-1.060141	1.4902
IntPrcIdxPCA2	-.3244869	.1328047	-2.44	0.015	-.5847793	-.0641945
Bond_Soc2	.2382607	.2403796	0.99	0.322	-.2328747	.7093961
nbetweenness	.9218817	.3201424	2.88	0.004	.2944141	1.549349
_cons	.8222528	2.070528	0.40	0.691	-3.235907	4.880413
sigma_u	0					
sigma_e	4.0027947					
rho	0	(fraction of variance due to u_i)				

. mfx

Marginal effects after xtreg
y = Linear prediction (predict)
= 4.1717701

Table 0.7: Fixed effects model Stata results

. xtreg LogPCVCS time14 time15 time16 Mukothima Gatunga Marimanti Gatue GrpAge LogPrdContAmtMonth FormRsn_CMkt Benefit_CMkt LeadMF_Ratio LogLoanAmt LeadTrain MktComt GrpStorAcc Inst_Main_Buyer Seed Pestcide Fertilizer RcdIndexC2_PCA IntPrcIdxPCA2 Bond_Soc2 nbetweenness, fe vce (cluster GrpName)

Fixed-effects (within) regression — Number of obs = 400
Group variable: SNum — Number of groups = 100

R-sq: within = 0.0607 — Obs per group: min = 4
Between = 0.0094 — avg = 4.0
Overall = 0.0050 — max = 4

F(8,98) = 3.87
corr(u_i, Xb) = -0.9761 — Prob > F = 0.0005

(Std. Err. adjusted for 99 clusters in GrpName)

LogPCVCS	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time14	1.715015	.7875013	2.18	0.032	.1522446	3.277786
time15	5.731701	1.964979	2.92	0.004	1.832263	9.631138
time16	5.325527	1.420978	3.75	0.000	2.505643	8.145411
Mukothima	0	(omitted)				
Gatunga	0	(omitted)				
Marimanti	0	(omitted)				
Gatue	0	(omitted)				
GrpAge	-1.723441	.6850569	-2.52	0.014	-3.082914	-.363968
LogPrdContAmtMonth	0	(omitted)				
FormRsn_CMkt	0	(omitted)				
Benefit_CMkt	0	(omitted)				
LeadMF_Ratio	0	(omitted)				
LogLoanAmt	-.0917925	.0849115	-1.08	0.282	-.2602966	.0767116
LeadTrain	0	(omitted)				
MktComt	0	(omitted)				
GrpStorAcc	0	(omitted)				
Inst_Main_Buyer	0	(omitted)				
Seed	.4530812	.6067598	0.75	0.457	-.7510139	1.657176
Pestcide	.8044715	.9696751	0.83	0.409	-1.119817	2.72876
Fertilizer	-.5529728	1.266141	-0.44	0.663	-3.065588	1.959643
RcdIndexC2_PCA	0	(omitted)				
IntPrcIdxPCA2	0	(omitted)				
Bond_Soc2	0	(omitted)				
nbetweenness	0	(omitted)				
_cons	13.16119	3.912254	3.36	0.001	5.397444	20.92493
sigma_u	12.561135					
sigma_e	4.0027947					
rho	.90781385	(fraction of variance due to u_i)				

. mfx

Marginal effects after xtreg
y = Linear prediction (predict)
= 4.1717701

Table 0.8: Linear prediction of margin

```
. margins

Predictive margins                                Number of obs   =        400
Model VCE    : Robust

Expression   : Linear prediction, predict()
```

	Margin	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
_cons	4.17177	.1743126	23.93	0.000	3.830124	4.513417

Table 0.9: Breusch and Pagan Lagrangian multiplier test for random effects

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        LogPCVCS[SNum,t] = Xb + u[SNum] + e[SNum,t]

        Estimated results:
                     |       Var     sd = sqrt(Var)
             ---------+------------------------------
             LogPCVCS |    19.21985        4.384045
                    e |    16.02237        4.002795
                    u |          0               0

        Test:   Var(u) = 0
                            chibar2(01) =      0.00
                          Prob > chibar2 =    1.0000
```

Table 0.10: Hausman test for fixed effect and random effects models

```
. estimate store re

.
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
time14	1.715015	.076862	1.638153	1.431129
time15	5.731701	.8798349	4.851866	4.365877
time16	5.325527	1.936025	3.389502	2.90307
GrpAge	-1.723441	-.0336375	-1.689804	1.47343
LogLoanAmt	-.0917925	-.1339271	.0421346	.0471865
Seed	.4530812	1.118094	-.6650129	.3100026
Pestcide	.8044715	4.169356	-3.364884	1.335811
Fertilizer	-.5529728	-.5668795	.0139067	.9035469

```
                b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       16.24
                Prob>chi2 =      0.0391

. hausman fe .
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
time14	1.715015	.076862	1.638153	1.431129
time15	5.731701	.8798349	4.851866	4.365877
time16	5.325527	1.936025	3.389502	2.90307
GrpAge	-1.723441	-.0336375	-1.689804	1.47343
LogLoanAmt	-.0917925	-.1339271	.0421346	.0471865
Seed	.4530812	1.118094	-.6650129	.3100026
Pestcide	.8044715	4.169356	-3.364884	1.335811
Fertilizer	-.5529728	-.5668795	.0139067	.9035469

```
                b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       16.24
                Prob>chi2 =      0.0391
```

Table 0.11: Pesaran's test of cross sectional independence

```
.
. xtcsd, pesaran abs

Pesaran's test of cross sectional independence =    -1.360, Pr = 1.8263

Average absolute value of the off-diagonal elements =     0.534
```

Table 0.12: Random effects model cross-sectional time-series feasible generalized least square regression (REM-FGLS) Stata results

. xtgls LogPCVCS time14 time15 time16 Mukothima Gatunga Marimanti Gatue GrpAge LogPrdContAmtMonth FormRsn_CMkt Benefit_CMkt LeadMF_Ratio LogLoanAmt LeadTrain MktComt GrpStorAcc Inst_Main_Buyer Seed Pestcide Fertilizer RcdIndexC2_PCA IntPrcIdxPCA2 Bond_Soc2 nbetweenness, panels (het) corr(psar1) rhotype(tscorr)

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   panel-specific AR(1)

Estimated covariances      =       100          Number of obs      =       400
Estimated autocorrelations =       100          Number of groups   =       100
Estimated coefficients     =        25          Time periods       =         4
                                                Wald chi2(24)      =    212.04
                                                Prob > chi2        =    0.0000
```

LogPCVCS	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
time14	.3043035	.4005565	0.76	0.447	-.4807728	1.08938
time15	1.469924	.4080689	3.60	0.000	.6701232	2.269724
time16	1.940812	.3946829	4.92	0.000	1.167248	2.714376
Mukothima	-1.802858	.6439772	-2.80	0.005	-3.06503	-.540686
Gatunga	-2.83241	.8728921	-3.24	0.001	-4.543247	-1.121573
Marimanti	-1.412558	.8286932	-1.70	0.088	-3.036766	.2116513
Gatue	2.157391	1.390741	1.55	0.121	-.5684116	4.883194
GrpAge	-.0361812	.0178263	-2.03	0.042	-.0711201	-.0012422
LogPrdContAmtMonth	-.0278306	.081318	-0.34	0.732	-.187211	.1315497
FormRsn_CMkt	-.8911825	.5437405	-1.64	0.101	-1.956894	.1745294
Benefit_CMkt	.7177488	.4568609	1.57	0.116	-.1776822	1.61318
LeadMF_Ratio	.3806378	.1662854	2.29	0.022	.0547244	.7065511
LogLoanAmt	-.1185912	.0485409	-2.44	0.015	-.2137296	-.0234528
LeadTrain	.1217775	.0291491	4.18	0.000	.0646463	.1789088
MktComt	.663807	.3206421	2.07	0.038	.0353601	1.292254
GrpStorAcc	.6183058	.4074452	1.52	0.129	-.1802721	1.416884
Inst_Main_Buyer	2.252912	.4508152	5.00	0.000	1.36933	3.136493
Seed	1.28241	.3702079	3.46	0.001	.5568158	2.008004
Pestcide	3.170862	1.424141	2.23	0.026	.3795967	5.962128
Fertilizer	-1.028398	.7146183	-1.44	0.150	-2.429024	.3722282
RcdIndexC2_PCA	.2279251	.4971401	0.46	0.647	-.7464516	1.202302
IntPrcIdxPCA2	-.3531585	.1267152	-2.79	0.005	-.6015157	-.1048013
Bond_Soc2	.3128777	.1928413	1.62	0.105	-.0650844	.6908398
nbetweenness	1.073765	.2932569	3.66	0.000	.4989922	1.648538
_cons	-.0774402	1.754442	-0.04	0.965	-3.516083	3.361203

Table 0.13: Marginal effects Stata results for generalized least squares random effects model

```
. mfx

Marginal effects after xtgls
      y  = Fitted values (predict)
         =  4.1495215
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
time14*	.3043035	.40056	0.76	0.447	-.480773	1.08938	.25
time15*	1.469924	.40807	3.60	0.000	.670123	2.26972	.25
time16*	1.940812	.39468	4.92	0.000	1.16725	2.71438	.25
Mukoth~a*	-1.802858	.64398	-2.80	0.005	-3.06503	-.540686	.66
Gatunga*	-2.83241	.87289	-3.24	0.001	-4.54325	-1.12157	.15
Marima~i*	-1.412558	.82869	-1.70	0.088	-3.03677	.211651	.07
Gatue*	2.157391	1.39074	1.55	0.121	-.568412	4.88319	.03
GrpAge	-.0361812	.01783	-2.03	0.042	-.07112	-.001242	7.095
LogPrd~h	-.0278306	.08132	-0.34	0.732	-.187211	.13155	4.70821
FormRs~t*	-.8911825	.54374	-1.64	0.101	-1.95689	.174529	.11
Benefi~t*	.7177488	.45686	1.57	0.116	-.177682	1.61318	.17
LeadMF~o	.3806378	.16629	2.29	0.022	.054724	.706551	.8265
LogLoa~t	-.1185912	.04854	-2.44	0.015	-.21373	-.023453	.71965
LeadTr~n	.1217775	.02915	4.18	0.000	.064646	.178909	9.59
MktComt*	.663807	.32064	2.07	0.038	.03536	1.29225	.49
GrpSto~c*	.6183058	.40745	1.52	0.129	-.180272	1.41688	.84
Inst_M~r*	2.252912	.45082	5.00	0.000	1.36933	3.13649	.16
Seed*	1.28241	.37021	3.46	0.001	.556816	2.008	.265
Pestcide*	3.170862	1.42414	2.23	0.026	.379597	5.96213	.015
Fertil~r*	-1.028398	.71462	-1.44	0.150	-2.42902	.372228	.0375
RcdInd~A	.2279251	.49714	0.46	0.647	-.746452	1.2023	.915171
IntPrc~2	-.3531585	.12672	-2.79	0.005	-.601516	-.104801	1.45002
Bond_S~2	.3128777	.19284	1.62	0.105	-.065084	.69084	6.80078
nbetwe~s	1.073765	.29326	3.66	0.000	.498992	1.64854	.49871

```
(*) dy/dx is for discrete change of dummy variable from 0 to 1
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Appendix 4: Questionnaire for grain farmer groups in Tharaka North and Tharaka South Sub-Counties

Questionnaire Number: …… Date of Interview: ……..

Enumerators (*Names*): 1. _____ 2._____

Dear Sir/Madam,

This questionnaire is meant to provide data for an academic research on, *analysis of Structure, Conduct and Marketing Performance of Smallholder Grain Farmer Groups in Tharaka North and Tharaka South Sub-Counties, Kenya.* This will inform recommendations to enhance the marketing performance of the groups. You will be briefed on the findings of this study. Any contribution given will be highly appreciated and your responses will be treated with utmost confidentiality. Thank you.

I. STRUCTURE

Q1. Profile of the group identity, origin and development *(Tick where applicable)*

Q2. Indicate the group's **membership** information as asked in the table below *(Tick and verify with records where applicable)*

I. Group identity *(Names)*		**II. Year formed**	**III. How group was started**	**IV. Main reason for formation**
Farmer group:		_____	1 = Government started 2 = NGO initiative 3 = Founder members initiative 4 = Other *(Specify)* _____ _____	1 = To access credit 2 = To market grains 3 = To market any other products 4 = To access farm inputs like seeds and fertilizer 5 = To help each other in social activities like during weddings or grief 6 = Other *(specify)*_____
Sub-county:				
Ward:				
Group secretary:				
Phone number:				

i. Number of group members			ii. How one becomes a member of the group	iii. Does the group charge a membership fee?	iv. If membership fee paid, how much?	v.Do you make periodic contributions to the group?	vi. If contributions made, how often?	vii. If contributions made, how much?
	Male	Female	1 = Born into the group 2 = Invited to join **3** = Voluntary request to join **4** = Other *(specify)* _____	1 = Yes 2 = No	KES. _____	1 = Yes 2 = No	_____	KES. _____
2013								
2014								
2015								

Q3. Rank the kinds of **benefits** members get from being a member of this group? *List all by order of importance)*

a	B	c	d	e	f	g	h	I

1 = Skills and capacity building in agricultural production and marketing
2 = Collective market for their grains
3 = Collective market for other products like art and craft, seedlings
4 = Collective farm production activities like planting, weeding and harvesting
5 = Inputs like seed and fertilizer at a subsidized price or lower per unit cost
6 = Table banking services (saving and borrowing with the group)
7 = Low interest credit access to external institutions
8 = Welfare services like in times of grief or weddings
9 = Others *(specify)* _____

II. CONDUCT *(Institutional capacity)*

Q4. Leadership *(Tick where applicable)*

A. Does the group have a constitution or written by-laws?
1 = Yes
2 = No

B. Indicate the group's leadership characteristics as asked in the table below

i. If group has a constitution or written by-laws, does it specify the mode of selecting leaders?	**ii. How are leaders selected?**	**iii. Out of the 5 key leaders: chairperson, vice-chairperson, treasurer, secretary, vice-secretary, how many are?**	**iv. After how long does leadership change?**	**v. When leadership changes, what proportion of a new face of 5 key leaders other than the previous leaders do you get?**	**vi. How would you rate the relationship of leaders to members?**	**vii. How would you characterize the leadership of this group generally?**
1 = Yes 2 = No	1 = Election 2 = Appointment 3 = Inheritance 4 = Other *(specify)* _____	1 = Male _____ 2 = Female _____	1 = Every year 2 = Every two years 3 = Every three years 4 = Every four years 5 = Every five years 6 = Other *(specify)* _____	1 = Few (1-2) 2 = Some (3) 3 = Many (4-5)	1 = Poor 2 = Fairly good 3 = Very good	1 = Harmonious 2 = Conflictive

C. Have the following committee members received relevant **training**? *(quality and skills of leaders)*

	Respective roles of the leader	**Group dynamics**	**Finance management**	**Record keeping**
Chairperson				
Vice chairperson				
Treasurer				
Secretary				
Vice secretary				

Q5. Internal practices: Indicate the group's internal practices as asked in the table below *(Tick where applicable)*

i. How often does the group hold meetings for all members?	**ii. What kind of *records* does the group have? *(Verify the records by seeing them)***	**iii. Are the minutes of the previous meeting read before starting a new meeting?**	**iv. Does the group run other *enterprise(s)* other than grains marketing?**	**v. If enterprise(s) present, kindly specify the enterprise**
1 = Weekly 2 = Every two weeks 3 = Monthly 4 = Other *(specify)* _____	1 = Minutes of meetings 2 = Members register 3 = List of assets 4 = Training records 5 = Invoices, delivery notes and receipt books 6 = Members contribution records 7 = Financial statements (income and expenditure) 8 = Other *(specify)* _____	1 = Yes 2 = No	1 = Yes 2 = No	1 = Shop 2 = Tree nursery site 3 = Craft 4 = Poultry 5 = Fruit and Juice 6 = Horticulture 7 = Other *(specify)* _____

Q6. For this question use this scale to rank the consensus view of members

Strongly disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly agree =5

		1	2	3	4	5
	d. Participation					
1	Members attend internal group meetings					
2	Members attend external meetings with other organizations					
3	Both members and leaders participate in decision making					
	e. Organizational culture					
1	Procedures are carried out as stated in the rules of the group					
2	There are is theft of group property or supplies					
3	There are conflict resolution mechanisms within the group					
	f. Organizational capacity					
1	The group reflects on and learns from previous experiences					
2	The group develops specific plans for the future (instead of reacting to opportunities as they present themselves)					

Q7. Financial capacity

A. For this question fill the group financial information as asked in the table below *(Tick where applicable)*

i. Does the group have table banking services?	**ii. If table banking services, how much money does the group have in circulation?**	**ii. Does the group lend to members (loan)?**	**iv. Is there an interest charged for borrowing?**	**v. Are there measures to address default on repayment of loans?**	**vi. Has the group accessed a loan in the last three (3) years?**
1 = Yes 2 = No	KES. _____	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No

B. If yes, in (A. vi) above, fill the loan details information in the table below

	Source	**Year**	**Amount (KES.)**	**Repayment period**	**Purpose: *1*=*Buy inputs*, *2*=*Build grains store*, *3*=*Buy farm implements*, *4*=*Meet marketing costs***
1.	Bank	2013			
		2014			
		2015			
		2016			
2.	Government fund like Uwezo fund, Women enterprise fund, CDF	2013			
		2014			
		2015			
		2016			
3.	NGO	2013			
		2014			
		2015			
		2016			
4.	Other *(Specify)*	2013			
		2014			
		2015			
		2016			

Q8. Marketing of grains: Indicate the group's access to a store and a means of transport, marketing committee and timing of proceeds

i. Does this group have access to a grains store?	**ii. If yes for store in (i), what are the terms of use?**	**iii. If yes for store in (i), what is the time taken to access the store from the group's meeting point?**	**iv. Does the group have access to a vehicle to transport their grains?**	**v. Does this group have a marketing committee?**	**vi. When do farmers receive their proceeds for grains sold collectively through the group?**
1 = Yes 2 = No	1 = Leased temporarily 2 = Long term lease 3 = Own a temporary store 4 = Own permanent store	1 = Less than 1 hour 2 = More than 1 hour	1 = Yes 2 = No	1 = Yes 2 = No	1 = Mostly received immediately 2 = Mostly delayed

Q9. Marketing of grains: Indicate the group's training, value addition and contracts information as asked in the table below

A. Are there group members who are trained in?				**B. Does the group have the following grain value addition activity(s)**				**C. Contracts in marketing**		
i. Value addition	**ii.** Post harvest handling	**iii.** Grains procurement process	**iv.** Tendering process	**i.** Milling	**ii.** Packing	**iii.** Branding	**iv.** Grading	**i.** Has the group ever signed any contract with the buyers in the past three (3) years?	**ii.** If contract signed, what were the specifications of the contract?	**iii.** If contract signed, how many of these contracts were executed successfully?
1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Yes 2 = No	1 = Specified price 2 = Specified quantity 3 = How grains will be delivered to the buyer 4 = Other *(specify)* _____	_____

Q10. Performance: In the past three (3) years, what is the total quantity (bags) of grains that the group has sold to different markets? *(Verify with records and record the total exact value in specific kg bags like 90kg or 100kg bags)*

	Crop	Local markets		CBO		Middlemen/ Broker		WFP		Schools		KALRO		Other *(Specify)*	
		QTY	***Price***	***QTY***	***Price***	***QTY***	***Price***	***QTY***	***Price***	***QTY***	***Price***	***QTY***	***Price***	***QTY***	***Price***
2013	Sorghum														
	Green grammes														
	Maize														
	Cowpeas														
	Other *(specify)*														
2014	Sorghum														
	Green grammes														
	Maize														
	Cowpeas														
	Other *(specify)*														
2015	Sorghum														
	Green grammes														
	Maize														
	Cowpeas														
	Other *(specify)*														
2016	Sorghum														
	Green grammes														
	Maize														
	Cowpeas														
	Other *(specify)*														

Q11. From the sales table (Q10) above, what is the main reason(s) for accessing the main market for the group's grains?

1 Easily met conditions to sell to the market
2 It offers a bulk market for member's produce
3 It offers the highest price
4 Prices are fixed
5 Other *(specify)* _____

Q12. Rank the most important problems facing this group with regard to selling members' produce collectively? *(Pair wise comparison)*

		1	2	3	4	5	6	7	8
		Exploitation by brokers	Some members selling individually	Members not trusting leaders with their grains and income	Delay of payments	Poor marketing skills	Limited storage space	Limited capital	Lack of necessary trade documents e.g. permits
1	Exploitation by brokers								
2	Some members selling individually								
3	Members not trusting leaders with their grains and income								
4	Delay of payments								
5	Poor marketing skills								
6	Limited storage space								
7	Limited capital								
8	Lack of necessary trade documents e.g. permits								

Q13. Input access: How many times has the group facilitated access to inputs like fertilizer and seeds for its members in the last 3 years?

	2013	**2014**	**2015**	**2016**
Seed				
Fertilizer				
Pesticide				
Other *(specify)* _____				

Q14. Social capital: Rank the consensus view of the group members about their group's level of social capital

	Strongly disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly agree =5	1	2	3	4	5
	a. Trust					
1	Members in this group trust the leaders with making decisions that are for members benefit					
2	Members in this group trust the leaders with the groups' assets and members' money					
3	Trust in the last three (3) years has improved					
	b. Group vision					
1	Majority of the group members understand where they would like to see the group achieve in the next 10 years					
	c. Close connections					
1	Majority of the group members are close relatives					
2	Majority of the group members come from this village					

Q15. Social networks survey:

Use the codes in the table below to specify organizations farmer groups have linked with

1=RIDEP 2=KALRO 3=Ministry of Agriculture 4=Plan International 5=World Food Programme	6=Tharaka Cereals Growers A. (TCGA) 7=Marimanti Cereals Growers A. 8= Cereals Growers Association (CGA) 9=East Africa Breweries (EABL) 10=National Drought Management A. (NDMA)	11=CARITAS 12=Agricultural Development Services 13=Institute for Culture & Ecology (ICE) 14= FAO 15= USAID	16= GAKIUMA 17=Africa Harvest 18= IMARA 19= KEPHIS 20= PACTEC	21= International Aid Services (IAS) 22= KIANDA Cereals Growers 23=Other(Specify)

Answer the questions as directed in the table below

	(Tick where applicable)				
	i. Organization	**ii. Relationship:** Group's nature of relationship with organizations it has linked with between January 2015 and January 2016?	**iii. Contact:** Frequency of contact with specified organizations January 2015 and January 2016 (on average). Contact can be meetings, trainings, seminars, phone calls, or emails	**iv. Experts and resources:** Rank (position 1 to the last) each organization on its importance to your group with regard to the resources (services and products) provided by the organizations linked to this group in the last one year	**v. No Contact:**
	List the organizations using the provided codes. (Others specify)	1= Communication 2= Collaboration 3= Partnership 4= Membership 5= Not directly linked	1= Annual (once) 2= Biannual (twice a year) 3= Quarterly (4 times a year) 4= Monthly 5= Weekly 6= Daily	1= Crop production information 2=Training in marketing 3= Field exposure visits 4= Provision of tools and equipment 5= Provision of farm inputs (e.g. seeds, fertilizer) 6= Linkage to buyers and markets 7= Others (specify)	List organizations the group would like to start relationship with.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Definition of types of relationships relationship between groups and other organizations it was linked with between January 2015 and January 2016 *(Use the information as guide to social networks Q15. ii.)*

Nature of linkage	*Definition*
Directly linked	
1= Communication	We shared information only when it is advantageous to either or both programs.
2= Collaboration	We worked side-by-side and actively pursued opportunities to work together, but did not establish a formal agreement.
3= Partnership	We worked together as a formal team with specified responsibilities to achieve common goals (had a Memorandum of Understanding (MOU) or other formal agreement).
4= Membership	We are registered as members of the organization and we get benefits when they arise
5= Not directly linked	We get assistance or resources from them only through another organization

Q16. Remarks: Answer the questions as directed in the table below

i. Recommendation from farmer group members: What do you think is needed to make this group more effective?	
1	
2	
3	
ii. Comment(s) by enumerator:	
1	
2	
3	