THE EFFECT OF COLLECTIVE ACTION ON PERFORMANCE AND MARKETING OF PASSION FRUIT AMONG SMALLHOLDER FARMERS IN NANDI COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

Declaration

    This thesis is my original work and has not been presented in this University or any other for the award of degree.

Signature ....   Date…17th July 2023

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KM17/3015/11

Recommendation

This thesis has been submitted with our approval as university supervisors.

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DEDICATION

I dedicate this work to my parents, family and friends for their unconditional love and support.

ACKNOWLEDGEMENTS

ABSTRACT

In Kenya, over 80 percent of smallholder farmers are engaged in the cultivation of horticultural crops. Passion fruit is one of the high value horticultural crops produced by smallholder farmers because of high returns. The enterprise is gaining inroads in the predominantly cereal growing areas of North Rift. Its production has not been intensified since farmers grow few vines, but they are now forming passion fruit producer and marketing groups. However, the contribution of collective action in production and marketing of passion fruits is not clear, and this formed the basis of the study. The study was conducted in Nandi County with the following objectives: to determine the factors that influence participation and commitment in producer and marketing groups; to determine the effect of collective action on enterprise performance, and to establish the effect of household, technical and institutional factors on the choice of the marketing channel among smallholder passion fruit farmers. Primary data was collected using multistage sampling techniques to arrive at a sample of 141 respondents. Data was analysed using excel for descriptive statistics and gross margin analysis, while STATA was adopted in analysing double hurdle and multinomial logit models. From the findings, selling price, membership in other groups, training on passion fruit enterprise management and distance to the nearest output market positively influenced smallholder farmers' participation and commitment to collective action, whereas the education level and age of the producer had a negative effect. Further, participation in collective action positively influenced passion fruit enterprise performance. Multinomial logit results on the choice of marketing channel indicated that farmers sold their produce through various channels. Channel choice was influenced by the gender of the producer, payment period, perception of being exploited and selling price. From the findings, it is evident that collective action could improve enterprise performance, which in turn would lead to increased farm revenue and household income. Hence, it is recommended that stakeholders should promote collective action in developing input and output markets for smallholder farmers. Further, it is recommended that policies that strengthen frameworks that guide group membership, and the construction of output markets should be put in place to support collective action and collective marketing among passion fruit farmers.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AERC	African Economic Research Consortium
ASDS	Agricultural Sector Development Strategy
ASL	Above sea level
CRA	Commission on Revenue Allocation
FAO	Food and Agriculture Organization of the United Nations
DH	Double hurdle model
GM	Gross margins
GoK	Government of Kenya
HCD	Horticultural Crops Directorate
ICT	Information and Communication Technology
KES	Kenya Shillings
KHCP	Kenya Horticulture Competitiveness Project
KNBS	Kenya National Bureau of Statistics
NGO's	Non-Governmental Organizations
SPSS	Statistical Package for the Social Science
USAID	United States Agency for International Development
WRI	World Resources Institute

CHAPTER ONE

INTRODUCTION

1.1   Background of the study

With the rising commercialization of agriculture among smallholder farmers, there has been a gradual shift from subsistence agriculture to market-led production patterns (Rubhara & Mudhara, 2019). In Kenya, horticultural production has been identified as one of the avenues that would contribute to agricultural commercialization in rural areas.

It is acknowledged that currently, the agricultural sector in Kenya is facing a growing problem of access to land and shrinking sizes of smallholder farms, with over half of the farms being less than 1.5 hectares (Kirimi *et al.,* 2011*;* Wangu *et al.,* 2021). The effects of reduced farm sizes are both negative and positive. Negative effects include decreased mechanization, uneconomical sizes, reduced crop productivity and low surplus hence subsistence orientation. However, Kioko (2019) demonstrated that more people on the land in Muranga had led to more intensive use of land, environmental recovery, higher production per person, new technologies, better contacts with markets and more sources of information.

There is a wide variety of horticultural crops currently grown in the country depending on the agroecological zone. In this respect, passion fruit production is gradually making inroads in the predominantly cereal growing areas of North Rift region of Kenya. Studies have shown that passion fruit production has higher returns than other agricultural enterprises commonly grown such as cereals and livestock because it is a high value crop (Kemboi *et al.,* 2020*;* Kibet *et al.,* 2011a). Since the enterprise is intensive with lower demand on land, it is becoming increasingly attractive for smallholder farmers who are faced with resource constraints, particularly land.

Currently, the average land holding in Nandi County is 1.2 hectares for smallholder households. Majority of these farmers produce mainly maize, tea and beans and engage in dairy farming. The production of these traditional crops in the County is proving futile because of declining arable land per household (County Integrated Development Plan (CIDP), 2017). With the exit of traditional crops, opportunities for venturing into the production of high value crops exist and the alternative option that has attracted a good number of farmers is passion fruit growing.

Passion fruit is ranked among the three most important fruits in Kenya's fresh fruit export market in terms of value and volume, with the leading being mangoes, followed by avocados (HCD, 2019*;* Mukoye *et al.,* 2022). Passion fruit's popularity is set to rise even

more due to changing consumer preferences as they move from carbonated soft drinks to fresh juices. Reports by HCDA (2010) indicate that there is a strong case for increasing passion fruit production in Kenya due to the increasing demand locally, regionally and in international markets. Domestically, there is a high demand for passion fruit juice and concentrate for use in fruit canning factories.

In the regional market, Uganda has significant passion fruit processing capacity and strong demand for purple passion fruit for fresh juice. Local buyers and those from Uganda are active seasonal buyers in Kenya, especially in areas in the Western and Rift Valley regions close to the border. The total export to Uganda is over 60 percent of total passion fruits exports (HCDA, 2011). Passion fruit is also exported to Europe and Middle East in significant quantities. The increasing demand for high value commodities provides farmers with an incentive to shift their production to such crops that have high potential for higher returns to land, labour and capital, and this has a positive impact on their welfare (Ali *et al.,* 2017).

However, production of passion fruit by small-scale farmers has not been intensified since most farmers grow few vines. This limited scale of operation makes it difficult for individual farmers to benefit from the enterprise due to the associated high costs related to production, acquisition of production inputs, setting up the enterprise and even marketing of the produce. Under such production constraints, small-scale producers may opt for collective action. Indeed, Fischer and Qaim (2011) concur that collective production and marketing is beneficial to farmers. Small-scale farmer organizations try to safeguard the interests of the members/participating farmers (Kibet *et al.,* 2011b).

There are passion fruit farmer groups in Nandi County that were formed through the members' initiative with the help of relevant government agencies and other stakeholders such as non-governmental organizations, input suppliers, financiers and buyers of the produce. The success of these farmer groups in improving passion fruit enterprise is dependent on the level of member's commitment to the group. This involves identifying with the group, loyalty to the group as well as, and the objectives the farmer had in mind before joining the group (Mugwe *et al.,* 2019). Fischer and Qaim (2012) found that the decision of a farmer to join a group depends on the expected benefits and costs. Therefore, before forming or joining an existing group, a farmer would weigh expected gains and compare them with the expected costs of being in the group. The key feature these farmer groups is that the majority are heterogeneous in their formation, gender, age, and economic status of the members.

1.2   Statement of the problem

Passion fruit enterprise is gaining popularity among smallholder farmers in Nandi County. This is because of the shift from cereal to horticultural production as a result of declining land sizes and its potential demand in the market. However, its production has suffered from low adoption signified by farmers planting a few vines. With low quantities, it has been difficult for them to access output markets leading to produce wastage. This has prompted the formation of producer and marketing groups to aggregate and market the produce. Although many farmers are members of these passion fruit producer and marketing groups, and the motivation behind this collective action has not been documented. Also, the effect of collective action on the performance of passion fruit enterprise at the farm level has not been evaluated. Further, the factors which influence the choice of market outlets among smallholder passion fruit farmers is least understood. This study is imperative in filling these knowledge gaps.

1.3   Objectives

1.3.1   Broad objective

The overall objective of the study was to improve household livelihood/or income through collective action on enterprise performance and marketing decision among smallholder passion fruit farmers in Nandi County.

1.3.2   Specific objectives

i.   To determine the factors that influence member participation and commitment in producer and marketing groups among smallholder farmers in Nandi County

ii.   To determine the effect of participation in producer and marketing groups on passion fruit enterprise performance among smallholder farmers in Nandi County

iii.   To establish the effect of technical, household and institutional factors on the choice of marketing outlet among smallholder passion fruit farmers in Nandi County

1.4   Hypotheses

i.   Household, technical and institutional factors have no significant effect on participation and commitment in collective action among smallholder passion fruit farmers.

ii.   Participation in producer and marketing groups has no significant effect on passion fruit enterprise performance among smallholder farmers.

iii.   Technical, household and institutional factors have no significant effect on the choice of marketing channel by smallholder passion fruit farmers.

3

1.6   Justification

Horticulture industry is the fastest growing agricultural sub-sector in Kenya. Farmers have realized the potential that passion fruit enterprise has in improving their welfare through higher productivity and increased household incomes. Passion fruit production largely provides employment, food security and income generation in rural areas (Zivenge & Karavina, 2012).

Smallholder farmers are faced with resource constraints that are difficult to be met by an individual farmer. Therefore, this has led to the formation of groups by the farmers to address such problems. Collective action is seen as an avenue for smallholder farmers to access lucrative output markets for their produce (Ndoro & Andersson, 2019). The ability of the farmers to organize themselves into groups is beneficial in terms of access to inputs and bargaining power in selling their produce; and it is easier for extension workers and other stakeholders to work with the farmers. Stakeholders such as Horticultural Crops Directorate (HCD) also benefit through easier enhancement of compliance standards and other market access requirements when farmers operate in groups. Furthermore, monitoring of quality and quantity standards are more efficient when there is collective responsibility. Group formation by farmers was geared towards improving the management of passion fruit enterprise through access to productive resources, with an intent of improving on the enterprise performance.

Thus, there is a justified need to understand the role of collective action on enterprise performance and marketing decisions in passion fruit enterprise in Nandi County. Clear understanding of the benefits of collective action in improving passion fruit enterprise will help formulate interventions that will be key in reducing poverty in rural areas. The study focused on smallholder passion fruit farmers since passion fruit is a high value crop produced by many farmers in Nandi County. Finally, the study was intended to contribute to knowledge on collective action towards achieving sustainable and inclusive social economic transformation among the people in Nandi County. Furthermore, for the government of Kenya to the goal of food security and nutrition in the Big Four Agenda (Gok, 2017), addressing agricultural production and marketing challenges through collective action is imperative. This will also go a long way in achieving the Sustainable Development Goals (SDGs) 1, 2, and 8: no poverty, zero hunger, and decent working and economic growth.

1.7   Scope and limitation

This research was conducted in Nandi County, and its focus was only on smallholder passion fruit farmers within the County. Since collective action is a wide field, the study

focused on its effect on passion fruit enterprise. This was mainly due to financial and time constraints that dictated the amount of information that was obtained from interviews using the structured questionnaire. Another problem was the poor record keeping among smallholder farmers. For this reason, most smallholder farmers relied on the recall method in providing information on the enterprise. In order to improve on the data quality, probing and triangulation was done supplementing it with secondary data.

1.8   Definition of terms

Collective action- can be defined as voluntary action taken by a group of individuals who invest time and energy in pursuit of shared goals and common objectives.

Household - A group of people bound together by ties, or kinship, who may live together under a single roof or compound, are answerable to one person as the head, share the same eating arrangements and make joint economic decisions.

Smallholder farmer-any farmer who owns and farms land between 0.5 and 2.5 hectares.

Gross margin-The difference between total revenue and total variable costs.

CHAPTER TWO
LITERATURE REVIEW

2.1 Overview of horticultural production in Kenya

Horticulture sub-sector is among the six agricultural sub-sectors in Kenya. According to economic survey 2017, the leading agriculture subsectors were tea, dairy and horticulture. It is the fastest growing and it contributes 33 percent to the agriculture GDP and 55 percent of all the total exports in agriculture (HCD, 2019). The sub-sector is ranked second in foreign exchange earnings after tea. Thus, it is an important sector in economic growth. The sector has been growing at the rate of 19.7 percent per annum, witnessing an increase in acreage from 402,796 hectares in 2017 to 471,367 hectares in 2018. During the same period, production increased from 5.88 to 6.696 million metric tonnes, and the sector earned the country KES 248.7 billion in 2018 (HCD 2019). Recently, fruit production in Kenya recorded an increase in area under production, in volume and value. However, in 2017 and 2018, the recorded increase in production volume was because of the expanding area under production and not attributed to increasing productivity.

In 2018, the area under fruit production increased by 6.2 percent from 175,617ha to 186,494 ha while production increased from 2.93 to 3.145 million metric tonnes recording a 7.4 percent increase. During the same period, the value from the sector increased from 53.44 billion to 59.39 billion KES representing 11.1 percent increase (HCD 2019). Horticulture subsector employs over 18 percent of the agriculture workforce directly and more than 70 percent indirectly, mainly in the rural areas where production is located. Horticultural production has contributed to reduction in poverty through increased incomes, both directly and indirectly. It is estimated that 90 percent of the farmers in rural areas of Kenya engage in horticultural production (Muriithi, 2011). Thus, economic growth and eradication of rural poverty is highly dependent on horticulture since the sub-sector generates relatively higher returns per hectare. Horticultural products produced in Kenya range from vegetables, fruits and cut flowers, with the first two horticultural products being produced mostly by smallholder farmers for both local and international markets (GoK, 2010).

2.2 Passion fruit production and marketing in Kenya

The colonial government introduced passion fruit into Kenya in the 1920s. It is a vigorous perennial vine which flowers and produces fruits within six months to one year after establishment. Passion fruit is a climbing vine that clings by tendrils to almost any support. It

can grow 15 to 20 feet per year once established. It is generally a short-lived crop, with a lifespan of two to four years. Purple and yellow passion fruits are the two major varieties cultivated in Kenya for commercial purposes. The different varieties have fruits that vary in taste, size and shape. They also vary in colour from purple to yellow- orange. The fruit is grown for both local and export purposes. Purple passion fruit fetches a good export market compared to the yellow variety. Kenya is the world's 5th largest producer of purple passion, with Brazil leading, followed by Ecuador, Indonesia and Colombia, respectively (KHCP, 2013). Passion fruit production has been on an upward trend in the area, with an increase from 2,698 hectares in 2015 to 2,896 hectares in 2018. It has also witnessed a decrease in the volume harvested from 162,531 in 2015 to 102,717 metric tonnes in 2018 (HCD, 2019), as shown in Figure 2.1: Trend analysis: 2015 to 2018, passion fruit seedlings planted, and volumes harvested.

However, the productivity of passion fruit declined over several years owing to diseases because of inadequate skills in hygiene during grafting and changing weather patterns (HCD, 2019).
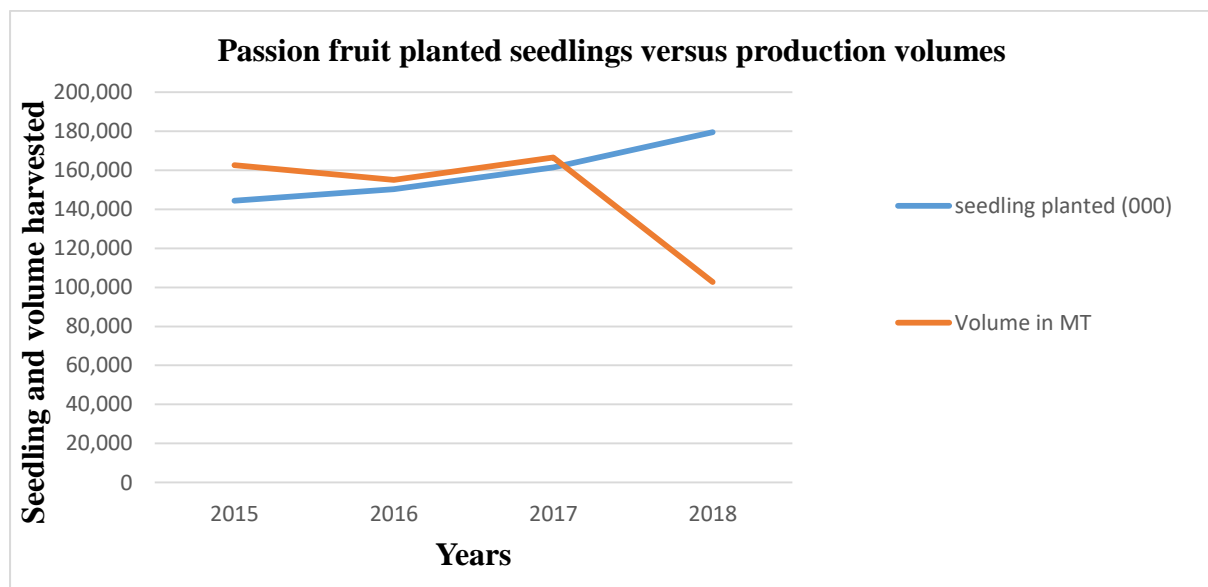
Figure 2.1: Trend analysis: 2015 to 2018, passion fruit seedlings planted, and volumes harvested.

Data source: *AFFA- Horticulture Crops Directorate 2019 validated report.*

A large volume of passion fruit produced in Kenya is mainly exported. As indicated in Figure 2.2, the leading export market of passion fruit is Uganda, with 64 percent of the total exported produce followed by United Arab Emirates with 13 percent, Belgium with 6

percent, while United Kingdom and other countries import 6 percent and 11 percent, respectively (KHCP, 2013).

Currently, demand in the export market is outstripping supply implying that Kenya is yet to produce enough for its local and export markets. Recently, passion fruit, especially the purple variety, has recorded the highest price in 2014, averaging over KES 70 per kilogram, whereas it averaged at KES 68 in 2013. Thus, it remains a lucrative enterprise for smallholder farmers in high and medium potential areas. This huge potential provided by the enterprise calls for the collaboration of stakeholders to boost its farming among smallholder farmers as outlined in the Kenya Vision 2030; Agriculture Sector Development Strategy (ASDS 2010-2020) and Agriculture Sector Transformation and Growth Strategy (ASTGS 2019-2029). Formation of effective farmer organizations can provide an avenue for sustained passion fruit production, as this will contribute to increased incomes among smallholder farmers, thus reducing rural poverty.
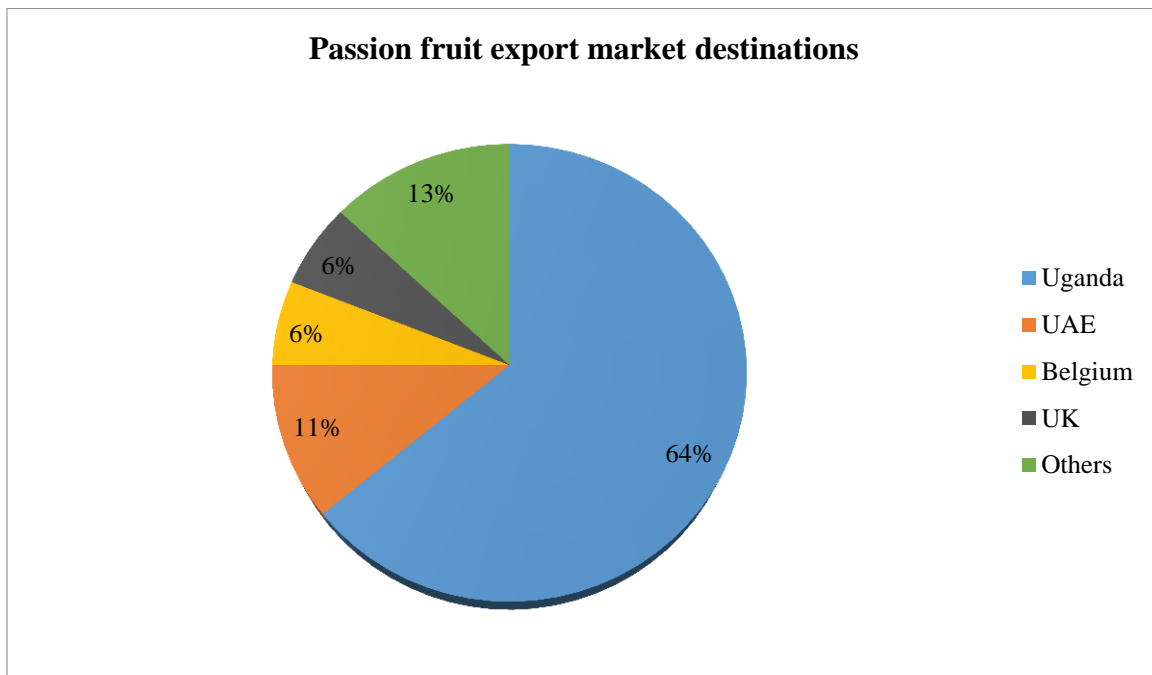
Figure 2.2: Passion fruit export market destinations.

Data source: *Kenya horticulture competitiveness validated report November 2013*

2.3   The role of collective action in smallholder agriculture

Collective action is an important tool in smallholder agriculture, particularly in developing countries. It is defined as a coordinated effort that seeks to bring about a greater impact, which individuals or small groups can achieve on their own (Nagasamy & Tomlin,

2019). Collective action is often facilitated through various methods, such as farmer networks, institutional platforms and multi-stakeholder partnerships. Through these activities, collective action helps build cooperation between smallholder farmers, strengthens farmers' collective capacity to influence institutions and implement policy changes, and assists members in understanding and sharing information. Collective action incentives smallholder farmers improve their productive and economic performance, increase access to markets and resources, benefit from improved agricultural technologies, and strengthen their negotiating power with stakeholders. Ultimately, collective action provides smallholder farmers with improved access to services, knowledge, resources, and opportunities that are integral to transforming the sustainable management of their agricultural land (Kirui & Njiraini, 2013).

Farmer groups are seen as important avenues with the ability to ensure that smallholder farmers remain competitive in the regional and global markets. They are also able to cope with high transaction costs and market failures in both input and output markets (Fischer & Qaim, 2012). Collective action is widely recognized as a positive force for rural development in Africa, especially in the agricultural sector. In the recent past, it has gained popularity in the context of agricultural transformation and competitiveness (Corsi *et al.,* 2017).

Mwambi *et al.*(2021) indicated that farmer groups enable individual farmers to empower themselves by increasing benefits and reducing marketing transactions. Being in a farmer organization allows individual farmers to better cope with risks and uncertainties associated with farming, particularly when there is no insurance against the perceived risks or when its availability is costly for individual farmers (Nshimirimana, 2009).

It is quite rare to find non-governmental organizations, research institutions, government agencies, financiers and other stakeholders that do not attempt to work with farmer organizations; it can be either producer or marketing farmer organizations all with a common goal in pursuit of development objectives (Place *et al.,* 2004). Farmer organizations play a role of acting as an intermediary between the producers and the buyers of the traded commodity. According to Minot (2008), farmer organizations do aggregate produce thus enabling farmers to benefit from economies of scale and be in a better position to bargain for better prices.

Most smallholder farmers are faced with a myriad of challenges, including the changing production techniques, increased concentration in the supply chain, low prices for their produce and more open markets to international competition, which pose a threat to smallholder farmers (Poulton *et al.,* 2010). The effect of these challenges is further

exacerbated by various forms of market failure, which are particularly common and severe in areas with poor infrastructure and communication networks (Markelova *et al.,* 2009). Because of this, smallholders are faced with high operational costs that significantly reduce their incentive to produce and subsequently participate in the markets (Poulton *et al.,* 2010). It has been noted that farmer organizations operating under collective production and marketing form the basis for enhancing market access and development of entrepreneurial skills among smallholder farmers (Shiferaw *et al.,* 2009). Successful collective production and marketing require better coordination of various activities. By pooling their capital, labour and other important resources, members of a farmer group are able to carry out profitable activities, which if undertaken by individual producers and marketers alone, would involve higher risk and greater effort (Ouma & Abdulahi, 2009).

Market failure in rural areas arise because of information asymmetry among the players and their bounded rationality. Farmer organizations have the potential to mitigate the effects of imperfect markets by enabling contractual arrangements, hence leveraging marketing functions for group members. Realization of this potential by farmer groups is highly dependent on their ability to convey market information, have well-coordinated activities at production and marketing level, negotiate for better contracts and mobilize producers to participate in markets (Shiferaw *et al.,* 2009). Thus, collective action by smallholder farmers leads to the establishment of a strong linkage with stakeholders regarding production and marketing (Markelova & Mwangi, 2010).

Collective action plays a pivotal role in improving credit access and training among smallholder farmers. By coming together in groups or cooperatives, these farmers can overcome individual constraints and amplify their bargaining power with financial institutions (Kangogo *et al.,* 2014). Through collective efforts, smallholder farmers can pool resources, share risks, and build stronger creditworthiness, making it easier to secure loans and access credit on more favorable terms (Suerey, 2020). Moreover, collective action facilitates the dissemination of vital agricultural training and knowledge among members. Through collective action, smallholder farmers benefit from training and knowledge-sharing sessions, facilitating adoption of modern farming practices, improve productivity, and adapt to changing market demands (Mwambi *et al.,* 2020).

2.4 Factors affecting participation in collective action.

Collective action is mainly defined as a deliberate action by a group of people who come together to achieve a common goal. These groups of people have several factors and

aspirations in common which they intend to achieve in the long run. It has been noted by various studies that participation in collective action is influenced by factors such as age, education level and social capital among others. Participation in collective action in mainly induced by the gains a farmer will receive, which has to be higher than the benefits from non-participation. Studies have indicated that age has both positive and negative effects with regards to participation in collective action. Kirui *et al.* (2014) revealed that age positively influences participation and commitment to collective action because young farmers are less enthusiastic to participate in farming activities and would prefer rewards based on individual effort. However, it has been noted that young farmers actively participate in collective action as it's a good avenue of sharing information by other stakeholders as well as interacting with more experienced farmers who are mostly advanced in age (Ssajakambwe *et al.,* 2019).

Social networks and participation in other community groups have profound effect on the farmer's decision to engage in collective action, although it has been documented that such decisions are largely informed by the success of the community groups in question. Information flow can adequately facilitate the formation of farmer collective action, especially when households are not located in a central place (Ombogoh *et al.,* 2016). This information flow is mostly concerned with time and venues for group meetings as well as other subsidiary information on pricing, payment timings and details on buyers.

Although collective action has potential to improve performance among smallholder farmers, there seem to be varied attributes that promote participation and its intensity. Such attributes cited by Fischer and Qaim (2011) include large farm size, group size, distance to markets and size of arable land. Involvement in group governance positively affected farmers' intensity of participation. Evidence cited by Kinuthia (2011) indicates that participation positively affects household income. Furthermore, various socioeconomic, farm-specific and institutional factors influence household income, which affects farmers' household welfare. These factors include access to transfers, off-farm income and education level as well as group membership.

It is acknowledged that collective action is an avenue for smallholder farmers to improve on their competitiveness and income. Despite this, there are problems that hinder the development and advancement of farmer organizations. Collective action is largely associated with the effect of free riders especially in groups characterised by large membership (Rotics & Clutton-Brock, 2021). In such situations, group members are less enthusiastic to accept collective liability, which has hampered the development of strong collective action among smallholder producers. Commitment to farmer groups/ cooperatives

is dependent on the prices received by the farmers from the sale of their produce (Awoke, 2021).

2.5   Collective action and enterprise performance

Collective action has been found to positively affect enterprise performance in several agricultural sectors, including passion fruit farming. This is because collective action allows individual farmers to increase their collective productivity, resources, and exposure to markets, thereby increasing overall enterprise performance (Nagasamy & Tomlinson, 2019). Collective action also facilitate other activities such as capital investments, implementation of labour-saving technologies, and collaboration on production decisions (Lenk & Vogel, 2017). Collective action groups can also provide valuable social support networks to individual producers, such as access to capital, labour, and resources essential to passion fruit farming and other forms of agricultural production (Goerlich *et al.,* 2018). Finally, collective action enables producers to gain market power and economic access, thus improving their enterprise performance (Brown *et al.,* 2019).

Farmer groups play an important role in the transfer of technologies that have a positive effect farm level productivity and production of quality agricultural products. This directly affects the performance of enterprises at farmer and group levels in terms of income, which determines their growth and development (Ombogoh *et al.,* 2016*;* Shiferaw *et al.,* 2009).

A report by FAO (2006) indicates that the underutilization of the prevailing farm resources has resulted in low competitiveness and productivity among smallholder farmers, this calls for intensification of crop production by smallholder farmers through improved farm management practices. Performance in agriculture can be enhanced by good agricultural, processing, and post-harvest management practices (Corsi *et al.,* 2017). The impact of post-harvest loss is profound in perishable products like horticultural crops. The lack of storage and processing facilities limits farmers' potential to add value to their produce thus reducing on their competitiveness (Bijman,2008). This is where farmer organizations through their collective action come in, since an individual farmer is unable to acquire storage, processing, packaging and even advanced transport facilities.

For smallholder farmers to be competitive, they need to have access to production inputs. The low use of fertilizers, improved planting material and other farm inputs has resulted in low agricultural productivity in Kenya, especially in the horticultural sector (Kibet *et al.,* 2011b). Some of the concerns highlighted by smallholders as hindering input use include high seed and fertilizer prices, substandard inputs in the markets and presence of

unscrupulous input dealers/suppliers (Eldridge *et al.,* 2022). The improvement of physical infrastructure such as roads as well as related trade facilitation arrangements is very critical to increased performance among smallholder farmers (Liverpool-Tasie *et al.,* 2020).

Previous studies have affirmed that collective action has potential to improve farmers competitiveness. Seurey (2020) alluded that collective action among smallholders can reduce transaction costs that hinders access to input and output market. Goerlich *et al.* (2018) opined that collective action enables farmers to strengthen their competitiveness in the input and output markets.

Smallholder farmers are faced with inadequate information and poor transfer of technologies because of weak extension capacity. Research institutions are inadequately funded with less motivated professionals leading to limited innovations and low rate of technology transfer in response to ever changing global trends (Kirui & Njiraini, 2013). For instance, extension services are inaccessible to more than 60 percent of farming population in many African countries including Kenya (Nshimirimana, 2009).

Reduced government expenditures on extension and agricultural training could reduce the accessibility and transfer of new technologies as well market information to farmers. With new channels for agricultural information flows, stakeholders such as NGOs, government agencies, input suppliers and financiers among other organizations have stepped up extension and training activities. This is mostly through farmer groups operating collectively (Fischer & Qaim, 2011).

It is a common observation that smallholder farmers in developing countries are unable to obtain credit or that they can do so only at usurious interest rates (Minot & Ngigi, 2004). This is not evidence of market failure. Interest rates will be high if the probability of default is high, which is indeed often the case commonly observed among individual smallholder farmers in Kenya. However, there is a new emerging trend where many financial institutions provide credit services to groups rather than individuals so that the members of the group stake their reputation and social relationship with others as a security (GoK, 2010*;* Kangogo *et al.,* 2014). Therefore, to make agri-business highly performing enterprise, there is need for both public and private sector to invest in that sector, as it is the base of development in most developing countries (Hellin *et al.,* 2009).

Performance of a particular enterprise is important in determining how farmers allocate the scarce resources and has an overall impact of improving farmers' livelihoods through increased household income. Commercialization of agriculture and rural development in general is dependent on the performance of the enterprise(s) in question. In

most cases, it has been found that farmers especially those who are resource constrained particularly with respect to land, venture into the production of crops that have high returns per unit area. This trend is common in high potential areas where the average arable land size per household is declining. Previous studies indicate that farmers with high commercialization index are those who engage in the production of high value crops that are mostly horticultural (Omiti *et al.,* 2013). This high commercialization index among smallholder farmers is mainly attributed to collective action (Mathobela, 2021). Research has found that participation in collective action initiatives significantly increases household output and input market participation by about 9 and 8 percent, respectively. It also improves household welfare by increasing incomes (Kirui & Njiraini, 2013).

Enterprise performance is in most cases producer specific. It is important to note that individual producer's effort mainly determines overall enterprise performance. However, this individual effort is mostly influenced by external factors which contribute to its excellence or poor performance, for instance collective action (Cheteni & Mokhele, 2019). Collective action has the potential to reduce transaction costs thereby increasing enterprise specific income through collective procurement of inputs and selling of farm produce. Collective action brings with it beneficial social capital, which has been seen to improve enterprise performance (Wambugu *et al.,* 2009).

Past studies revealed that various dimensions of social capital affected the performance of farmer organization members at both group and individual level, either positively or negatively. Heterogeneous farmer groups in terms of membership were more likely to perform better probably due to diversity in ideas and complementarity of skills.

2.6   Collective action and market participation

In Kenya, the marketing of agricultural commodities suffers from several endogenous risks including high transaction costs, high risks, and missing markets which can be addressed through collective action (Orsi *et al.,* 2017). Smallholder farmers in rural areas face high production costs, this problem is further exacerbated by increasing transaction and marketing costs. This has reduced their incentive to participate in high end markets. Collective action in marginalized rural areas enable farmers to improve access to market for their products at a fairer price. They help members by aggregating their produce over the number of producers, finding a trader interested in buying, negotiating the price, quality specifications, collecting payment and paying farmers (Wambugu *et al.,* 2009).

The way rural producer groups perform their useful role is largely determined by the sharing of information among members (Fischer & Qaim, 2012). Realizing this potential will, however, depend on the ability to convey market information, coordinate production and marketing functions, define and enforce property rights and contracts, and more critically, mobilize producers to participate in markets thus enhancing their competitiveness (Shiferaw *et al.*, 2009). Thus, collective action by smallholder farmers leads to the establishment of a strong linkage with input suppliers and marketers (Mangisoni, 2006).

Participation in agricultural markets by smallholder farmers as indicated by the degree of their commercialization in the crop enterprises is significantly affected by variables such as land size, participation in collective action and access to credit. The degree of commercialization among the low-income households is significantly and positively influenced by membership in groups (Mathenge *et al.*, 2010). This assertion reinforces the importance of collective action among smallholder farmers on market participation in quest to improve household income. Such efforts that promote collective action with supportive and innovative mechanisms for market functions will need to account for the challenges of a new generation of farmer groups emerging as business-oriented enterprises (Shiferaw *et al.*, 2009).

Farmer organizations can succeed in promoting market participation if internal management of these groups is encouraged with minimal government interference, and if collective action reduces transaction costs and improves marketing of agricultural products. This means that a new set of policies and institutional reforms are needed to help transform farmer groups into private sector enterprises with clear business plans to support and facilitate the market participation among smallholder farmers through better market access and efficiency (Mukundi *et al.*, 2013). Activating collective action would therefore be critical in realizing this goal. Collective marketing mostly happens if the gains in terms of reduced transaction costs, better input and/or product prices, and production capacity enhancement increase welfare benefits.

2.7   Marketing channel characteristics

Markets in the rural areas have unique characteristics that differentiate them from those in the urban. Rural markets are characterized by poor infrastructure, weak institutions and high illiteracy levels (Mburu *et al.*, 2007). It has been observed that poor transport and infrastructure leads to imperfect and inefficiently integrated markets (Cheteni & Mokhele, 2019). Each marketing channel has its advantages, with its own problems and constraints.

Different types of smallholder farmers are differently integrated with outside markets (Shiferaw *et al.,* 2009).

Before choosing a marketing channel, smallholder farmers consider the costs associated with transportation, profits, level of trust among the available brokers and familiarity of the markets, among other factors (Mgale & Yunxian, 2020). Unfortunately, some marketing choices pose problems for farmers, and can result in lower farmer earnings. Farmers are often obliged to sell to their neighbours even when the latter cannot pay promptly for the produce. However, smallholder farmers prefer farm gate sales because they receive direct immediate payments and do not incur marketing costs such as transportation costs and tax payments (Cheteni & Mokhele, 2019). Smallholder crop farmers are said to use middlemen in marketing, thereby exposing themselves to price manipulation and exploitation.

Seasonality of agricultural production, particularly in rural areas, has resulted in markets where the produce from the farmers is available seasonally (Tura *et al.,* 2016). Traders in rural areas operate with low capital having low purchasing power and thus buy in smaller quantities and pay in cash because financial institutions are mostly inaccessible (Tura *et al.,* 2016). In most cases, smallholder farmers sell through local traders resulting in smaller quantities transacted compared to sales through other marketing channels. Such traders are also characterised by low-quality standards and the simultaneous purchase of multiple commodities at the farm level, with limited or no packaging (WFP, 2014). While on the other hand, farmers dealing in contract marketing experience high quality standards that require additional costs and effort, premium prices and increased chances of access to credit facilitated by the contractual arrangement.

2.8   Determinants of marketing channel choice

The choice of marketing channels has been examined from different angles, with particular focus on smallholder farmers in developing countries. Choice of marketing channel is defined as the farmers' decision on the point of sale for farm produce. Farmers receive prices and other benefits that are varied in different marketing channels and the farmer is likely to choose the one that gives higher benefits. The choice of a market outlet is likely to determine the price that the farmers will receive for the produce sold. Using multinomial logit analysis, Tesfamariam *et al.* (2015) evaluated determinants of the choice of marketing channel among small-scale honey producers in the Tigray region of Ethiopia. The findings indicate that inadequate access to credit and longer distance to the collection point increased

the probability of selling to informal relative to formal marketing channels (Mathobela, 2021). Household farm size and the number of beehives decreased the probability of using informal market channels relative to industrial processors. Choice of formal marketing channels was associated with high levels of produce being sold and consistent supply (Mburu *et al.,* 2007). Chikazunga *et al.* (2008) revealed that farmers chose informal marketing channels because they could not meet the threshold levels for quality and quantities required by formal marketing channels. This was constrained by low levels of education, access to information and other production assets such as green houses.

In situations where farmers sell their produce, output price and payment period are highly considered in choosing market outlets. When the farmers do not prefer being paid upon delivery, the security of their proceeds must be guaranteed. In studies by Kihoro *et al.* (2016) and Mburu *et al.* (2007), it was observed that farmers preferred marketing facilitators that paid on monthly basis, had formalized credit terms and with a secure payment system for their produce. However, this was inconsistent with findings by Shiferaw *et al.* (2009) who, in their study on rural market imperfections and the role of institutions in collective action to improve markets for the poor, found that most farmers preferred intermediaries, with greater dominance in rural agricultural markets. These intermediaries paid on the spot whereas farmer organizations and other formal buyers could not. This led to the development of long and complex marketing outlets characterized by high transaction costs, which lowered farmers' share of consumer prices (Ssajakambwe *et al.,* 2019).

A study by Dlamini-Mazibuko *et al.* (2019) revealed that institutional and technical factors influence agricultural marketing channels amongst smallholders. Such factors include access to market information, existence of extensive social capital, good infrastructure, and group participation. These attributes mainly determined the probability of a farmer to participate in either formal or informal marketing channel (Jari, 2009*;* Kihoro *et al.,* 2016). On the contrary, Zivenge and Karavina (2012) found that collective action or being a cooperative member had no influence on the choice of a particular channel, but rather other socioeconomic characteristics played a major role in determining a market outlet of the produce. On the other hand, Kibet *et al.* (2011) examined farmer participation in markets for horticultural crops in the arid and semi-arid areas of the North Rift region of Kenya and indicated that farmers producing improved horticultural crops had a higher probability of participating in organized modern marketing channels.

Furthermore, farmer participation in traditional markets was dictated by the effective price of the produce. Education level of the producer positively influenced participation in

formal marketing channels. Hence, household, socioeconomic and institutional characteristics influence the choice of marketing channel.

From the literature reviewed, there is a consensus that household, technical and social characteristics influence the decision of a farmer to participate and commit to collective action as well as on the choice of a marketing channel. From the literature, it is evident that collective action affects enterprise performance.

2.9   Theoretical and conceptual framework

2.9.1   Theoretical framework

The theory of collective action is based on the New Institutional Economics approach to the solution of societal problems and is thus concerned with the conditions under which groups of people with a common interest will perceive that interest and act on it (Ouma & Abdulahi, 2009). Transaction cost and utility of maximizing theory are the main drivers of collective action as posited in the New Institutional Economics. Menard (2005) indicated that transaction costs theory seeks to explain the role of market and non-market institutions in an exchange. Transaction cost theory has been widely used in studying agricultural markets in developing countries (Okello & Swinton, 2007). In analysing of agricultural marketing particularly in Kenya, this theory has been supportive in estimating the impact of collective action on the institutional structure of markets.

Smallholder farmers participating in collective action are hypothesized to increase income from their farming activities and in turn this is expected to provide greater incentives to participate in the market. Because this study focuses more on expected benefits from collective action, which is broader than transaction costs theory, utility maximizing theory fit well in examining participation and commitment to collective action. In most cases, collective action leads to forming common interest groups. Given the expected costs and benefits, an individual chooses whether to participate in collective action initiative or not. However, such choices are made under conditions of uncertainty. In this case, the decision maker is assumed to weigh up the expected utility of profits from the collective good or service through participation in a collective action initiative, represented as $E[U(\pi^p)]$ and the expected utility of profits from non-participation, represented as $E[U(\pi^n)]$.

The decision to participate in a collective action initiative occurs when:

$$E[U(\pi^P)] - E[U(\pi^n)] > 0 \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (1)$$

Where

$$E[U(\pi^p)] = U[E(PQ(Z^p) - W^pX^p)] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.... (2)$$

and

$$E[U(\pi^n)] = U[E(PQ(Z^n) - W^nX^n)] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

E is the expectation operator given the constraints facing the decision maker, P is the output price, Q is the expected output level, X is a column vector of input quantities. Column vector W indicates the input prices and costs associated with the collective action such as financial contributions and costs to attend group meetings. Household and other socioeconomic characteristics are represented by vector Z. The individual's expected utility of profits associated with participation and non-participation in collective action as presented in equation 4 is unobserved and can be represented by the latent variable Y^*, which defines the propensity for the decision maker to participate in a collective action initiative:

$$Y^* = E[U(\pi^P)] - E[U(\pi^N)] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

The variable Y^* is unobservable to the analyst. What is observed is whether a decision maker participates in a collective action initiative or not. This can be presented as Y and is linked to Y^* as follows;

$$Y = 1 \; if \; Y^* > 0, \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (5)$$

$$Y = 0 \; if \; Y^* \leq 0 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (6)$$

When $Y^* > 0$, the decision maker decides to participate in collective action and $Y = 1$ is observed. Otherwise, if $Y^* \leq 0$ the decision maker decides not to participate in collective action and $Y = 0$ is observed. For an individual decision maker i, the latent variable Y^* is assumed to be related to observed characteristics through a structural model as follows (Greene, 2002):

$$Y_i^* = \beta X_i + e_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.......................... (7)$$

Where (i=1, N)

Where X_i a vector of household and other socioeconomic characteristics, β is a coefficient vector, and e_i is a random disturbance term. From above equations, the probability of a decision maker i, to participate in a collective action initiative is given by the following probability model:

$$\Pr[Y_i = 1] = \Pr[Y_i^* > 0] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(8)}$$

$$= \Pr[\beta X_i + e_i > 0]\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(9)}$$
$$=1\, F(-\beta X_i) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(10)}$$

$$=F(\beta X_i)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(11)}$$

Where Pr [.] is a probability function and F (.) is the cumulative distribution function. The exact distribution of F depends on the distribution of the error term e_i.

2.9.2 Conceptual framework

Collective action among smallholder passion fruit farmers is influenced by several factors.

Figure 2.3 illustrates the relationship between the factors influencing collective action, market channel choice and ultimately enterprise performance. In this case, farmers tend to operate collectively to address issues of market failures with an intent of reducing transaction costs hence maximizing returns from passion fruit enterprise. The decision of an individual farmer on whether to participate and subsequently commit or fail to commit to collective action is influenced by household socioeconomic characteristics, technical and institutional factors. Policy environment influences the commitment of an individual farmer. Farmer's participation and commitment to a group is expected to have an impact on enterprise performance. As performance increases due to ability to access production inputs at lower

prices, better bargaining and guaranteed output markets, it is likely to result in increased returns from the enterprise and subsequently higher incomes.

Household factors	**Technical factors**	**Institutional factors**
-Age of the producer	-Access to clean planting material	-Membership to other groups
-Gender of the producer	-Training on enterprise management	-Payment period
-Education of the producer.	-Access to agricultural information	-Credit application
-Land size	-Distance to the buyer	-Access to market information
-Off farm income	-Perception of being exploited	-Farm gate selling price
-Number of other farm enterprises		-Quantity sold

County government and regulatory bodies' policies

-Participation in collective action
-Non-participation in collective action

Marketing channel choice

Commitment to collective action

Improved passion fruit enterprise performance

Improved household incomes

Figure 2.3: Conceptual framework

⟶ Indicates the direction of influence.

CHAPTER THREE
METHODOLOGY

3.1   Study area

The study was conducted in Nandi County, Kenya (Figure 3.1). It is located in the Rift Valley region and comprises five administrative Sub-Counties, including Nandi North, Nandi Central, Tindiret, Nandi East and Nandi South. It is located between 35° 05`E and $35^{o}28$` E and 00° 10`S and $00^{o}05$`N and covers an area of 2,884.2 square kilometres with a population density of 310 persons per square kilometre. The county borders the following counties: Uasin Gishu to the east, Kisumu to the south, Vihiga to the west and Kakamega to the north. According to KNBS (2019), Nandi County has a population of 885,711, of which 36.1 percent live below the poverty line and 89.2 percent live in rural areas and depend on agriculture for their livelihood.

The County is in agro-ecological zone II with annual temperature ranging from 12°C to 23°C. It receives rainfall of between 1,200 mm and 2,200 mm per annum, with an altitude ranging from 1300 m to 2500 m ASL (Jaetzold & Schmidt, 1983). Agriculture is one of the main economic activities carried out by most of the residents in the County. Majority of the farmers practice mixed farming. Horticulture farming is emerging as a new trend in due to its high returns and high demand from the rapidly growing urban population. Passion fruit farming is strongly gaining popularity among smallholder farmers in Nandi County and is replacing traditional crops such as maize due to its high returns. The production and marketing of passion fruit is done collectively or individually and this forms the basis for this research.
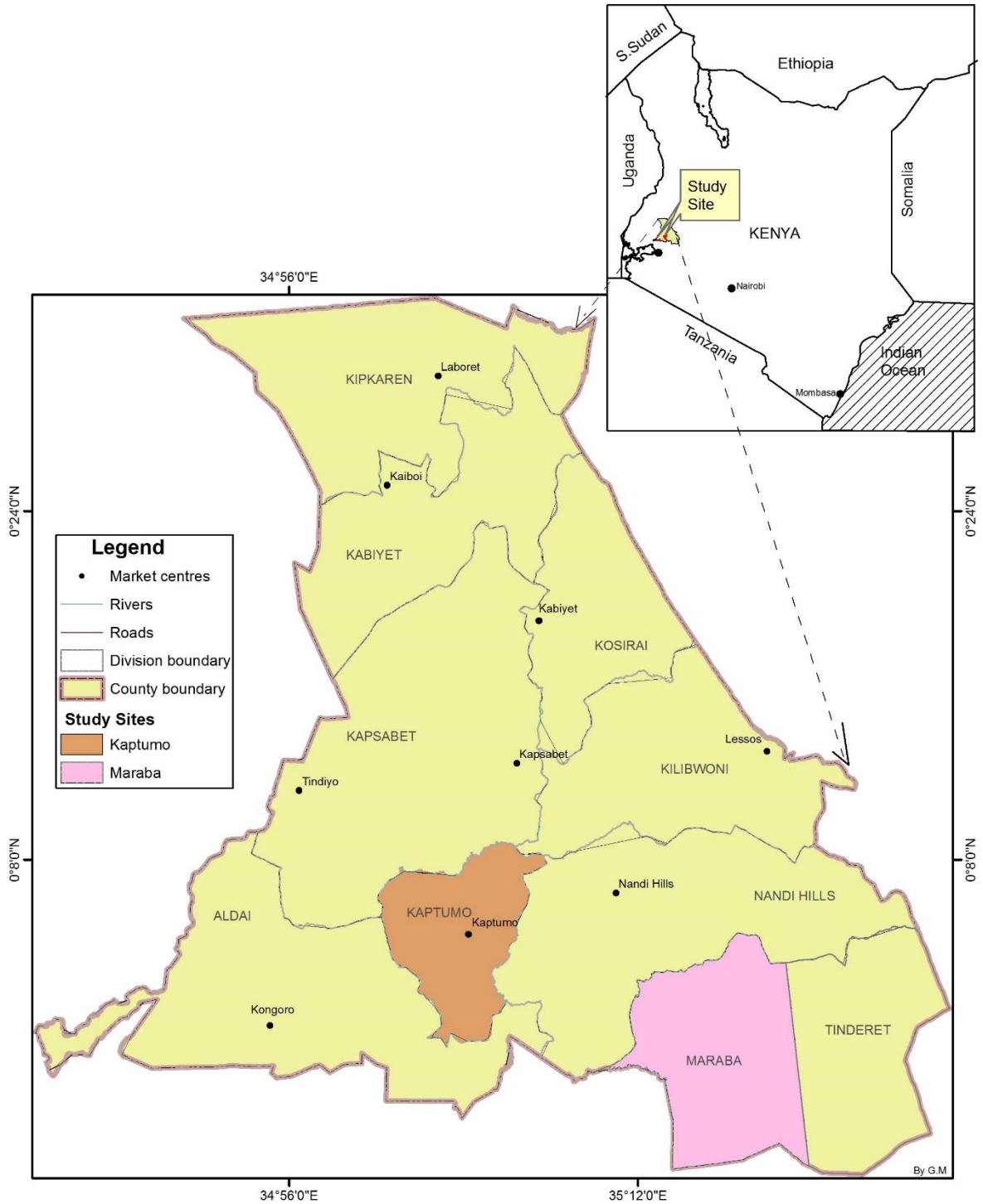
**Figure 3.1: Map of Nandi County. Source*; www.wri.com*

3.2   Sample size calculation and sampling procedure

With regards to sampling, several sampling methods were employed in this case. First, Aldai and Tindiret Sub counties were purposively selected due to the higher concentration of farmers involved in passion fruit production. Kaptumo/Kaboi and Koyo/Ndurio wards in Aldai Sub County and Maraba and Soghor/Soba wards in Tindiret Sub

County (Figure 3.1), respectively, were selected purposively because they were the main passion fruit producing wards in terms of the number of farmers engaged and volume produced.

Sampling frame was stratified into two groups of farmers of members of passion fruit farmer groups and that of non-members. The first group comprised farmers engaged in collective action and was obtained from a list of farmer organizations in the Ministry of Agriculture offices in Nandi County. The second group consisted of passion fruit farmers not participating in collective action. The list of farmers from this category eligible for interviews were confirmed through phone calls.

The sample size was determined using the formula developed by Cochran, 1977; Czaja and Blair, 2005. This formula is mostly useful when the population is known. In this case, the population of passion fruit farmers in Nandi County was approximately 2,760. Thus, the sample size was calculated as follows:

$$n = \frac{N}{1+N(e^2)} \quad \text{... (12)}$$

Where n is the sample size, N is the population, and e is the precision level or the margin of error acceptable to the researcher.

Thus, the sample size was calculated as:

$$n = \frac{2760}{1+2760(0.0064)} = 148 \quad \text{... (13)}$$

Therefore, the sample size of the study was a total of 148 respondents. However, during data cleaning, seven questionnaires were incomplete and were discarded leaving 141 to be used for analysis. Out of these, 95 were engaged in collective action (group members) and 46 were non-group members selected proportionate to the population size of each stratum. The population of farmers in groups was 1,876 whereas 884 were not in groups. The distribution of respondents who were randomly selected is presented in Table 3.1.

Table 3.1: Distribution of Sampled farmers in each stratum by sub-county

Sub-county	Wards	Group members		Non-group Members	
		Population	Sampled farmers	Population	Sampled farmers
Kaptumo	Kaptumo/Kaboi	253	13	119	9
	Koyo/Ndurio	591	30	279	13
Tindiret	Maraba	413	21	195	10
	Soghor/Soba	619	31	291	14
Total		**1,876**	**95**	**884**	**46**

3.4   Data collection

Primary data was collected in June 2014 through face-to-face interviews guided by a structured questionnaire. Both qualitative and quantitative data with attributes such as household characteristics as well as institutional and technical information was collected. These include age, gender, access to clean planting material, training on enterprise management, membership in other groups, labour and transport costs among others.

3.5   Analytical methods and techniques

3.5.1 Objective one: To determine the factors that influence member participation and commitment in producer and marketing groups among smallholder farmers in Nandi County

Participation and commitment are key to successful collective action among smallholder farmers. This objective examines factors influencing the decision that a farmer makes to participate and subsequently commit to collective action (Mugwe *et al.,* 2019). Since the decision made by an individual farmer to participate and commit in collective action is sequential, it makes it possible to analyse it using the double hurdle model. The double-hurdle model is an improvement of the Tobit model and was initially proposed by Cragg (1971). It assumes that a farmer makes two decisions with respect to participating in a group, of which each decision is determined by a set of explanatory variables. In the first hurdle,

based on impediments to participation, the household decides whether to join a farmer group or not.

The second hurdle on the level of commitment to collective action is based on the value of inputs a producer procured through the group relative to total value of inputs used and the proportional value of output sold collectively relative to total value of output sold. A different latent variable is used to model each decision process a farmer makes (Feng *et al.,* 2006), with a binary probit determining the decision to participate and a Tobit determining level of commitment using the value of business the farmer does with the group as a proxy (Fischer & Qaim, 2011).

Model specification

1ˢᵗ Hurdle: Farmers' decision to participate in a group.

Farmer's participation in collective action or farmer group is a discrete choice. That is, a farmer may or may not decide to participate in collective action. The response is expected to be 1 for participation and 0 otherwise. Therefore, a Probit model is appropriate in the analysis. In this case, $Y^* > 0$ if the farmer decides to participate in collective action and $Y = 1$ is observed. Otherwise, if $Y^* \leq 0$ the farmer decides not to participate in collective action and $Y = 0$ is observed as in equation 16. The latent variable Y^*, which defines the propensity for the decision a maker to participate in a collective action. The variable Y^* is unobservable to the analyst. What is observed is whether a decision maker participates in a collective action initiative or not. This can be presented as Y and is linked to Y^* as follows;

$$Y_i^* = \beta X_i + e_i \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (14)$$

$$Y = 1 \ if \ Y^* > 0, \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (15)$$

$$Y = 0 \ if \ Y^* \leq 0 \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots$$
(16)

Where:

Y=is the dependent variable, which takes the value of 1 for participation in collective action and the value of 0 for not participating in collective action.

Y^*= the latent variable for participation in collective action

X_i= Vector of independent variables for participation in collective action

β= Coefficient of parameters estimated

e_i= the error term.

The econometric model specification is as follows:

$$Mem\_Group^* = \beta_0 + \beta_1 Gender\_producer + \beta_2 HH\_size + \beta_3 Education\_producer$$
$$+ \beta_4 Age\_producer + \beta_5 Age\_squared + \beta_6 L\_size + \beta_7 Access\_PM$$
$$+ \beta_8 Sellingprice + \beta_9 Mem\_Ogroups + \beta_{10} T\_management$$
$$+ \beta_{11} A\_marketinginfo. + \beta_{12} Credit\_apply + \beta_{13} D\_market + \varepsilon_i$$

Where: $Gender\_producer$ = gender of the producer; HH_size = number of individuals per household; $Education\_producer$ = education level attained by the producer in years; $Age\_producer$ = age of the farmer/producer in years; L_size = size of the land owned by the household in hectares; $Access\_PM$= whether producer accessed clean planting materials or not; $Sellingprice$ = output selling price in KES; $Mem\_Ogroups$=membership in other groups; $T\_production$ =whether producer received training on passion fruit production or not; $A\_marketinginfo$= whether the farmers had access to marketing information or not; $Credit\_apply$ =household producers who applied for credit or not; D_market= distance to the nearest output market (km).

2nd Hurdle: Farmers' commitment to the group

The second part of the generalised double hurdle (DH) model is the Tobit model (Cragg, 1971). In this case, the dependent variable to be modelled is within a limited range that is between 0 and 1. The Tobit regression model (Tobin, 1958) is more efficient than Ordinary Least Squares (OLS), thus more appropriate in estimating the parameters to avoid biased and inconsistent parameter estimates. In this study, the value of business that a farmer does with the group is measured by the sum of the proportions of inputs and outputs that a farmer purchases or sells through the group. These are defined as the value of inputs that are procured through the group and the amount of output marketed through the group as a proportion of the total value of inputs used and output sold by an individual farmer. This is given by equation 17:

$$Y_i^* = \beta' X_i + \varepsilon_i \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.$$
(17)

From the above equation, Y_i^* is a vector of the latent variable that is not observed for values less than 0 and greater than 1.

X_i, represents a vector of explanatory variables, which includes household characteristics, technical and institutional factors affecting the level of commitment.

β is a vector of the unknown parameters,

ε_i is a vector of the error terms that are distributed normally with mean 0 and variance σ^2

i=1, 2, 3. . .n represents the number of observations.

From Greene (2002) Y_i is the observed variable representing the proportion of the value of business the farmer does with the organization; its value is censored from below at L= 0 and from above at U= 1. Thus, this gives rise to the equation below:

$$Y_i = \frac{Value\ of\ inputs\ through\ group + Value\ of\ output\ through\ group}{Value\ of\ all\ inputs + Value\ of\ all\ output} \dots\dots\dots\dots\dots\dots\dots \text{(18)}$$

From equation 18, the value of inputs procured through the group is added to the value the of output sold through the group; The result is then divided by the sum of total value of inputs used in the passions fruit enterprise and the total output sold by a farmer. The result gives a proportion of Y_i

Therefore, Y_i^* is observed if:

$$\left\{ \begin{array}{l} Y_i = 0 \ if \ Y_i^* \leq L \\ \quad = Y_i^* \ if \ L \leq Y_i^* \leq U \\ \quad = 1 \ if \ Y_i^* \geq U \end{array} \right\} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(19)}$$

where L is the lower bound censored at 0, and U is the upper bound censored at 1.

The expected value of the latent variable Y_i^* is given by the following equation:

$$E\left(Y_i^*/X\right) = \beta'X \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(20)}$$

The change in probability of the dependent variable as an explanatory variable change by a unit is given by:

$$\frac{\partial E(Y_i^*/X)}{\partial X_i} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. \tag{21}$$

As the proportion of the value of the business, the farmer does with the group, Y_i, is truncated from below at 0 and from above at 1, its conditional expected value is given by equation

$$E\left(\frac{Y}{X}, L < Y^* < U\right) = \beta X + \sigma \frac{\phi(Z_L) - \phi(Z_U)}{\Phi(Z_U) - \Phi(Z_L)} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. \tag{22}$$

Where, $Z_L = (L - \beta X)/\sigma$ and $Z_U = (U - \beta X)/\sigma$,

$\phi(\cdot)$ and $\Phi(\cdot)$ are the density function and cumulative distribution of a standard normal variable, respectively. In the absence of the stated limits, $Z = (\beta X)/\sigma$.

However, the estimated coefficients from the Tobit model do not directly give the marginal effects of the independent variables on the dependent variable. Nevertheless, their signs show the direction of change in the probability and intensity of value of the business that a farmer does with the group or farmers' organization as the respective independent variable change (Amemiya, 1985). Thus, the econometric specification for the second hurdle on the commitment to collective action is as follows:

$$\begin{aligned}
Commitment = \; & \beta_0 + \beta_1 Gender\_producer + \beta_2 HH\_size + \beta_3 Education\_producer \\
& + \beta_4 Age\_producer + \beta_5 Age\_squared + \beta_6 L\_size + \beta_7 Access\_PM \\
& + \beta_8 Sellingprice + \beta_9 Mem\_Ogroups + \beta_{10} T\_production \\
& + \beta_{11} A\_marketinginfo + \beta_{12} Credit\_apply + \beta_{13} D\_market + \varepsilon_i
\end{aligned}$$

Where: $Gender\_producer$ =gender of the producer; HH_size = number of individuals per household; $Education\_producer$ = education level attained by the producer in years; $Age\_producer$ = age of the farmer/producer in years; L_size =size of the land owned by the household in hectares; $Access\_PM$ = whether the producer accessed clean planting materials; $Sellingprice$ =output selling price in KES; $Mem\_Ogroups$ =membership in other groups; $T\_production$ = whether the producer received training on passion fruit production; $A\_marketingin$= access to marketing information; $Credit\_apply$ = whether household producers applied for credit or not; D_market = distance to the nearest output market (km).

Description of variables used in objective 1

The variable *Age-of the producer* is a continuous variable. It is measured as the number of years of the respondent who makes major decisions regarding the management of passion fruit enterprise. It is used as a proxy for experience in farming and attitude towards risk. It was expected, therefore, that this variable positively influences participation and commitment in collective action by smallholder passion fruit farmers. According to *a priori* expectation, older farmers are more likely to participate in collective action with greater commitment as compared to young farmers. This was because of their accumulated knowledge and experience in production and marketing of their produce.

Variable *Age_squared* is a continuous variable measured as the square of the age of the producer in years. This variable was designed to measure the consistency of advancement in age with respect to decisions on participation and commitment in collective action. It was expected that the likelihood of a farmer participating in collective action decreases with age.

HH_size is a variable referring to the size of the household where the producer belongs. It was proxy for the availability of labour as far as passion fruit enterprise is concerned. Household with more members tend to have a higher availability of family labour which was expected to negatively affect participation in collective action. Conversely, this variable was expected to positively influence commitment to collective action due to increased value of market share sols through the group.

The variable *Education_producer* is a continuous variable indicating the number of years that the respondent spent in formal education. Passion fruit producers with more education are more likely to accept new ideas. It was expected that farmers with higher level of education are more likely to participate in collective action with higher commitment since they can access and utilize information.

The variable *Gender_producer* is a dummy variable indicating the sex of the passion fruit producer, with 1 denoting male and 0 female. This variable intended to capture differences in market orientation between male and female producers, with female producers being expected to have a higher propensity to participate and commit to collective action. This is because women are more exposed to collective action are compared to their male counterparts.

The variable *Access_ PM* is a dummy variable designed to measure whether the farmer had access to clean planting materials or not. It was hypothesised that access to clean planting material acted as an incentive for passion fruit farmers to participate and commit to collective action. It was anticipated that restricted access to clean planting material negatively affected participation and commitment to collective action.

The variable *L_size* is a continuous variable measuring number of hectares of arable land owned by the household where the producer is a member. It was expected that farmers with smaller parcels were more likely to participate and be more committed to collective action initiatives as compared to those farmers with larger parcels of land (Fischer & Qaim, 2012). It is important to note that smallholder farmers with small parcels of land are likely to benefit more from collective action because of increased bargaining power than when acting individually.

The variable *Sellingprice* is a continuous variable capturing the price of passion fruit offered at the farm gate. It was hypothesized that prevailing farm gate price was expected to influence participation and commitment to collective action positively (Omiti *et al.,* 2016). Lower farm gate prices incentivise farmers to participate and commit to collective action while favourable farmgate selling price was expected to impede participation and commitment.

The variable *Mem_Ogroups* (membership in other groups or associations) was a dummy with 1 indicating group membership in other groups and 0 indicating non membership in other groups. Examples of such groups include saving and internal lending community (SILC) groups, environment groups and welfare groups. According to *a priori* expectation, individuals with membership in other groups had a higher probability of participating and committing to passion fruit farmer groups because they had better understand on the benefits of collective action. This was expected to positively influence participation and commitment to collective action.

Credit application (*Credit_apply)* is a dummy variable indicating whether a farmer had applied for any form of credit regarding passion fruit enterprise or not. Kirui *et al.* (2013), opined that smallholder farmers participate in collective action because of expected economic benefits. According to Kangogo *et al.* (2014), farmers in groups had a higher chance of accessing credit as compared to non-group members. Most smallholder farmers are resource constrained and thus have increased need of credit facilities to enable them finance production activities. Therefore, individual farmers in need of credit were more likely to participate and highly commit to collective action in order to increase their chances of access.

The variable *D_market* (distance to the nearest output market) is a continuous variable introduced to capture effect of market access for agricultural output on participation and commitment to collective action. It was expected that longer distances to the output market encourage participation and commitment to collective action since they induce producers to

sell their produce collectively with an attempt to reduce transaction costs such as transport and handling costs.

A_marketinfo this is a dummy variable that measured whether the farmers had information on passion fruit marketing or not. Access to this type of information acts a disincentive to farmers' engagement in group activities. Thus, it was expected that with access to this kind of information, smallholder passion fruit farmers were less likely to participate and commit to farmer groups.

T_production is a dummy variable measuring whether a farmer had received training on passion fruit enterprise or otherwise. It was expected that training would have a positive relationship with participation in collective action and positive/negative effect on commitment to collective action depending on whether the expected benefits were met. On the contrary, farmers who received training on passion fruit enterprise management were less likely to participate and subsequently commit to collective action.

Objective 2: To determine the effect of participation in producer and marketing groups on passion fruit enterprise performance among smallholder farmers in Nandi County

To analyse the effect of collective action on enterprise performance, gross margin analysis was used. Gross margin is defined as total revenue less all variable costs (Kay *et al.,* 2004). It takes into consideration the costs that go into production and the revenue generated, hence profitability of an enterprise. It was calculated using farm gate prices for output and input retail prices. Net profit was not estimated since fixed costs were not taken into consideration during the computation.

Since the farmers operated in a competitive environment, it was assumed the inputs used were heterogeneous in terms of their types, quantities, and the prices that they paid for them. It was further assumed that farmer organizations had the ability to bargain for better prices because of their capacity to aggregate their produce and thus enjoyed economies of scale. Farmers in these groups were likely to get similar prices per payment received, while those who were not in the groups were likely to receive varied prices every time, they sold their produce. This meant farmer groups could influence the price by varying the output sold through an outlet. Nevertheless, for non-members, the output price was expected to vary depending on the agreement between the farmer and the buyer per particular sale/transaction. The computation of gross margin is given as:

$$\prod_j = [(P_y)Q_y]_j - \sum_{i=1}^{n}[(P_{xi}X_i) + TC]_j \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (24)$$

Where:

$\prod_j$ is the gross margin of the jth farmer

$[(P_y)Q_y]_j$ is the total revenue for the jth farmer

$[(P_{xj})X_{ij} + TC]_j$ is the total variable costs of the jth farmer, which include the operational costs in the whole enterprise such as input costs, cost of labour (both skilled and unskilled) and transport costs.

TC is the transaction costs. This includes transport cost and the cost of searching for inputs sellers and output buyers.

P_y is the output price received by the jth farmer

Q_y is the output of the jth farmer

Whereas P_x is the input price paid by the jth farmer for the ith input or service and X_{ij} the quantity of ith input or service used by the jth farmer.

In order to examine the differences in terms of variables that contributed to calculation of gross margin among smallholder farmers who participated in collective action and those who did not, t-test was conducted on various major costs. The aim was to assess where the difference in gross margin arises from. Overall difference in the gross margin will provide the general assessment of whether collective action influences passion fruit enterprise performance.

Objective 3: To establish the effect of technical, household and institutional factors on the choice of marketing channel among smallholder passion fruit farmers in Nandi County

Multinomial logit regression analysis was used to analyse the effect of household, technical and institutional factors on the choice of passion fruit marketing channel. The choice of marketing channel is a fundamental aspect of agricultural marketing.

Model specification

The probability of a farmer choosing a particular marketing channel given other alternatives is:

$$\text{Prob } (P_j = i) = \frac{\exp(X_j\beta_j)}{\sum \exp(X_j\beta_k)} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(24)}$$

Where P_j is the the probability with which a smallholder passion fruit farmer j will choose market channel i, that is $\text{Pr } (P_j = i)$

In this case i represents the marketing channel choices.

P_i takes values 1, 2, 3 and 4 each representing choice of marketing channel: small trader =1, large trader=2, exporter =3, broker = 4.

X_i are factors affecting the choice of a market channel, β were parameters to be estimated, and e is random error term.

With alternative choices, the probability of farmer j choosing channel i is given by,

$$Pr \, o \, b(P_i = j) = \frac{e_{zj}}{\sum_{k=0}^{j} e_{zk}} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(25)}$$

Z_i is the market channel outlet chosen (Greene, 2002) and is given by,

$$Z_i = B_j X_i \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(26)}$$

and Z_k is an alternative choice that could be chosen (Greene, 2002) given by

$$Z_k = \beta_k X_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(27)}$$

The model estimates are used to determine the probability of choice of a market channel i given factors that affect the choice X_i.

With a number of alternative choices, log odds ratio is computed as:

$$\ln(\frac{p_{ij}}{p_{ik}}) = \alpha + \sum X_i(B_j - B_k) + e \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(28)}$$

P_{ij} and P_{ik} are probabilities that a farmer will choose a given channel and alternative channel, respectively. $\ln(\dfrac{P_{ij}}{P_{ik}})$ is a natural log of probability of choice i relative to probability for choice k, α is a constant, β is a matrix of parameters that reflect the impact of changes in X on the probability of choosing a given channel. e is the error term that is independent and normally distributed with a mean zero N(0,σ).

Marginal effects of the attributes on choice are determined by getting the differential of probability of a given choice:

$$Pr\,o\,b(P_i = j) = \frac{e_{zj}}{\sum_{k=0}^{j} e_{zk}} \dotfill (29)$$

Marginal effects

$$(\delta) = \frac{\partial P_i}{\partial X_i} = pi(Bj - \sum_{k=0}^{j} P_k \beta_k) = P_i(\beta_j - \beta) \dotfill (30)$$

Every sub-vector of β enters every marginal effect through probabilities and weighted averages. The econometric specification for the multinomial model is indicated below,

$$
\begin{aligned}
Marketchannel \\
= \beta_0 + \beta_1 Mem\_Group + \beta_2 Gender\_producer + \beta_3 Education\_producer \\
+ \beta_4 Age\_producer + \beta_5 Sellingprice + \beta_6 D\_Buyer + \beta_7 Q\_sold \\
+ \beta_8 No\_Aenterprises + \beta_9 P\_exploited \\
+ \beta_{10} P\_Period + \beta_{11} A\_marketinfo + \varepsilon_i
\end{aligned}
$$

$No\_enterprises$ = number of enterprises at a household level other than passion fruit. The rest of the variables are as indicated in objective 1.

Description of variables used in the analysis of objective three.

Independent variables (Table 3.2) hypothesised to affect the choice of a marketing channel by smallholder passion fruit farmers were mainly obtained from the literature review on previous related studies and guided by a theoretical framework.

The variable *Age-of the producer* is a continuous variable. It is measured as the number of years of the respondent who makes major decisions regarding the management of passion fruit enterprise. It is used as a proxy for experience in farming and attitude towards risk. It

was expected, therefore, that this variable positively influences the choice of market channel by smallholder passion fruit farmers. Older farmers are assumed to have more accumulated knowledge and experience in production and marketing of their produce thus have high propensity to choose marketing channels such as exporters and larger traders because of previous interactions in other agricultural enterprises.

The variable *Education_producer* is a continuous variable indicating the number of years that the respondent spent in formal education. It was expected that farmers with higher level of education can access and utilize information better. Findings by Tesfamariam *et al.* (2015) indicated that more years of formal education are linked to improved decisions in selling to a channel that offers the best prices with minimal transaction costs such as exporters.

The variable *Gender_producer* is a dummy variable indicating the sex of the passion fruit producer, with 1 denoting male and 0 female. Concerning the choice of marketing channel, male producers were expected to choose organized marketing channels such as exporters and large traders. This is attributed to the fact that male farmers were likely to have established linkages with organized traders through interaction with them when marketing produce from other agricultural enterprises. This variable intends to capture differences in market orientation between male and female producers.

The variable *D_Buyer* is a continuous variable measured in kilometres. It is included in the analysis to capture the effect of transport costs in marketing of the produce. Therefore, it was expected that farmers with farms far from the collection point prefer selling their produce to brokers instead of incurring transportation cost. Increased transport costs reduce farmer's margins from the enterprise; therefore, farmers will transfer this cost to buyers thus choosing a marketing channel that has collection point closer to the farms.

The variable *Sellingprice* is a continuous variable capturing the price of passion fruit offered at the farm gate in KES per kilogram. It was hypothesized that farm gate price was expected to influence positively as well as the choice of a market outlet (Omiti *et al.,* 2016). It was expected that farmers were more likely to choose a channel which offered a competitive price. Competitive pricing plays a critical role with regards to the marketing outlet chosen by smallholder farmers. For instance, Mburu *et al.* (2007) found that more farmers in central Kenya chose the channel that offered a higher price for milk. In this case, it was hypothesised that export and large trader marketing channels offer competitive prices.

The variable *P-Period* is a categorical variable, and it refers to the period which a buyer takes to pay the farmer for the produce sold. It was hypothesized that the longer the period a buyer takes to pay, the lower the probability of the farmer selling through that channel. It was

expected that farmers would prefer channels which pay promptly such as brokers and only preferred those with longer payment period but with contractual arrangements. Such channels include exporters and larger traders who are more organized with secure payment systems.

The variable *Q_sold* is a continuous variable measuring the quantity of output sold through a particular market outlet in kilograms. This variable was expected to have a positive or a negative influence on marketing decisions (Fisher & Qaim, 2012). It was hypothesised that farmers with lower quantities of marketable produce were likely to sell to brokers as compared to those with large quantities, who would be more likely to sell through organized marketing channels such as exporters.

The variable *P_exploited* is a dummy indicating whether a farmer perceived that buyers were exploiting them. This was expected to influence marketing channel choice by smallholder passion fruit farmers. It was expected that producers who perceived a particular channel to be exploitative opted for an alternative channel with less exploitative tendencies. Exploitative tendencies in this case were hypothesised to be poor pricing, less accurate weighing scales and downgrading the quality of farmers' produce. It was expected that farmers will perceive broker marketing channel have exploitative tendencies as compared to exporter, large traders, and smaller traders marketing channels which were perceived to have less exploitative tendencies.

A_marketinfo this is a dummy variable that measured whether the farmers had information on marketing. Informed farmers were likely to sell their output through a market outlet associated with higher prices. Access to this type of information enables smallholder passion fruit farmers to make decisions with regards to the marketing channel choice that would provide better terms of engagement. It was expected that export marketing outlet will provide market information leading to better terms of engagement whereas brokers were expected to asymmetry of information with farmers, and it was hypothesized to have unfavourable terms of engagement with low returns.

No_enterprise is a continuous variable measuring the number of household agricultural enterprises other than passion fruit. It was hypothesised that farmers with more enterprises were likely to sell their produce through more familiar channels with previous transactional interaction. For instance, farmers who sell most of their produce through brokers are likely to engage brokers in passion fruit marketing holding all other factors constant. Similarly, farmers would engage small traders, exporters and large traders given their previous interaction. Farmers with more different farm enterprises have less time to spend on the

marketing of each individual crop. This reduces the chances of looking for new buyers for their produce (Fischer & Qaim, 2011).

Table 3.2: List of variables to be used in double hurdle and multinomial logit models and enterprise performance analysis

Variable code	Variable	Variable type	Unit of measurement
Mem_Group	Participation in collective action	Dummy	participation=1, non-participation= 0
Commitment	Commitment to farmer groups		Proportion between 0 and 1
Marketchannel	Marketing channel choice	Categorical	broker =1, small trader=2, large trader=3, processor = 4,
Gmargin	Gross margin	Continuous	Amount in KES
Age_producer	Age of the person responsible for making production and marketing decisions	Continuous	Number of years
Gender_producer	Gender of the person responsible for making production and marketing decisions	Dummy	Male=1, Female=0 (Male= base category)
Education_producer	Education of the person responsible for making production and marketing decisions	Continuous	Number of schooling years
Access_PM	Access to passion fruit clean planting material	Dummy	Yes=1, No=0
P_ exploited	Perception of being exploited by passion fruit buyers	Dummy	Yes=1, No=0
L_size	Size of the farm owned by the producer's household	Continuous	Hectares
A_marketinfo	Access to market information by smallholder passion fruit farmers	Dummy	Yes=1, No=0

D_market	Distance to the nearest output market	Continuous	Kilometres
D_Buyer	Distance to the selling point of passion fruit	Continuous	Kilometres
P-Period	Payment period	Continuous	Days
Credit_apply	Application for credit facilities/services	Dummy	Yes=1, No=0
Q_sold	Quantity of passion fruit sold	Continuous	Amount in kilograms
T_management	Training on passion fruit enterprise management	Dummy	Yes=1, No=0
No_ enterprise	Total number of farm enterprises per household	Continuous	Number of enterprises
Sellingprice	Passion fruit selling price per kilogram	Continuous	Amount in KES
TotalRevenue	Total revenue from passion fruit enterprise	Continuous	Amount in KES
T_Variable cost	Total variable cost incurred in passion fruit enterprise	Continuous	Amount in KES

Note: DH= Double hurdle model, MNL= Multinomial logit model and GM= Gross margin analysis.

CHAPTER FOUR
RESULTS AND DISCUSSION

This chapter presents the results from the analysis. It is divided into four sections. Section 4.1 describes the descriptive statistic of the respondents. Section 4.2 focuses on factors influencing participation and commitment in collective action, whereas section 4.3 presents the results on the effect of collective action on enterprise performance. Finally, section 4.4 is a discussion on the institutional, technical and household factors affecting the choice of the marketing channel.

4.2   Descriptive results

4.2.1   Production constraints of passion fruits

Understanding passion fruit production dynamics is imperative. Like in any other agricultural production, passion fruit had several constraints faced by smallholder farmers. Results in Table 4.1 convey that high incidence of diseases as a major constraint, with 33 percent of the farmers citing the same. Passion fruit enterprise if not tendered well in the field, is vulnerable to diseases, especially woody stem virus disease. The high cost of inputs was ranked second by 24 percent of the farmers. Since passion fruit enterprise is resource intensive, the high cost of inputs acts as a barrier to farmers from expanding the enterprise and from producing high quality fruits.

Table 4.1: Production constraints indicated by passion fruit farmers in Nandi county.

Production constraints	Percentage
High incidence of diseases	33
High cost of inputs	24
Unfavourable weather conditions	12
Lack of agronomic advice	11
High incidence of pests	10
Lack of clean planting material	7
No production constraint	3
Total	**100**

Unfavourable weather conditions were ranked the third constraint. For instance, occurrence of hailstorms during flowering and fruit development affects the yield and

subsequently the quality of the produce. Majority of the respondents highlighted their dependence on rainfall for production thus, inadequate rainfall during the flowering stage affects fruit development leading to reduced productivity. This finding implies that weather weather-related risk is inherent to passion fruit production.

Passion fruit production requires skills, especially in main field agronomic practices such as planting, application of fertilizer, pesticide and fungicide application, trellising and pruning. Notably, 11 percent of farmers indicated a lack of agronomic advice as a constraint in producing passion fruit. The high incidence of pests was cited by 10 percent as a challenge. Poor access to extension services could be attributed to these findings.

Lack or inaccessibility of clean planting material was not a major challenge among passion fruit farmers. Only seven percent of the respondents cited this as a challenge. This can be attributed to the high presence of many stakeholders on the ground promoting the production of good quality seedlings, especially the grafted seedlings. Although the seedlings were available, the study showed that the prices were higher, and those farmers who were not receiving subsidy could not access them easily. Only four percent of the respondents did not experience any constraints in passion fruit production. This indicated that passion fruit farming could have a huge potential if some of these production challenges are addressed.

4.2.2 Marketing constraints experienced by smallholder passion fruit farmers in Nandi county.

Passion fruit is a commercial crop, and the enterprise faces several marketing challenges. The main constraints farmers encountered in marketing their passion fruit produce is presented in Table 4.2. The results indicate that fluctuating market prices ranked higher with 36 percent of the farmers citing it as a major marketing constraint. Fluctuating prices expose the farmers to more risk, which is a disincentive to further expand passion fruit production. Unfavourable contractual arrangements were cited as the second most important marketing challenge. According to the findings, 26 percent of the farmers felt that the contractual terms did not favour them. High transport cost to the point of sale was a major constraint for 23 percent of passion fruit farmers. This high transport cost reduces farmers' revenue besides compromising the quality of the fruit for sale.

Fluctuating demand was another constraint cited by 9.2 percent of farmers. As a result of this, farmers found it hard to develop production and marketing plan for their produce. Farmers without marketing constraints and with other minor constraints comprised three

percent and two percent, respectively. These results, therefore, have a greater implication on the commercialization of passion fruit enterprise and indirectly on the incomes.

Table 4.2: Passion fruit marketing constraints experienced by smallholder farmers in Nandi county.

Marketing constraints	Percentage
Fluctuating marketing prices	36
Unfavourable contractual arrangement	26
High transport cost	23
Fluctuating demand	9
No marketing constraint	3
Other constraints	2
Total	**100**

4.2.3 Product attributes required by buyers.

Passion fruit product attributes varied among different buyers. Such requirements determine the marketing channel that an individual farmer will choose depending on the ability to meet the set standards. Preferred attributes for passion fruits required by buyers are presented in

Table 4.3.

Table 4.3: Product attributes preferred by passion fruit buyers.

Buyer Attribute	Percentage
Level of maturity	50.7
Physical wholeness	26.0
Size	23.3

Results in

Table 4.3 showed that about 51 percent of the farmers cited the level of maturity as an important attribute highly considered by the buyers. This is because the product is consumed as a fruit and its level of maturity and ripeness has significant influence on the taste and quality. Physical wholeness was ranked second by passion fruit buyers, and about one-quarter (26 percent) of the farmers indicated that most buyers, especially exporters, were keen on the physical wholeness of the passion fruit. This is because of the stringent requirements on

quality in the export market. Size, though not ranked highly by farmers, was considered an important produce attribute by passion fruit buyers. Notably, size is a quality requirement by consumers both in the export and local markets. Some farmers would get a better price for passion fruits that buyers considered to be of larger size.

4.2.4 Credit application

Credit application is important to smallholder farmers because it increases the chance to access finance used in purchasing inputs, paying for operational costs and covering production related costs. Table 4.4 specifies the constraints faced by smallholder farmers in their attempt to acquire agricultural credit services.

Table 4.4: Constraints in applying for credit by members of passion fruit groups in Nandi county (n=95).

Constraints in accessing credit	Percentage
lack of collateral	30
Exorbitant interest rates	29
Few credit services	20
Tedious application procedure	16
Stringent terms and conditions	6
Total	**100**

Application for credit by the farmers was affected by several constraints despite their willingness to apply and acquire credit. From the constraints cited, lack of collateral ranked highly, with 30 percent citing it a major constraint in applying for agricultural credit services. High interest charged by credit service providers barred farmers (29 percent) from applying for credit. Notably, the low numbers of credit service providers hindered 20 percent of the farmers from applying for credit, while those few available had tedious application procedures, as cited by 16 percent of the respondents who had experienced constraints in applying for credit. Finally, 6 percent of the passion fruit producers who experienced difficulty applying for credit cited stringent terms and conditions of credit service providers as a constraint in applying for credit services, especially in formal institutions. To further develop the passion fruit sector, this finding shows that there is a need to intensify efforts to enable access to agricultural finance.

4.2.5 Access to extension services

Access to extension services by smallholder farmers is key in increasing productivity and improving enterprise management in general. Passion fruits, being a horticultural produce, needs careful planning and implementation of agronomic practises to optimize production. Therefore, extension services are crucial in providing advisory services on agronomic practices and marketing information. Results in Table 4.5 indicate that 45 percent of the respondents encountered the difficulty of accessing extension services because of few extension personnel. Given the policy of demand driven on the provision of extension services hindered farmers from accessing information. As indicated, 46 percent cited distance to the nearest extension personnel acted as a constraint.

Table 4.5: Constraints to accessing extension services by members and non-members of passion fruit groups in Nandi county (n=141)

Constraints in accessing extension services	Percent
Few extension personnel	44.85
Distance to the nearest extension officer	46.33
Long waiting time	5.88
Exorbitant extension charges	2.94
Total	**100**

Long distance travelled by smallholder farmers to access extension officer acted as a disincentive for smallholder farmers from seeking extension advice. Due to low ratio of extension worker to smallholder farmers, there is a long period taken by 6 percent of the farmers before receiving agricultural advice at individual level (Table 4.5). A smaller percentage (3 percent) indicated that they were unable to seek extension services because it was too expensive for them. This result has a major implication for the overall development of passion fruit. According to Baloch (2016), access to extension services has an effect of increasing the yield which translates to improved household incomes.

4.2.6 Membership to other groups by passion fruit farmers

The results, as shown in Table 4.6 reveal that most of the smallholder passion fruit farmers belonged to more than one group. Though farmers were members of producer and marketing groups, they were found to participate in other community groups such as social investment and community groups.

Table 4.6: Membership to other groups by passion fruit farmers in Nandi county.

Type of the group	Percentage
Agricultural	67.74
Savings and credit	19.35
Community	11.29
Educational	1.61
Total	100

The results showed that due to their occupation as farmers, about 68 percent participated in at least one other agricultural group, 19 percent in different forms of savings and credit groups, 11 percent in community development groups and two percent in educational groups.

4.2.7 Socioeconomic characteristics of passion fruit farmers in Nandi county.

Socioeconomic characteristics were key in determining the decisions made by smallholder farmers about the production and marketing of passion fruit. Table 4.7 describes continuous variables, while Table 4.8 describes discrete variables. Since there were two clusters, those who participated in collective action and those who did not, a comparison of means was done using the student t-test for continuous variables and Chi-square for discrete/categorical variables. The results in Table 4.7 show comparisons of means with regards to continuous variables describing the socioeconomic characteristics of the farmers. Out of the eight variables, the quantity of the produce sold, distance to the nearest output market, and selling price significantly differed between farmers who engaged in collective action and those who did not.

From the results, difference in the quantity sold was significant at one percent (Table 4.7). This implies that smallholder passion fruit farmers in groups were more commercialized than non-group members, as indicated by the quantity of produce sold. The farmers who participated in group activities resided far from output markets (collection points), approximately one kilometre farther than non-group members, and therefore it became necessary for them to join groups for aggregation. Results indicated a difference of KES 9 regarding farm gate price received between farmers in groups and those who were not was

significant at one percent. This is explained by better bargaining power from collective marketing by group members.

Table 4.7: Socio-economic characteristics of passion fruit farmers in Nandi county. (Continuous)

Variable		Mean	Std. Dev.	t- value	Min.	Max.
Age of the producer	Group member	45.84	13.89	1.08	20	79
	Non-member	43.09	14.91		20	70
Household size	Group member	5	2.56	0.47	1	11
	Non- member	5	1.99		1	9
Education level of the producer	Group member	8	3.91	0.70	0	18
	Non-member	9	3.77		0	15
Land size in hectares	Group member	1.92	1.32	0.87	1.64	2.19
	Non- member	1.71	1.20		1.35	2.19
Number of enterprises	Group member	4	1.38	1.53	2	7
	Non- member	4	1.32		2	7
Quantity of produce sold	Group member	923.1	596.4	2.69***	801	1044
	Non- member	659.3	420.8		534.5	784.3
Distance to the nearest output market	Group member	2.592	2.914	1.819*	1.997	3.185
	Non- member	1.689	3.461		0.661	2.717
Selling price/kilogram	Group member	66.03	10.68	3.29***	63.86	68.21
	Non- member	57.06	21.77		50.6	63.53

*, **, *** denote significant level at 10%, 5% and 1% level, respectively

In terms of age and education level of the producer, household size, land size and number of enterprises, there was no significant difference among the group and non-group farmers. Comparisons of means for discrete variables describing the socioeconomic characteristics of the farmers were done using Chi-square, and the results are shown in Table 4.8.

In passion fruit enterprise, clean planting material is key to attaining good yields and, ultimately, better income. There was a significant difference of 1 percent between group and non-group members in terms of access to clean planting material. Approximately 78 percent

of group members had access to clean planting material compared to only 28 percent of the non-members.

Group and non-group members had a significant difference (at 5 percent) in access to marketing information among passion fruit farmers. A higher percentage of the farmers in groups (93 percent) had access to information compared to 78 percent for those not in groups. The information received was mainly on prevailing prices, buyer quality attributes and collection days. In terms of credit application, there was a significant difference of 5 percent between group and non-group members. Approximately 75 percent of group members had applied for credit compared to 63 percent of non-group members. Results indicate a significant difference of 1 percent between group and non-group members in terms of access to training on passion fruit. Most group members (91 percent) had some form of training on enterprise management compared to only 4 percent of non-members.

Table 4.8: Socioeconomic characteristics of passion fruit farmers in Nandi county (Discrete)

Characteristic		Group members n=95		Non-group members n=46		$\chi2$ value	Total N=141	
		No.	Percent	No	Percent		No.	Percent
Gender of the producer[1]	Male	81	85.36	37	80.43	0.54	118	83.69
Access to clean planting material	Yes	74	77.89	13	28.26	32.31***	87	61.7
Membership in other groups	Yes	68	71.58	10	21.74	31.15***	78	55.32
Perception of being exploited	Yes	49	50.04	30	66.67	3.59*	79	56.03
Training on passion fruit production	Yes	86	90.53	2	4.35	98.12***	88	62.41
Credit application	Yes	72	75.79	29	63.04	64.16**	101	71.63
Access to market information	Yes	88	92.63	36	78.26	6.02**	124	87.94

*, **, *** denote significant level at 10%, 5% and 1% level respectively

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[1] Male is the base category for gender of the producer variable.

With regards to membership in other groups and associations, there was a significant (1 percent) difference between group and non-group members. Approximately 72 percent of farmers participating in collective action had membership in other groups or associations, whereas 22 percent of non-group members belonged to other groups. Such groups and associations were primarily agricultural, savings and credit, and groups focusing on natural resource management. Generally, 55 percent of the farmers had membership in other groups and associations.

From the description, it is apparent that there was a distinct difference in terms of socioeconomic characteristics among group and non-group members. However, some socioeconomic characteristics such as the producer's age, gender, education level, household size and the land size in hectares had no major difference among group and non-group members.

4.3   Factors influencing participation and commitment in producer and marketing groups among smallholder passion fruit farmers in Nandi county.

In analysing participation and commitment to collective action, double hurdle model was used. This model assumes that the decisions to participate in collective action and the level of commitment are sequential. A farmer can decide to participate in collective action, but committing to the same group is independent.

4.3.1   Participation in collective action

Table 4.9 shows the summary of results of participation in collective action. Out of the variables considered, the producer's age, access to market information, credit application and membership in other groups were significant at 5 percent significance level, while training on passion fruit enterprise management was significant at 1 percent significance level.

The coefficient for the age of the person responsible for making production and marketing decisions was negative, suggesting that the probability of participating in collective action diminishes with age. This infers that older farmers are less likely to form/join a farmer group. Age was also taken as a proxy for experience in farming. Therefore, experienced farmers tend to have lower participation in farmer groups than young and inexperienced farmers seeking information on new ways of farming (Kangogo *et al.,* 2013*;* Mensa *et al.,* 2014).

The findings concur with Kibet *et al.* (2011b), who found that older farmers were less likely to adopt high value crops with new ways of farming and even get involved in emerging profitable enterprises such as passion fruit. Thus, from the results, the hypothesis that age has no significant effect on participation in collective action was rejected.

Table 4.9: Determinants of participation in collective action by passion fruit farmers in Nandi county.

Variable	Marginal effects	Standards errors	Z scores
Household size	-0.012	0.004	0.123
Gender of the producer	0.897	0.544	0.173
Education level of the producer (years)	-0.073	0.097	-0.811
Age of the producer (years)	-2.542**	1.113	-2.309
Age squared	-0.005	0.033	-0.080
Land owned	-0.294	0.939	-0.316
Access to market information	1.262**	0.649	1.971
Access to planting material	1.155	0.690	1.462
Selling price (in KES)	0.030	0.034	0.826
Applied for credit	2.098**	0.877	2.41
Training on passion fruit production	3.180***	0.912	3.500
Membership in other groups	0.022**	0.091	0.224
Distance to the nearest output market (km)	0.081	0.196	0.896

*, **, *** denote significant level at 10%, 5% and 1% level respectively

Access to market information by smallholder passion fruit farmers increased the likelihood of participating in collective action by 126 percent, contrary to *a priori* expectation. Smallholder farmers continuously gather information on new production and marketing trends. The possibility of getting this information through groups acts as an incentive for smallholder farmers to participate in collective action. Intuitively, one would join the group with intention to learn and share experiences among other members (Arcas-Lario *et al.,* 2014). This observation can also be attributed to information flow from

stakeholders to the farmers, which in most cases is channelled through farmer groups, hence the positive relationship between participation in collective action and access to market information.

Credit is an important service for smallholder farmers mostly engaged in commercial agriculture. The need for this service/facility increased twice the likelihood of participating in collective action and this result concurs with the expected results although the null hypothesis that institutional factors (credit application) has no significant effect on participation in collective action was rejected. Smallholder farmers particularly those without collateral find it difficult to access formal credit services individually. However, the trend in rural credit providers is that to qualify, members must form groups and the individuals serve as guarantors to one another. This prompted smallholder passion fruit farmers to form/ join groups in order to comply with the requirement. Indeed, Kinuthia (2009) revealed that access to credit incentivises participation in collective action as it increases the chances of successful application. This implies that a farmer weighs the benefits of being a group member before participating and the ease to which ones had access to credit is one of the factors considered. This observation is coupled with financial institutions' changing strategies of promoting group lending, which has further enticed farmers to engage in collective action (Kangogo *et al.,* 2013).

Training on passion fruit production positively influenced participation in collective action. Training increased the likelihood of a farmer participating in collective action three times, as indicated in the variable description. However, this result leads to the rejection of the null hypothesis that technical factors such as training have no significant effect on participation in collective action. Passion fruit production requires specific skills such as grafting in the nursery, correct spacing, transplanting, trellising in the field and pruning. Thus, training on good agricultural practices in passion fruits is a pre-requisite in its adoption. In most cases, such training is provided to farmers by stakeholders, preferably in groups. This observation increases the likelihood of farmers participating in collective action to access quality training.

Membership in other groups and associations positively influenced the decision to participate in collective action leading to the rejection of the hypothesis, though it concurs with the expected result. Passion fruit producers with membership in other groups had a higher probability of participating in collective action by 14 percent. The plausible explanation behind this observation is that farmers who interact with other groups clearly understand the benefits of collective action (Fischer & Qaim, 2011).

51

4.3.2. Description of farmer groups and their benefits

Farmer groups under consideration in this study were mainly common interest groups focusing on passion fruit enterprise. Members formed these groups with technical assistance from the ministry of agriculture and, cooperative development government officials, and other interested stakeholders. Passion fruit farmers had to register in these groups to enjoy the benefits of being a member. Some of these benefits included established linkages to the markets to facilitate collective marketing as well as negotiation of better prices from the buyers. Groups had the ability to set buying/collection days with arrangements together with the buyers at the pick-up points. Since quality passion fruit planting material is not easy to access, farmers from the groups benefitted from ease access to quality grafted seedlings and collective acquisition of other inputs such as fertilizer and pesticides. Furthermore, passion fruit groups befitted from capacity-building sessions on passion fruit management provided by various extension service providers. Farmers who were group members were linked to financial service providers, increasing their access to credit facilities.

4.3.3 Commitment to collective action

Commitment to collective action is key to ensuring the sustainability of a group. This refers to an individual farmer's investment of time and resources in group activities. The results from the double hurdle model are shown in

Table 4.10. The significant coefficients were education, land size, access to planting material, selling price, and credit application.

Education of the producer was found to influence commitment significantly and negatively to passion fruit farmer groups at 5 percent. The hypothesis is rejected. A one-year increase in the education level of the household head reduced the likelihood of a farmer's commitment to collective action by 1.2 percent *ceteris paribus*. Implicitly, a higher level of education is a proxy for higher income and engagement in other income-generating activities especially formal employment. This reduces their availability to attend meetings and subsequent participation in other group activities. Furthermore, educated farmers are more likely to make their own production and marketing arrangements, thus affecting their level of commitment to collective action initiatives. These findings are consistent with Muriithi *et al.* (2011) and Agbonlahor *et al.* (2012).

The size of the land owned by the producer determined the extent of commitment to group activities. At a 5 percent significance level, the producer's land size positively

influenced farmer's commitment to collective action. This observation leads to the rejection of the hypothesis that there is no relationship between land size and commitment to collective action. In this case, an increase in the size of land owned by one hectare increases the likelihood of farmer's commitment to collective action by 13 percent. This could be attributed to the assumption that farmers with larger farmers size are likely to have high passion fruit produce, which encourage collective action for a better bargain of prices, reduced market search costs and Global Gap certification (Karatepe & Scherrer, 2021).

Table 4.10: Factors affecting commitment to collective action by passion fruit farmers in Nandi county.

Variable	Marginal Effects	Standard. Errors.	Z
Household size	-0.123	1.029	0.765
Gender of the producer	1.066	0.091	0.670
Education level of the producer(years)	-0.012**	3.023	-2.153
Age of the producer (years)	-0.027	0.013	-1.446
Age squared	0.017	0.198	-1.392
Land size in hectares	0.134**	0.079	1.767
Access to market info.	2.127	0.115	1.036
Access to planting material	0.290***	0.114	2.633
Selling price (in KES)	-0.010**	0.004	-2.017
Applied for credit	0.213***	0.087	2.615
Training on passion fruit production	-0.099	0.776	-1.217
Membership in other groups	0.124	0.017	1.016
Distance to the nearest output market(km)	0.016***	1.015	3.110

*, **, *** denote significant level at 10%, 5% and 1% level respectively

However, Fischer and Qaim (2012) argued that a farmer with small parcels of land was more likely to benefit from group activities and thus induce them to commit further

compared to those with large parcels. Findings by Kirui *et al.* (2013) also contradict this observation. However, the plausible explanation is that farmers who have planted passion fruits anticipate expanding their acreage with time if they find it profitable. This makes them continue participating in group activities.

Access to clean planting material was significant and positively influenced commitment to collective action. The results in

Table 4.10 indicate that farmers with access to clean planting material were more likely to commit to collective action by 29 percent. Propagation of clean planting material was challenging for most farmers and could only be accessed in well-established propagation nurseries. Such propagation initiatives increased the propensity of commitment to collective action since in most cases seedlings were procured collectively. The strong relationship between access to clean planting material and commitment to collective action informed the rejection of the null hypothesis.

The farm gate-selling price significantly influenced the farmer's decision to commit to collective action at 1 percent; thus, the null hypothesis is rejected. An increase in prevailing effective price by KES 1 decreases the likelihood of a group member's commitment to collective action by at least 1 percent. A plausible explanation is that smallholder farmers tend to shun groups and sell in spot markets when the farm gate price is favourable, and they urgently need cash. This practice is common when organized markets present challenges, particularly regarding quality requirements, low farm gate prices, and delayed payments (Ssajakambwe *et al.,* 2019). This is antagonistic to collective action. It is apparent that farmers commit to their groups only when the market is organized.

Application for credit facility positively and significantly influenced commitment to collective action at 1 percent significance level. This finding informed the rejection of the hypothesis that credit application had no significant effect on commitment in collective action. It is important to note that passion fruit production is capital-intensive because it requires inputs like poles, wires, fungicides, and pesticides which can increase the demand for credit. Such cost projections increase the need for successful credit application, thus increasing the likelihood of farmers' commitment to collective action.

Distance to the nearest output market was positive and significant at 1 percent, leading to the rejection of the hypothesis. An increase in distance to the nearest output market by one kilometre increases farmer commitment to the group/association by 1.6 percent. This is because the further it is from the market, the higher the transaction cost and the need for collective action becomes imperative. Indeed Shiferaw *et al.* (2009) opined that farmers who

reside far from the nearest output markets have a higher commitment to reduce transaction costs and thus maximise on the use of collection points.

4.4 Effect of collective action on passion fruit enterprise performance in Nandi county.

4.4.1 Gross margin analysis

Gross margin analysis was used to evaluate enterprise performance for group and non-group members. Gross margin is the difference between the revenue generated and variable costs incurred in an enterprise. It indicates the viability of an enterprise and its performance in general.

Results in Table 4.11, indicate that the gross margins were significantly higher for farmers who participated in collective action and those who did not. There is a significant difference between group and non-group members in terms of costs of inputs such as seedlings, fertilizer, fungicides, pesticides wire, and poles. It is evident that collective action plays a role in the competitive acquisition of inputs, thus helping to lower costs.

There was a significant difference at 1 percent (t = 3.29) in farm gate prices received by farmers. Farmers in groups fetched higher prices than non-group members, implying that collective action influences market performance. This difference provides evidence that collective marketing is beneficial to smallholder farmers because of their improved bargaining power, contrary to the stated null hypothesis.

It is revealed that seedlings, fertilizer and chemical costs were lower among group members. This is because farmers in groups sourced these inputs in lumpsum, benefiting from economies of scale. Groups tend to have more information about the best price of these inputs in the market; hence they can easily buy at lower prices. Farmers in groups can bargain for better input prices than individual farmers, hence the difference. There was a significant difference in land preparation, harvesting and handling costs. Farmers who participated in groups incurred higher land preparation costs, harvesting, and handling costs as compared to those who were not in groups. This contradicts *a priori* expectation given that both groups live in the same locality where the cost of these activities is similar. A plausible reason behind this observation is that although group members had collective harvesting as well as sorting in an attempt to reduce hired costs, there were some cases where the groups hired an expert with a known reputation to carry out activities at a slightly higher price leading to increased activity costs. Although farmers participating in collective action had higher land preparation, harvesting and handling costs, their total variable costs (TVC) were lower than non-participants, implying that collective action affects enterprise performance.

Table 4.11: Comparison of gross margin for group and non-group members

Variable	Mean values		Difference in mean
	Group member (n=95)	"Non-member" (n=46)	
A: Revenue generated			
Quantity sold(kg/hectare)	9,354	7,585	+*
Price (KES^2/kg)	66.03	57.07	+***
Total Revenue/hectare	617,644.62	432,827.95	
B: Operating Costs			
Seedlings cost (KES/hectare)	29,656.80	48,606.90	+***
Fertilizer cost (KES/hectare)	23,981.00	38,647.00	-***
Chemicals cost (KES/hectare)	18,923.00	35,247.68	-**
Cost of wire and timber (hectare)	12,947.69	19,070.07	-**
Transport cost (KES)	3,117.037	2,212.71	+
Total operation costs	88,625.53	143,784.36	-***
C: Labour Cost			
Land preparation (KES/hectare)	3,450.54	2,222.69	+**
Trellising cost (KES/hectare)	2,045	1,950.00	+
Pruning cost (KES/hectare)	4,857.16	5,932.96	-
Transplanting (KES/acre)	1,725.27	2,011.35	-
Chemical application (KES/hectare)	3,345.00	3,420.00	-
Weeding (KES/acre)	1,825.44	1,411.38	+
Harvesting and handling costs (KES/hectare)	5,175.80	3,334.04	+***
Total	22,424.21	20,271.42	+
D: TVC/hectare= B+C	111,049.74	164,055.78	-**
E: GM/hectare= A-D	506,594.88	268,772.17	+***

*, **, *** denote significant level at 10%, 5% and 1% level respectively

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[2] 1 USD= 88 KES for 2014 June exchange rates.

From the results, it is evident that farmers in groups realized better margins than their counter parts who were not in groups. This is because of the ease in accessing these inputs through farmer groups. This difference is statistically significant at 5 percent. The findings further show that passion fruit can improve household incomes for resource-constrained smallholder farmers, especially when acting collectively. This assertion confirms the positive relationship between collective action and passion fruit enterprise performance.

4.5 Passion fruit marketing

4.5.1 Passion fruit marketing channels

According to Table 4.12 exporters bought the highest volume of 1,143 kilograms at a mean price of KES 65, whereas brokers bought an average of 688 kilograms at an average price of KES 60. Large traders (wholesalers) offered better farm gate prices as compared to other market outlets.

Table 4.12: Volumes sold, and prices paid by different buyers to passion fruit farmers in Nandi county.

Buyer type	Mean price	Volume	Percentage
Small trader	64	817	56
Large trader	67	837	8
Exporter	65	1,143	22
Brokers	60	688	14
Total	**64**	**834**	**100**

Generally, smallholder passion fruit farmers received an average of KES 64 per kilogram, while the average marketed volume was 834 kilograms. Most of the farmers sold their produce to small traders, whereas the large traders (wholesalers) and exporters did business with fewer passion fruit farmers with larger volumes. This result calls for further expansion and increased access to export markets by smallholder passion fruit farmers to enhance improved livelihoods. The export market can absorb large quantities of the produce at better prices. This, however, is highly dependent on the ability of the farmers to adhere to the production standards as stated in the contracts.

Small traders also play a major role in passion fruit marketing. This could be because most of them are not very strict regarding passion fruit standards and specifications requirements, thus making it the most preferred market channel.

4.5.2 Collective marketing

According to Table 4.13, the aggregate results show that 59 percent of the farmers sold their produce through a farmer group, whereas 41 percent sold individually. Most of the farmers who participated in collective marketing sold their produce to exporters (73 percent); larger traders (64 percent) and small traders (62 percent), while fewer (39 percent) sold to brokers. Participation in collective action increases the chances of participating in niche markets. This is because, through the groups, farmers can access extension services and information on production and marketing requirements, particularly on contractual arrangements offered by exporters and large traders. Since most exporters and large traders would require huge quantities and a consistent supply of passion fruits, it compels individual farmers to participate in farmers' group which help in bulking their products.

The results further indicate that farmers who were not in groups were more likely to sell to brokers (61%). This is because for individual farmers, it is cumbersome and costly to look for markets therefore creating room for brokers. Brokers' marketing channel was widely accepted by smallholder farmers because of their ability to pay on the spot and cut on transaction costs Jengka (2020), even when they offer very oppressive prices.

Table 4.13: Percentage of selling mode by smallholder passion fruit farmers in Nandi county.

Buyer type	Selling mode	
	Individually	**Through a group**
		Percentage
	Percentage	
Small trader	38	62
Large trader	36	64
Exporter	27	73
Broker	61	39
Aggregate percentage	**41**	**59**

4.5.3 Choice of marketing channel

Smallholder farmers sell their produce to a market channel for several reasons ranging from price offered, the buyer's proximity to the farmers, the quantity of the produce available for sale and the presence of a contractual arrangement.

Table 4.14: Reasons for choice of a marketing channel by passion fruit farmers in Nandi county.

Buyer type	Reason for selling to a respective buyer (in percentage)			
	Only available	Better prices	Nearest	Contractual arrangement
Small trader	34	59	7	0
Large trader	9	91	0	0
Exporter	13	67	0	20
Broker	89	0	11	0
Total percentage	**36**	**56**	**4**	**4**

The results, as presented in Table 4.14 show that passion fruit farmers who sold their produce to small traders, large traders and exporters did so because of better prices offered. This finding corroborates with Mailu *et al.* (2012), that prices are key in influencing smallholder participation in the market.

The results further show that the main reason why farmers (34 per cent) sold to small traders because it was the only outlet available to them. Some 59 percent of farmers sold to small traders because they offered better prices while 7 percent found them to be the only available buyers within the locality. The small traders could purchase passion fruits more frequently and conveniently whenever produce was available for sale.

There were only two reasons why farmers sold to large traders: it was the only available outlet for 9 percent and that it offered better prices as reported by 91 percent of farmers. Generally, 56 percent of the respondents sold their produce to a buyer of their choice because of better farm gate prices.

The choice of exporter outlet arose because it was the only outlet available for 13 percent of farmers and offered better prices for 67 percent while 20 percent were bound by contractual arrangements. The choice of brokers as an outlet was prompted by being the only ones available to 89 percent of farmers while 11 percent found them at close proximity.

4.   Effect of institutional, technical and household factors on the choice of passion fruit marketing channel

Multinomial logit model was estimated to determine the factors influencing passion fruit farmers' choice of marketing channel. Table 4.15 shows the results of the model. The model fits the data well as indicated by the Log-likelihood Ratio (LR), which is significant at 1 per cent. The pseudo R-squared is also good, though in most cases, it may not be a perfect measure of fit in the multinomial logit model (Greene, 2002).

Table 4.15: Factors affecting the choice of marketing channels by passion fruit farmers in Nandi county.

Variables	Large trader Relative risk ratio	Exporter Relative risk ratio	Broker Relative risk ratio
Age of the producer (years)	0.9689	1.0174	1.0419**
Education level of the producer (years)	1.2303*	1.0504	1.0124
Gender of the producer	0.3999	0.1900**	0.3896
Group membership	0.4269	1.6144	1.9080
Distance to the buyer	0.8729	0.7746*	0.8742
Payment period(days)	5.7861***	6.0941***	0.5765
Perception of feeling exploited	0.6029	0.4448	11.3593**
Selling price(in KES)	1.0461	0. 9436**	0.9321*
Quantity sold (kg)	0.9997	1.0009**	0.9995
Access to market information	2.3751	1.1590	0.8127
No. of enterprises	0.7547	1.1109	0.7082

Log likelihood= -108.537,   Pseudo R^2= 0.2889   N=135,   Probability Chi sq.= 0.000

*, **, *** denote significant level at 10%, 5% and 1% level respectively; *Small traders' channel is the base category*

The results Table 4.14 presents four market channel choices available to passion fruit smallholder farmers, which included small traders, exporters, large traders and brokers, with small traders as the reference category. The significant variables from the analysis were: the gender of the producer, payment period, perception of being exploited, and the output-selling price.

The age of the farmer/producer had significant influence at 5 percent on the decision to select a marketing channel contrary to the stated hypothesis. Older farmers were more likely to sell to a broker than smaller traders. It is plausible that older farmers tend to be more risk-averse, therefore sell to brokers who pay cash on the spot. Chiv *et al.* (2020) revealed that farmers with more experience chose direct markets over export markets. These findings conform to Kihoro *et al.* (2016) and Xaba and Masuku (2013), who noted that older farmers were more reluctant to venture into new marketing activities. However, the results contradict Muthini (2015), who revealed that older farmers sold their mango produce to the export market rather than brokers.

The years of schooling significantly influenced the decision to select a marketing channel at 10 percent. An extra year of schooling increased farmers' likelihood of choosing a larger trader 1.2 times relative to a smaller trader. This is because higher education level increases the ability to source, analyse and understand market information such as supply arrangements, contracts and price negotiations associated with large traders and exporters (Kiprop *et al.,* 2020). Large trader channels put farmers with lower levels of education in a disadvantaged position when negotiating for better terms of engagement and contract understanding. These results are in tandem with Mutura *et al.* (2015). Consequently, the hypothesis that the number of schooling years has no significant effect on the choice of the marketing channel was rejected.

Gender of the producer had a significant influence on the channel choice of an exporter, at 5 percent, leading to the rejection of the null hypothesis. Male producers were 0.19 times more likely to sell their produce to exporters relative to small traders. This finding concurs with Nxumalo *et al.* (2019) and Vorlaufer *et al.* (2012), who revealed that female farmers were less likely to sell their produce to organized buyers. This is because most male farmers have access to and control over productive resources, leading to increased marketed volumes preferred by large traders and exporters compared to small traders who deal primarily in small quantities. Furthermore, male producers have more established market linkages than female producers, thus preferring a larger trader marketing channel.

In contrast to initial expectations, the proximity to the buyer increased the likelihood of selling to exporters at 10 percent significance level. Specifically, for each additional kilometre away from the buyer, there was an increase of 77% in the probability of selling to exporters relative to small traders. These findings align with a study by Kihoro *et al.* (2016) and Martey *et al.* (2012), which similarly observed that as the distance to the buyer increases, smallholder farmers were likely to sell to more organized markets such as exporting companies and cooperatives. The plausible explanation for this disparity could be attributed to the fact that in the study area, farmers residing far from the buyer tend to aggregate their produce at designated selling points on specific days and this kind of organization was favourable to exporters.

The payment period significantly influenced the decision to participate in a marketing channel at 1 percent. Results show that farmers chose to participate in larger trader/exporter marketing channel because they preferred slightly more extended payment period. An increase in the payment period increased farmers' likelihood of choosing either a large trader or exporter relative to a small trader as the main marketing channel by approximately 5.5 and 6.1 times, respectively, *ceteris paribus*. This is because larger traders and exporters are mostly registered companies and have formal payment systems through established financial institutions. Moreover, these farmers tend to build trust with these larger traders/exporters because of guaranteed trade repetitiveness, thus assuring them of long-term market compared to small traders in the market. The findings conform to Kirui *et al.* (2016) which indicated that farmers prefer payment at regular intervals. The results suggest rejecting the hypothesis that institutional factors have no significant effect on smallholder passion fruit farmers' choice of marketing channel.

Farmers' perception of being exploited by buyers was significant at 5 percent in influencing the decision to participate in a marketing channel. Farmers who perceived produce buyers as exploitative were 11.4 times more likely to select the broker channel relative to small traders holding other factors constant. The plausible explanation behind this observation is that farmers tend to be sensitive to the choice of buyer when there is perception of being exploited by a buyer, thus preferring channels that are less exploitative and easily controlled. Larger traders and exporters were perceived to exploit farmers because stringent requirements led to lower marketed volumes when compared to brokers who buy any produce with limited focus on quality attributes. Furthermore, buyer knowledge contributed significantly to the choice of brokers who were found to be less exploitative. The repeated

interactions between farmer and brokers contribute to the choice of this channel given trust gained over time. This finding contradicts Kihoro *et al.* (2016), which revealed that given alternatives, farmers would prefer not to sell their produce to brokers as a marketing channel due to exploitative tendencies, particularly on pricing. However, this result is similar to that of Musemwa *et al.* (2007), who found that farmers who perceived to be exploited sell their produce to marketing outlets/channels where output prices are more competitive with less stringent quality requirements.

The selling price offered by a buyer were significant at 5 percent for exporter and 10 percent for broker in influencing the decision to choose a marketing outlet. An increase in the selling price of passion fruits by one-shilling increased farmers' likelihood of choosing channel of exporter by 0.95 times relative to a small trader and also increased the likelihood of selecting a broker by 0.93 times. The reason is that if an exporter increased the unit price of passion fruits, it is likely that the increase may be sustained for longer compared to brokers increasing their buying price. Brokers were chosen over small traders because of their consistency in buying the produce and the high probability of an assured market. This finding concurs with Shiferaw *et al.* (2009), Tesfamariam *et al.* (2015), Xaba and Masuku (2013) and Zivenge and Karavina (2012), who agreed that smallholder farmers tend to prefer consistent farm gate prices, offered mainly by an exporter as opposed to a small trader. The positive relationship between farm gate price and the marketing channel choice of exporter indicates that farmers prefer dealing with organized and consistent buyers when prices are favourable and choose brokers when the prices in the organized markets are less favourable (Chiv *et al.*, 2020). This observed effect of price on marketing channel choice contradicts the null hypothesis that selling price has no significant influence on the choice of a marketing channel leading to its rejection.

The quantity sold of passion fruits was significant at 5 percent induced farmers to choose the export channel and thus, hypothesis is rejected. An increase in quantity sold by one kilogram would increase passion fruit farmers' likelihood of choosing an exporter relative to other channels *ceteris paribus*. This is because exporters can handle large volumes involving huge transactions compared to small traders. As farmers increase the quantities of passion fruits sold, they are more likely to sell to larger traders to avoid post harvesting losses.

Farmers' decision to select export markets is due to their large volumes could also be because these markets have specific collection days; hence harvesting is done when needed, thus reducing post-harvesting handling costs associated with large volumes harvested (Chiv

et al., 2020). This finding agrees with Nyaga *et al.* (2016), who concluded that traders who bought large volumes from farmers reduced post-harvest losses, while Tefamariam *et al.* (2015) found that an increase in the quantity of honey at the household level available for sale increases the likelihood of selling to exporters and other organized markets.

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS

5.1   Conclusions

As indicated in the gross margin analysis, passion fruit farming as an enterprise has high returns per unit area. Even though it takes almost six months before the first harvest, it has proven beneficial to smallholder farmers in the county facing shrinking land sizes.

i.   The age of the producer and education level negatively affected participation in collective action, whereas membership in other groups, land size, selling price and training on passion fruit enterprise management had a positive effect on the involvement in collective action. Commitment to collective action was positively influenced by land size, access to clean planting material, credit application and distance to the market. Education level of the producer and the selling price negatively influenced commitment to collective action.

ii.   Based on the results, there was a significant difference in gross margin among farmers who participated in collective action and those who did not. Specific difference was noted from the gross margins emanated from variable costs such as the cost of seedlings, fertilizer costs as well as harvesting and handling costs. Selling price contributed to the disparity in the gross margin between passion fruit farmers who participated in collective action and those who did not. This clearly indicate that collective action positively influences passion fruit enterprise performance.

iii.   Farmers sold their produce through various marketing channels. The available channel options included small traders, large traders, exporters and brokers. Factors such as farm gate selling price positively influenced the choice of a broker, gender of the producer influenced the choice of an exporter, perception of being exploited influenced the choice of a broker, and quantity of the produce sold as well as payment period positively and significantly influenced farmers' decision to sell the produce to through an exporter as a marketing channel. Although group membership is important in produce aggregation and improving bargaining power, it had no significant influence over the choice of a marketing channel.

5.2   Recommendations

Based on the results from the study, the following recommendations were made:

i.   It is recommended that the production of high value crops through collective action should target young and youthful farmers who are resource constraint and less risk averse. It is recommended that collective action be adopted to develop markets in areas where transaction costs are likely to be high. It is evident that collective action can enhance smallholder farmers' capacity to access production inputs at competitive prices and well-structured markets. Therefore, government agencies and other stakeholders should promote a group approach in developing input and output markets for smallholder farmers.

ii.   More efforts and resources should be directed towards the development of small traders it was revealed that there was potential for them to absorb most of the produce as compared to export markets and traders. Owing to the large number of local traders coupled with the ability to procure large volumes, there is a possibility to receive competitive prices because of the convenient access to the farmers. Since pests and diseases was the most problematic constraint cited by the farmers, stepping up agriculture extension services through various media is recommended to ensure that the farmers have substantive technical knowledge in crop management. It will also ensure that the farmers remain active in production, particularly when there is an assurance of reduced effects of woody virus disease.

iii.   Further, it is recommended that policies that strengthen frameworks that guide group membership, and the construction of output markets should be put in place to strengthen collective action and collective marketing among passion fruit farmers.

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Appendix A: Household Survey Interview Schedule

Household Questionnaire

My name is Kibet Walter Kemei a master 's student at undertaking research on "*Effect of collective action on passion fruit enterprise among smallholder farmers in Nandi County Kenya.* Your participation in the study is voluntary, and all information will be treated as confidential.

GENERAL INFORMATION

Date of the interview (DD/MM/YY) ____/_____/_____] Name of the respondent/producer
_____

Time of the interview (in 24hrs system) _____

Relationship the of the respondent to household head _____ (1= household head, 2=spouse, 3=grown up child >18yrs, 4= relative)

Name of the enumerator   _____
Subcounty _____

Division   _____   Location
_____

Sub-location   _____   Village
_____

Telephone/mobile no. of the respondent _____

Group member :   *1=Group member*   *0=Non- member*   **GRP_MEM**   _____

Q1: DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLD MEMBERS

Member ID	Name of HH member	In which **year** was this person born?	What is the **sex** of member? *1=male* *2=female*	What is the **highest** level of education completed? *See codes below*
Mem	**Name**	**Yborn**	**Gender**	**heduc**
1 (head)				
2 (spouse)				
3				
4				
5				
6				
7				
8				
9				

Q2 PASSION FRUIT PRODUCTION

Q2.1.   How many **acres** in **total land holdings** does the household **own**?

     TACRES_____

Q2.2. Fill the information below on the passion fruit enterprise for the **Season 2012/2013**

Field No.	Acres	Is this field 1=owned w/ deed 2=owned w/o deed 3=rented 4=owned by parent/ relative 5=government/ communal/ co-operative	If owned, who owns this field? (use mem numbers from Demog table)	If rented, what is the cost (KES) of rent for the season?	Who is **responsible** for this crop? (use mem from the Demog table).	Seed type/Planting material 1=local seedlings/vines 2=improved(crafted) seedlings/vines	Quantity of **seedlings used** Cost if purchased this season			Number of **productive vines**	Harvest *N/A=not yet harvested*	
							Quantity	Unit	**Cost per unit** (Ksh)		Quantity	Unit
Field	**Acres**	**Tenure**	**memown**		**Memgt**	**Sdtype**	**sqt**	**sunit**	**scost**	**ptrees**	**hvt**	**Hunit**

INPUT USE ON PASSION FRUIT PRODUCTION

Q2.3.List all the crop **inputs** (excluding seed/planting materials) that the household used on **passion fruit** enterprise during the cropping seasons for **2012/2013**, then fill the table below.

		Type	Qty	Unit	**If purchased**, cost (KES) per unit	**If not purchased**, how much (KES) would you pay per unit were you to buy?		
	Field	**input**	**Inpqty**	**Inpunit**	**Inpcost**		**inpsorce**	**Mpurch**

LABOUR USE IN PASSION FRUIT PRODUCTION

Q2.4. How do you rate the availability of labour used in passion fruit production?
LAV_____

0=unavailable 1=Easily available   2=Available

Q2.5. Record in the table below details of use of **Hired and Shared/Family labour and cost of oxen/tractor** on **passion fruit enterprise** by the household during the **2012/13** cropping year.

| Labor activity name *Use codes below* | Oxen/tractor | | Ksh /person/ Day | If by contract, Total Ksh | # hired | # Days worked | Ksh/ person / day | If by contract, Total Ksh | # of adults in shared/family labour | | No. of days | Total Ksh |
	# Hired	# Days worked							Males	Females		
Lactivty	**Nmale**	**Dmale**	**Shmale**	**conmale**	**nfem**	**dfem**	**Shfem**	**confem**	**Mshared**	**Fshared**	**Dshared**	**Lpcost**

3 PRODUCE MARKETING

Q3.1. Did this household **sell passion fruit in** the **2012/2013 cropping year**? *1=Yes   0=No*

SELLCROP_____

Quan tity	Unit (use codes belo w)	Ks hs	Unit (use codes below – could differ from those for quant ity)	Did you sold 1=Individ ually 2=Throug h a group?	Who bought your produce? 1= small trader 2=Large trader 3=Exporte r 4=Broker 5=Superm arkets	Why did you sell to this buyer ?	Dista nce to this buyer in kms	Paym ent perio d 1= Cash, 2=2-5days 3= 6-14 Days 4=Aft er 14 days	Trans port cost in KES	If used own means of transp ort, how much (KShs) would it cost if you were to hire?	Who in this househ ols makes marke ting decisio ns? 1=Mal e 0= Fmeale 2=Both
Quan ts	**qsu nit**	**spric e**	**ssunit**	**slmode**	**Buyer**	**whybu yer**	**Kmbu yer**	**p_peri od**	**trcost**	**owntrc ost**	**Decsel**

Unit codes*:*   1=90kg bag 2=kg 3=50 kg bag 4= 25 kg bag   5=10 kg bag 6 =debe 8=w/barrow 9=cart
10=Extended bag 13=gorogoro **p-period codes**: No. of days

Q3.2   What attributes do buyers of passion fruit look for in the product?

Attribute1_____ Attribute2_____ Attribute3_____ Attribute4_____

1=Variety   2=Size   3=Maturity   4=Level of ripening   5=Cleanliness   6=Colour7=Skin texture

8=Physical wholeness (no spots/bruises)   9=Other (specify)_____

Q3.3   What constraints, if any, do you face in the production of passion fruit (*Rank in order of importance*)?

Prodconst1_____Prodconst2_____Prodconst3_____Prodconst4_____

1=Lack of clean planting materials   2=Unfavorable weather   3=Lack of agronomic advice   4=High cost of inputs   5=High incidence of pests

6=High incidence of diseases   7=Lack of agronomic management skills   8=Other (specify)_____

Q3.4   What constraints, if any, do you face in marketing of passion fruit (*Rank in order of importance*)?

MKTCONST1_____   MKTCONST2_____   MKTCONST3_____
        MKTCONST4_____

*1=Lack of demand   2=Low prices   3=High cost of transport 4=Unfavorable contractual arrangement
        5=Other (specify)_____*

Q3.5.   If you did not sell, why didn't you sell?

NOSELL1_____   NOSELL2_____   NOSELL3_____
        NOSELL4_____

1=Lack of buyers   2=Little production   3=Production meant for subsistence only   4=Other (specify)_____

Q3.6 Do you feel exploited by traders?(in both input and output markets) 1=Yes   2= 0

Q3.7 If yes, how exploitative are they? 1 =Highly exploitative 2=moderate exploitative 3= low exploitative 4= No exploitation

Q 3.8 Did you receive any training on passion fruit enterprise management? TE_MGT_____ 1= Yes 0= No

4 PARTICIPATION IN FARMER GROUPS

Q4.1 Do you or any member of this household belong to any group or organization?   *1=Yes   0=No [skip to Q4.c]* GROUP_____

Q4.2 List all the names and ID of members of the household who belong to any group and answer subsequent questions

Name & ID of household member who belongs to a group *(May have multiple lines with the same ID number, if that person belongs to multiple groups.*	What type of group is this? 1=agricultural 2=savings & credit 3=education 4=community 5=religious 6=other (specify) (*if GRUP is not =1 then skip* **YRJOIN***)*	Which activity/ enterprise(s) does this group deal with? i.e. Group type		How much (Ksh) is membership fee	What services does the person get from the group? 1=credit/loan 2= marketing 3= input purchases 4=savings 5=joint extension services 6=market information 7=water catchment 6=other (specify)	What benefits does the person derive from participating in the group? 0=None 1= information 2=higher prices 3= credit/loan 4=ready market 5=other (specify)		
name	Mem	Grup	grpent1	grpent2	Fee	Service	befit1	befit2	befit3

Q4.3 Do you attend group meetings/trainings?_____ 1=Yes   2= No

Q4.4 If yes, how many times did you attend in the 2012/2013 production period _____ times.

Q4.5 How far (on average) is the venue of group meetings from your home? _____kms

Q4.6 If you **or** any member **of this household** do/does not belong to any group or organization, **why**?

NOGROUP1_____   NOGROUP2_____   NOGROUP3_____

       NOGROUP4_____

1=No group to join   *2=Do not have time for group activities*   *3=Groups are not beneficial 4=Other*
(specify)_____

5. FIANCIAL SERVICES - CREDIT

Q5.1   Did any member of this household **apply for credit** (either cash or in kind) between **April 2012 and April 2013? CREDTRY** _____

          1 = yes   *2 = no* →*go to Q5c*

If **Q5.1= No**, why did **you or any member of your household not** apply for credit in the last 12 months? **NOCRED_____**

1=No security/collateral   2=Had outstanding loan   3= Credit received in kind   4= Don't Know   5=Did not
need credit   6=Credit services unavailable   7= Other (specify) _____

Q5.2.   In **your opinion**, how would you rate the following attributes of credit to farmers in this area?

  i.   Availability of credit services   *1=unavailable   2=available but few*
            3=adequately available   **CRAVAIL_____**

  ii.   Interest rate charged on credit   *1=exorbitant   2=reasonable   3=too low*
               CRINTERST_____

  iii.   Application process/procedure for credit   *1=too long   2=reasonable   3=too short*
             CRAPROCESS _____

  iv.   Information on terms and conditions of credit   *1= not clear   2=inadequate 3= clear*
           CRINFO_____

v. Stringency of terms and conditions of credit *1=very stringent 2=favorable   3=not stringent*

CRCOND_____

Q5.5. What **constraints**, if any, have you faced in accessing credit?

CRCONST1_____ RCONST2_____ CRCONST3_____ CRCONST4_____
CRCONST5_____

1=few credit services 2=lack of collateral/security 3=exorbitant interest rates 4=tedious application procedure 5=stringent terms and conditions

6 ACCESS TO AGRICULTURAL INFORMATION

Q6.1 Did you access any extension services in the previous production period (2012/2013)? _____
1= Yes, 2= No

Q6.2 Did you access any information on marketing of passion fruit in the period 2012/2013? _____ **1= Yes, 2= No**

Q6.3 What are your main sources of **information on agricultural production and marketing**? FINFO1____
FINFO2_____ FINFO3_____

1=Government organizations	*7=Newspapers*	*13=Internet*
2=Non-governmental extension agents	*8=Farmers' magazines /newsletters*	*14=Private service providers*
3=Other farmers	*9=Input dealers*	*15=Research institutions*
4=Farmers organizations / Cooperatives	*10=Field days /demonstrations*	*16=Commodity traders*
5=Radio	*11=Extension leaflets*	*17=Other (specify)* _____
6=Mobile phone	*12=Agricultural shows (ASK)*	

Q6.4 What **constraints**, if any, have you faced in accessing extension services?

CRCONST1_____ RCONST2_____ CRCONST3_____ CRCONST4_____
CRCONST5_____

1=few extension service providers 2=Distance 3=exorbitant interest rates   4=tedious   application procedure

7 Off-farm income

Q7.1. List all off-farm income (including remittances, dividends and pension) earned by all household members March 2012 and March 2013.

Person name (*As in demography table*)	Person ID (*As in demography table*)	Which **Income earning activity(ies)?** *(See activity codes below)*	Months involved in the activity in the last 12 months	What was the monthly estimate of income (Kshs) from this activity
NAME	**MEM**	**ACTIVITY**	**ACTMONTH**	**INCMONTH**

8 INFRASTRUCTURE (*Measures of market access*)

Q8. Distances (km) from your homestead   *(0=service not available).*

   a.   What is the distance from your homestead to the **nearest agricultural**   DEXTN_____
   extension service provider?

   b.   What is the distance from your homestead to the **nearest output market**   MKTKM_____
   place for **farm produce**?

   c.   What is the **type of the road** from your homestead to the **nearest farm**   RDAGMKT_____
   produce market? (*use codes below*)

   Road type codes: *1=murrum /all weather   2=tarmac   3=dry weather   4=foot path***.**

Q9. List all the major enterprise the farmer had in the 2012/2013 production period

Farm enterprise	Who is responsible for its management?

Codes for responsibility   **1**=household head **2**=spouse **3**= Household head and spouse **4**=grown up child>18yrs **5**= Relative **6**= Farm worker

Thank you

Adopted with modifications from Tegemeo Institute of Agricultural policyand development, Egerton University

Appendix B: Research Permit

REPUBLIC OF KENYA

NACOSTI

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SCIENCE, TECHNOLOGY & INNOVATION**

Ref No: **356668**

Date of Issue: **28/October/2021**

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This is to Certify that Mr.. Kibet Walter Kemei of Egerton University, has been licensed to conduct research in Nandi on the topic: EFFECT OF COLLECTION ACTION ON PERFORMANCE AND MARKETING AMONG SMALLHOLDER PASSION FRUIT FARMERS IN NANDI COUNTY KENYA for the period ending : 28/October/2022.

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88

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Appendix C: Publications

Journal of Development and Agricultural Economics

Full Length Research Paper

Factors influencing participation and commitment to collective action among smallholder passion fruit farmers in Nandi County, Kenya

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Passion fruit is one of the high value horticultural crops cultivated by smallholder farmers because of high returns. The enterprise is gaining inroads in the predominantly cereal growing areas of North Rift. Its production has not been intensified since farmers grow few vines, but they are now forming passion fruit producer and marketing groups. However, the contribution of collective action is not clear. This informed the study. The study was conducted in Nandi County, Kenya with an objective of understanding factors influencing participation and commitment to collective among smallholder passion fruit farmers. Both primary and secondary data was collected using multistage sampling techniques to arrive at a sample of 141 selected respondents. Data collected was analysed using excel for descriptive statistics and STATA was adopted in analysing double hurdle model. From the findings, selling price, membership in other groups, training on passion fruit enterprise management and distance to the nearest output market positively influenced smallholder farmers' participation and commitment to collective action, whereas education level and age of the producer had a negative effect. It is recommended that stakeholders should promote collective action in developing input and output markets for smallholder farmers.

Key words: Double hurdle, collective action, smallholder farmers.

INTRODUCTION

With the rising commercialization of agriculture among smallholder farmers, there has been a gradual shift from subsistence agriculture to market led production patterns (Omiti et al., 2006). In Kenya, horticultural production has been identified as one of the avenues that would

in Kenya is facing a growing problem of access to land and shrinking sizes of smallholder farms, with over half of the farms being less than 1.5 ha (Kirimi et al., 2011). The effects of reduced farm sizes are both negative and positive. Negative effects include decreased