

**TRANSACTION COSTS AND MARKET PARTICIPATION AMONG
AVOCADO SMALLHOLDERS IN MURANG'A COUNTY**

KELVIN NJUGUNA KARING'U

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THE UNIVERSITY OF EMBU**

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DECLARATION

This thesis is my original work and has not been presented elsewhere for a degree or any other award.

Signature.....

Date.....

Kelvin Njuguna Karing'u

Department of Agricultural Economics and Extension
University of Embu
A510/1139/2017

This thesis has been submitted for examination with our approval as University Supervisors.

Signature.....

Date.....

Dr. Hezron N. Isaboke

Department of Agricultural Economics and Extension
University of Embu

Signature.....

Date.....

Dr. Samuel N. Ndirangu

Department of Agricultural Economics and Extension
University of Embu

DEDICATION

I dedicate this work to my mother Veronica Muthoni your prayers, endless encouragement and resolute support made it possible to complete this study.

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ABBREVIATIONS

EU	:	European Union
FAO	:	Food and Agriculture Organization
GoK	:	Government of Kenya
KES	:	Kenyan shilling
KBDS	:	Kenya Business Development Services
LM	:	Lower Midland
MoA	:	Ministry of Agriculture
MNL	:	Multinomial Logit
MT	:	Metric Tone
OECD	:	Organization for Economic Co-operation and Development
SDGs	:	Sustainable Development Goals
SSA	:	Sub-Saharan Africa
UM	:	Upper Midland
USA	:	United State of America
USAID	:	United States Agency for International Development

DEFINITION OF TERMS

Gross Margin- Gross margin is estimated as total revenue from sale of crop output less variable costs incurred (Firth, 2002). For this study gross margin is estimated as the revenue on avocado sold (KES/ per Kg) less costs of production and marketing costs (KES/ Kg).

Market participation- This refers to involvement of farmers in any activity that promote sale of agricultural products (Key *et al.*, 2000). For this study market participation was modelled as; export market participation and participation through choice of avocado marketing channels.

Marketing channels – These are alternative routes of products flow from producers to consumers (Sigei *et al.*, 2014). For this study marketing channels involves selling directly to the market, local traders, brokers and marketing organizations.

Smallholder avocado farmer – Small holder farmers are characterized by land holding of less than 10 hectares and has 30 avocado trees or less in production stage.

Transaction Costs- refers to costs incurred when looking for trade partners, negotiating with them, making a contract and enforcing it (Jagwe & Machethe, 2011). For this study transaction costs considered were marketing organizations fees, subscriptions and cost of information search and harvesting costs.

ABSTRACT

Access to market plays a vital role in poverty alleviation among smallholder farmers in Sub-Saharan Africa. Agricultural markets provide income generating opportunities for farmers in rural areas hence improving their livelihoods. Avocado fruit has a high demand in both local and export markets due to its nutritional value and industrial use. However, smallholder avocado farmers have not benefited from this increased demand. The purpose of the study was to assess the effects of transaction costs on market participation among smallholder avocado farmers in Murang'a County. Stratified random sampling was applied to obtain a sample of 384 farmers. Murang'a County was selected because it is one of the leading producers of avocados in Kenya. Findings showed that sales through farmer market organizations had the highest gross margins while sales through local traders had the lowest gross margin. Heckman first stage regression results showed that cost of information search negatively affects the probability of export market participation. Further the results indicated that factors such as years in avocado marketing, membership to farmer organizations and trainings on avocado farming positively affected participation in export market. The second stage OLS regression results revealed that harvesting costs negatively affects the extent of market participation, while factors such as farm size and farm income positively affect participation in export markets. Results of Multinomial regression analysis showed that the probability of choosing brokers was significantly affected by farm size, household head's gender, education level of household head, time taken to collect avocado, access to extension, farm income and intercropping avocado with coffee. On the other hand off-farm income, dairy cattle kept by the farmer, intercropping avocado with coffee, growing organic avocado, travelling costs to buyer locations, farmer organization membership fees and subscriptions affected farmers' decision on direct sales to market. Trainings on avocado farming methods, time taken to collect avocados, delayed buying of avocados and off-farm income were among the factors that significantly affected the probability of choosing to market through local traders. Farm gate price reduced the likelihood of choosing brokers and direct sales. This study therefore recommends that strengthening farmer marketing organizations is vital in increasing the number of farmers engaging in export marketing chain. Also there is a need for provision of market information especially on avocado collection dates by the exporters.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Avocado (*Persia americana*) is experiencing a rapidly increasing global demand (Amare *et al.*, 2019). In recent years it has emerged as the most traded fruit after pineapple and mango that contributes more than 25% of tropical fruits export annually in the global market (Food and Agriculture Organization (FAO), 2019). Avocado contains fat-soluble vitamins, protein, potassium and unsaturated fatty acids that are less common in other fruits (Duarte *et al.*, 2017). The fruit pulp has about 30% oil content similar to olive oil (George *et al.*, 2019). It is used in the pharmaceutical and cosmetic industries as a raw material (Duarte *et al.*, 2017).

Africa has shown a burgeoning trend in uptake and production of avocados that currently stand at 751,881 metric tonnes (FAO, 2019). South Africa, Ethiopia, Cameroon, Rwanda and Kenya are the top five exporters of avocados in the region (Amare *et al.*, 2019). Despite the immense growth in production of avocados, small-scale avocados farmers in the rural set-up of Africa face many constraints when choosing the marketing channels for their produce. Such constraints may include lack of assured markets and low farm gate prices, small scale production, distantly separated markets and seasonality in production (Yankson *et al.*, 2016).

Smallholder farmers in developing countries especially Sub-Saharan Africa participate in agricultural markets such as export and domestic chains (Abayneh & Tewodros, 2013). Gains from participation in export markets are higher compared to local markets (Saenger *et al.*, 2013). Therefore, interventions aimed at facilitating smallholder market access such as farmer organizations are essential in enhancing farmers participation in the market (Key *et al.*, 2000; Barrett, 2008). More so, reduction of transaction costs through improved road infrastructure and market information systems enhance small scale farmers' market participation (Ouma & Jagwe, 2010).

In Kenya, horticultural industry is the fastest growing agricultural subsector and is valued at KES 236.45 Billion (United States Agency for International Development (USAID),

2017). The value of fruits stands at 53.24 billion. Banana, pineapples, mangoes and avocados being the major fruits grown (USAID, 2017). The report further indicated that these four main fruits contributed 82.12 percent of total horticultural exports in 2017. Avocado alone accounted for more than 17 percent of this value and is projected to increase due to the latest opening of the market in China (USAID, 2017). The area under the production of avocado has been on the increase, currently it stands at 7500 Hectares (Ha) and yielding 115,000 Metric Tonnes(MT) annually (Wasilwa *et al.*, 2017). These clearly reflect the potential of this crop in promoting various facets of economic development.

Despite the increasing trend in hectares under production, avocado exports from Kenya is lowest compared to major avocado exporters such as South Africa and Chile that export over 50% of the produce (Amare *et al.*, 2019; Horticultural Crops Directorate (HCD), 2015). This is due to bundle of challenges faced by farmers when trading in these markets (OECD, 2018). Such includes unavailability of market information and under-developed production systems, delayed payment for fruits delivered, high transaction costs as well as failure to meet qualitative standards of the export markets (Shiferaw, 2018). These limitations crowd out smallholder involvement in export market chains and also limit choice of appropriate marketing channel.

Murang'a County is the leading producer of avocados in Kenya, with production of 120,645 tones valued at 2.5 billion Kenyan shilling (46.9 %) and a production area currently estimated to be 4,319 hectares (USAID, 2017; Ministry of Agriculture (MoA), 2017). The main varieties grown include fuerte, hass, thigerton and golden (Knopp & Smarzik, 2008) . Avocado farming in the County is of great importance to rural households as one of the major sources of income. However, majority of farmers are unable to realize their full potential due to limited market access. Interventions have been put in place to improve avocado marketing. For instance, a project initiated by Kenya Business Development Services (KBDS) in 2003 to improve incomes through contract farming failed in 2008. Possible reasons for failure included its inability to meet costs for services provided to farmers and insufficient quantities of fruits. Thus, this led to formation of

Avocado Growers Association of Kenya (AGAK) in 2009 which links farmers to exporting companies through marketing groups (Mwambi *et al.*, 2016).

Despite formation of these organizations, farmers still sell through informal markets. Therefore, there is a need to understand what factors promotes or prevents farmers from participating in agricultural marketing (Abayneh & Tewodros, 2013; Saenger *et al.*, 2013; Yaseen *et al.*, 2018). It is also evident that various transactional costs are barriers to smallholders market participation (Macharia *et al.*, 2014; Jagwe, 2011; Makhura, 2001). Studies carried out in Murang'a County focused on determinants of export participation (Mwambi *et al.*, 2016; Oduol *et al.*, 2017), but the transaction costs and market participation has not been documented. Thus, this study models the transactional costs and market participation among smallholders in Murang'a County.

1.2 Statement of the problem

Avocado is used in various forms as a fruit and raw material for cosmetic industries. These have increased demand for avocados in local and export markets. However, small scale farmers in Sub-Saharan countries in general and Kenya in particular have not substantially benefited from this demand. Several interventions have been put in place in Murang'a County to enhance smallholder avocado farmers' participation in export and domestic markets. Despite these efforts small scale farmers still face challenges when marketing avocados and make them to easily opt selling to domestic markets in order to minimize losses due to fruit spoilage that largely occurs after harvesting. Farmers therefore, may choose to participate in more than one market channel which attracts transactional costs that conventionally reduce gross margins expected. Such costs affect the market participation and choice of marketing channels among smallholder farmers. In addition, there is scanty research based information that show factors influencing export market participation and choice of marketing channels among smallholder avocado farmers in Murang'a County. Therefore this study comes in to bridge this knowledge gap.

1.3 Objectives

1.3.1 General objective

The general objective of this study was to investigate transaction costs and market participation among avocado smallholders in Murang'a County.

1.3.2 Specific objectives

The specific objectives of this study were to;

- i. Estimate gross margins across different avocado marketing channels among smallholder farmers in Murang'a County.
- ii. Assess the effect of transaction costs on export market participation among smallholder avocado farmers in Murang'a County.
- iii. Determine factors affecting choice of avocado marketing channels among smallholder farmers in Murang'a County.

1.4 Research questions

The research questions of this study were;

- i. What are the gross margins across different avocado marketing channels among smallholder farmers in Murang'a County?
- ii. How does transaction costs affect export market participation among smallholders avocado farmers in Murang'a County?
- iii. What are the factors affecting choice of avocado marketing channels among smallholder farmers in Murang'a County?

1.5 Justification of the study

Avocado is among major fruits that have ability of improving farm incomes among small scale farmers in developing countries (Amare, 2019). However, farmers may be at disadvantage in meeting the transaction costs in various marketing channels. An assessment of effect of transaction costs on smallholder avocado farmer participation in export market is useful to stakeholders such as the County government so as to frame interventions that aim to scale down the costs thereby improving incomes of smallholder farmers. An analysis of the variables that impede or improve farmers' choice of the various marketing channels is important to policy makers' in order to plan appropriate interventions aimed at linking resource-poor farmers to markets. In addition, findings of this study are

beneficial to farmers through documentation of information on gross margins across various market routes and unique factors that characterize each channel. Further, this study contributes to existing literature on export market participation among avocado smallholders where limited information exists.

1.6 Scope of the study

The study was confined to Murang'a County. The primary data was collected from smallholder avocado farmers in seven key avocado producing locations; Kigumo, Kagundu-ini, Ruchu, Gaichanjiru, Ithiru, Muruka and Ng'araria. Gross margins across the avocado marketing channels among smallholders were estimated. Information on transaction costs and export market participation among avocado farmers was determined. Finally information on the factors affecting choice of marketing channels among smallholders was also determined.

CHAPTER TWO

LITERATURE REVIEW

2.1 Review of avocado production in Kenya

Avocado is grown in a number of agro ecological zones in Kenya (Cooper *et al.*, 2003; Horticultural Crops Directorate (HCD), 2015). It is mainly cultivated in highlands receiving an annual rainfall of between 1000 to 2000 mm (Griesbach, 2005). The main varieties for export market are fuerte and Hass while Pueblo, Duke and G6 are grown for the domestic market (Mellado & Ferrari, 2011). About 70% of avocado crop is grown in central and eastern regions (Wasilwa *et al.*, 2017), with central region leading in avocado production (USAID, 2017). Specifically, Central region accounts 40% of total avocado production in Kenya, Eastern 30%, Western region 13%, Rift Valley 10% and Nyanza region contributes 6% of avocado output (MOA, 2017).

Avocado contributed KES 5.41 billion from 287,268 tons accounting for 8.91 percent by value of the fruits sub-sector output in Kenya in 2017 as reported by USAID, (2017). Further avocado contributes to about 17% of the total horticultural exports (Horticultural Crops Directorate (HCD), 2015). Appendix 1 indicates the area under avocado production, volume of production and value of output in 2016 and 2017 for the leading counties in Kenya. Murang'a, Kisii and Kiambu were the top three counties in avocado production in 2017.

2.2 Gross margins across different marketing channels

Gross margin tool is used to determine the profitability of farm enterprises (Firth, 2002). Gross margin for each market channel is calculated as the product of the channel's farm gate price and quantity sold through the channel that is gross income less variable costs (Firth, 2002).

In a study by Chacha (2013), cost of inputs such as agrochemicals, fertilizer, irrigation, labour, and seedlings; farm size and amount of fruits harvested in kilogrammes (Kgs), price of output per Kg sold either to middlemen, contracted buyers or at spot-markets were used to estimate profitability. Costs regarding to marketing of the fruits were not considered. Average costs such as labour costs per hectare, cost of seeds, cost of insecticides, cost of

chemicals, cost of irrigation and other costs such as fuel costs and average revenue were used to calculate gross margins in direct marketing and broker marketing channels among onion farmers in Ethiopia (Taye & Ponguru, 2017). The study also did not include transaction costs in the analysis, further the study only considered only two marketing channels while more informal marketing channels exist among smallholders in developing countries. Muthini *et al.* (2017) estimated gross margins of mango farmers using average price per piece less average cost of fertilizer, labour and pesticides across various marketing channels used by farmers. Although the study estimated gross margin under different marketing channels, transaction costs were not included.

Based on literature review, marketing costs such as transaction costs has largely been omitted in estimation of gross margins among smallholders. Therefore, in this endeavour this study includes transactional costs to estimate gross margins of avocados farmers when they sell through different channels available.

2.3 Effect of transaction costs on market participation

Market participation is any market related activity that promote involvement of smallholder farmers in sale of agricultural products (Key *et al.*, 2000). A study by Jagwe, (2011) using Heckman two stage models showed that farmer groups reduce fixed transaction costs whereas distance to market, ownership of transport means and size of the households were linked to proportional transaction costs. Variables such as harvesting, sorting, grading and packaging costs were not included.

Findings by Bwalya *et al.* (2013) shows that transaction costs factors such as ownership of assets and access to alternative channels affects market participation, extent of participation was affected by owning oxcart, experience in maize marketing and family size. The study focused on transaction costs factors but the actual transaction costs were not measured. Macharia *et al.* (2014) also addressed transaction costs using a Tobit model and the results indicate that payment delays, cost of information search, sorting and rent costs affected market participation negatively. Tobit model can only give effect of transactional costs on farmer's market participation thus modelling the extent of participation was lacking in the study. Another study by Osebeyo & Aye, (2014) using

binary logit model revealed that variables such as transportation cost, access to market information and market distance affects market participation. Application of binary logit model does not give extent of farmer participation in market and also proportional transaction costs such as harvesting and sorting costs were omitted.

Participation in agricultural market has also been reported to have relationship with farmer characteristics, Adeoti *et al.* (2014) results indicates that group membership, road conditions, farm size, total maize produced, education, primary occupation affects farmers' market participation. Yohannes *et al.* (2014) using Heckman two stage models showed experience, access to market information, quantity of avocados and market access influence market participation, however transactional costs factors such as market distance and road type were not addressed.

Osmani & Hossain, (2015) found that family labour, land size, livestock earnings and farm output affects output market participation but the extent of participation was omitted. An application of double hurdle model by Tura *et al.* (2016) shows that access to credit, market price and household size influenced market participation. Further, the study reported that proportion sold was influenced by household size, proximity to market, farm size, price, other farm income, off-farm activity and livestock holding. Transaction costs variables such as road condition and transport costs were not considered. Harrizon *et al.* (2016) showed that gender, farmers' age, education, farming years and delayed payments affected market participation. Farming years, age and delayed payment further affects the output marketed. Several studies have reported that agricultural trainings, price, road accessibility, access to extension services and technologies such as seed technology affects farmers' participation in market, however factors for instance intercropping has been addressed by the studies (Ingabire *et al.*, 2017; Kyaw *et al.*, 2018; Adepoju *et al.* , 2019; Mariyono, 2019).

Findings suggest that transaction costs and market participation relationship exists (Jagwe, 2011; Bwalya *et al.*, 2013; Osebeyo & Aye, 2014; Macharia *et al.*, 2014). Fixed transaction costs have been studied explicitly by previous works, however little has been done on proportional transaction such as harvesting, sorting and transport costs (Macharia *et al.*,

2014). In addition, recent studies on market participation have focused on determinants of market participation and the influence of transactional costs is omitted (Yohannes *et al.*, 2014; Osmani & Hossain, 2015; Tura *et al.*, 2016; Ingabire *et al.*, 2017; Kyaw *et al.*, 2018; Adepoju *et al.*, 2019; Mariyono, 2019). Moreover, studies carried out in Murang'a County have put more focus on contract farming and women involvement in high value markets (Mwambi *et al.*, 2016; Oduol *et al.*, 2017). A general conclusion observed from these reviews is that although participation of farmers in contract farming affects their income, a small number of farmers participate in this chain with a large pool of farmers found to breach the contracts. Therefore, there is a need to assess variables that influence farmers' decision to participate in export markets.

2.4 Factors affecting choice of marketing channels

Choice of marketing channels is the decision by farmers on where to sell or not to sell their produce (Muricho *et al.*, 2015). Socioeconomic factors have been found to affect farmers' decision on choice of marketing channels. Age, education, gender, and experience were found by number of studies to attract or bar farmers' decision on choice of various marketing channels but family size was not included (Sigei *et al.*, 2014; Maina *et al.*, 2015; Kihoro *et al.*, 2016; Zhang, 2016; Adanacioglu, 2016). Factors such as level of output, farm income, farm size, crop varieties and production specialization have effect in regard to choice of marketing channels but a variable such as organic farming technology was not addressed (Zhang, 2016; Adanacioglu, 2016; Dessie *et al.*, 2018). Further, farming types, number of livestock and number of trees have been found to affect choice of various marketing outlets (Corsi *et al.*, 2018). However, intercropping was not included in the analysis.

Multinomial model results by Muthini *et al.* (2017) indicated that distance to local market affects mango farmers' choice of various marketing channels in Makueni County. Market factors such as delayed payment and transport cost were not addressed. Mango *et al.* (2018) also found that distance to the nearest town affected choice of output markets among farmers. Similarly payment delays and time taken to collect the produce in days were not addressed by the study. Price has been reported by various studies to have effects on choice

of marketing channels but distance to markets and transport costs were not included in the analysis (Sigei, 2014; Kihoro *et al.*, 2016; Zhang, 2016).

Results of Maina *et al.* (2015) using multinomial model indicated that access to extension services affected choice of marketing channels among mango farmers in Makueni County. Other institutional factors such as access to market information were not addressed by the study. Also results of Kihoro *et al.* (2016) showed that access to credit affect farmers choice of marketing channels. Marketing groups and marketing cooperatives were reported to affect choice of marketing channels although institutional factor such as trainings was not addressed (Sigei, 2014; Zhang, 2016; Muthini *et al.*, 2017; Fischer & Wollni, 2018; Mango *et al.*, 2018).

Previous studies on choice of marketing channels have shown that several farm and off farm characteristics affect choice of marketing channels. However factors such as intercropping, transport costs, organic farming technologies and time taken to collect farm produce and receive payment have not been addressed. Hence, this study fills this gap in existing knowledge by analysing factors affecting choice of avocado marketing channels.

2.5 Research gap

Previous studies on effect of transaction costs on smallholder farmers' market participation and choice of marketing channels have focused on transaction cost factors effect on market participation and have not estimated transaction costs which occur during exchange of the outputs (Jagwe & MacHethe, 2011; Sigei, 2014; Maina *et al.*, 2015). In addition, studies on transaction costs have focused on fixed transaction costs for instance negotiation costs, monitoring costs and information search costs while omitting proportional transaction costs such as harvesting cost. Moreover, studies on factors affecting choice of marketing channels have been common in other agricultural output (Bignebat *et al.*, 2015; Maina *et al.*, 2015; Jagwe, 2011; Kihoro *et al.*, 2016; Mabuza *et al.*, 2014) with limited focus on avocado. Thus, there is need for research which can inform to what extent transactional costs affect market participation and choice of marketing channels in Kenya so as to provide farmers and policy makers with information that will guide on transaction costs minimization and effective avocado marketing channels. This study therefore fills these

gaps by assessing effect of transaction costs on market participation and choice of avocado marketing channels among small-scale farmers in Murang'a County.

2.6 Conceptual framework

Figure 2.1 is the conceptual framework for this study. It shows the relationship between the dependent variables and independent variables hypothesized in the study.

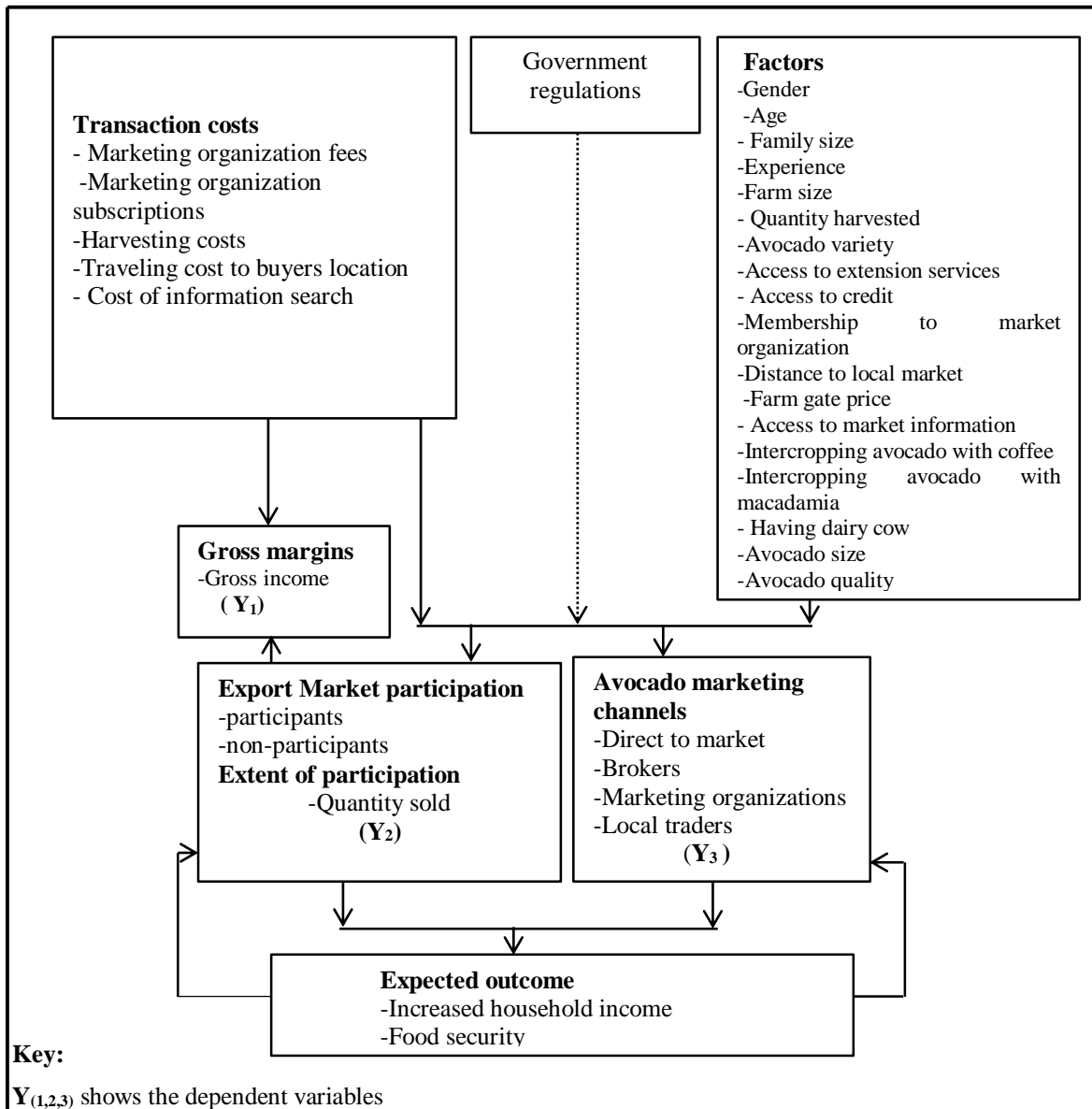


Figure 2.1: Conceptual framework

It is conceptualized that transaction costs such as information search costs, traveling costs to buyers location, farmer marketing organization membership cost (negotiation costs), farmer marketing organization subscriptions (monitoring costs) and harvesting cost that is

behavioural uncertainty costs (Seggie, 2012) affects participation in export market. It was expected that factors such as gender, age, education, family size, experience, farm size, quantity harvested, avocado variety, farm gate price, distance to nearest market, marketing organizations membership and access to market information affect farmers' choice of avocado marketing channels. Farmers' decisions to sell in various marketing channels attract transaction costs which affect the gross margins received. Choice of appropriate avocado marketing channels increase household income and improve food security among small scale farmers. Government regulations were expected to regulate the relationship between the dependent and independent variables of the study.

2.7 Theoretical framework

Transaction cost theory and random utility theory explains avocado farmer's behaviour on market participation and choice of marketing channels.

2.7.1 Transaction cost theory

Based on the concept of transaction cost theory by Coase (1937), farmers' participation in the market is constrained by transaction costs incurred during marketing such as information search costs, negotiation costs, monitoring costs, cost of transporting products to market, cost of sorting and grading and cost of harvesting (Key *et al.*, 2000). These costs were deemed to limit avocado farmers' participation in export market. It was also assumed that an avocado farmer would not participate in a given market when transaction costs incurred in that market outweigh the benefits received from the market (Musemwa *et al.*, 2008).

The theory of transaction cost is explained by use of Heckman two stage model by Key *et al.* (2000). Further, the study argued that fixed transaction cost influence smallholder farmers market participation while proportional transaction costs affect both market participation and extent of participation. Heckman two stage models developed by Heckman (1979) has shown good results by studies evaluating transaction costs and market participation (Alene *et al.*, 2008; Bwalya *et al.*, 2013; Muricho *et al.*, 2015). Therefore this framework was used to conceptualize the effect of transaction costs on farmer's decision on export market participation and extent of participation.

2.7.2 Random utility theory

The main assumption of Random utility theory is that individuals are rational decision makers with well-defined preferences, and will make decisions based on the utility derived (Thaler and Eric, 1990; McFadden, 1986). In regard to the theory, a farmer is expected to make decisions considering exclusive alternatives that constitute a set of avocado marketing channels that maximizes the returns (Sigei, 2014). An avocado farmer assigns a set of perceived utility to the alternative marketing channels and selects the marketing channel that maximizes his/her utility. The utility assigned to each alternative depends on a number of measurable attributes of the alternative choice and those of the avocado farmer who is the decision maker.

Random utility theory is widely used with the multinomial logit model to explain farmers' behaviour with regard to choice of marketing channels (Maina *et al.*, 2015; Sigei, 2014; Muthini *et al.*, 2017; Kihoro *et al.*, 2016). This is because the model allows measurement of dependent variable with multiple choices (Wooldridge, 2002). In this case avocado farmers were expected to make a decision on four major marketing channels considered in the study. Henceforth, the Random Utility theory was used to develop a framework that explains the determinants of choice of avocado marketing channels among smallholders in Murang'a County.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study area

The study was conducted in Murang'a County. The County occupies a total area of 2,558.8 Km² and lies between latitudes 00° 34' and 10° 7' South and longitudes 36° and 37 ° 27' east (Murang'a County Development Plan, 2018). The County majorly lies under upper midland agro-ecological zone (UM) with some traces of lower midland (LM). It was selected for the study since it is the leading producer of avocados in Kenya, producing 120,645 tons of avocado annually within an estimated land coverage of 4,319 hectares (USAID, 2017). The County has seven major avocado producing locations; Kigumo, Kagundu-ini, Ruchu, Gaichanjiru, Ithiru, Muruka and Ng'araria (Knopp & Smarzik, 2008).

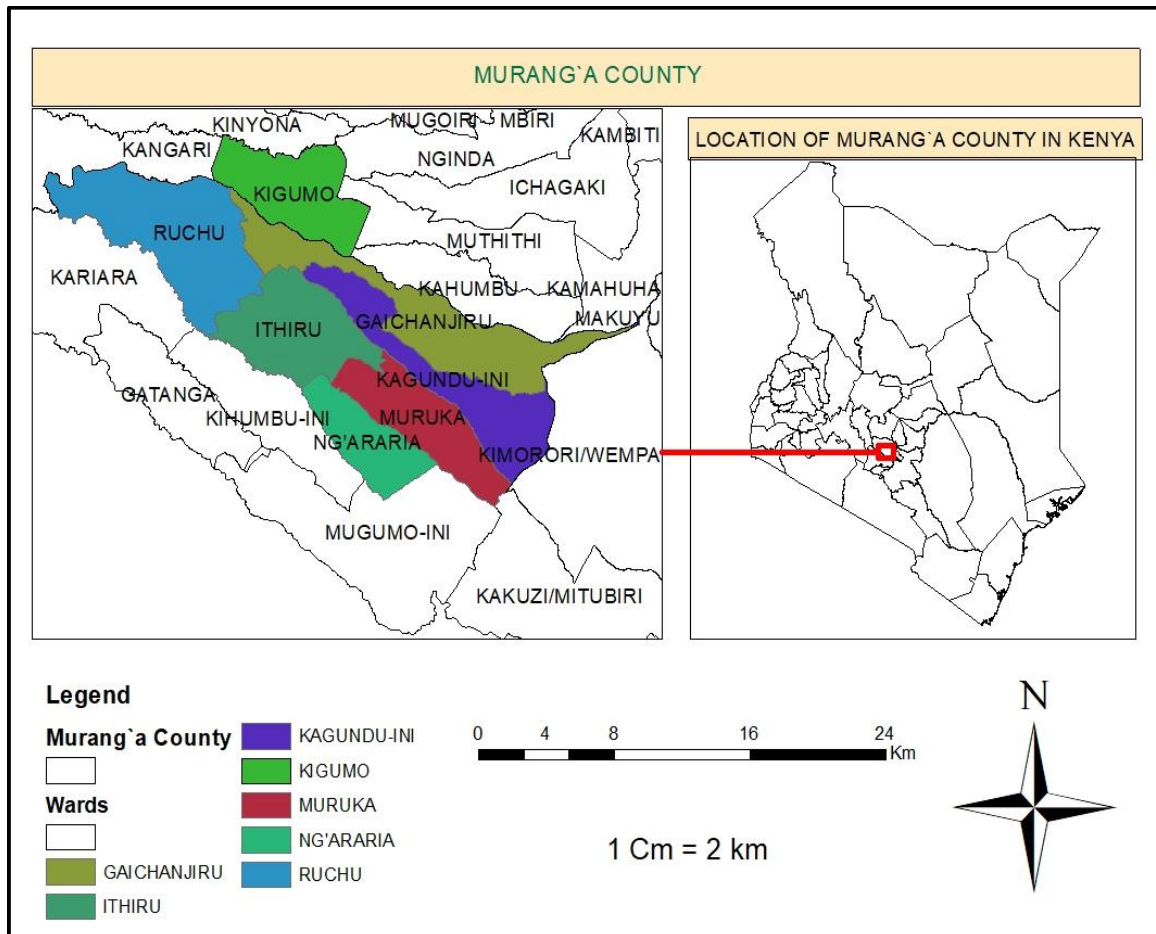


Figure 3.1: Map of the study area

3.2 Research design

The research design used in the study was cross sectional survey design. This research design allows collection of data from a large group of people at one point of time, thus was appropriate for this study (Fraenkel & Wallen, 2008). This research design allows for description of characteristics among groups considered in the study (Kothari, 2004). It also allows narration of facts and characteristics concerning individual, group or situation. Thus this research was appropriate for this study since it allowed collection of data on transaction costs, socioeconomic and market characteristics among smallholder avocado farmers in Murang'a County.

3.3 Target population

The target population for this study was smallholder avocado farmers in Kigumo, Kagundu-ini, Ruchu, Gaichanjiru, Ithiru, Muruka and Ng'araria locations of Murang'a County. The total number of avocado farmers in these areas is 15,265 according to report on building avocado cluster in Central Kenya (Knopp & Smarzik, 2008).

3.4 Sampling design and sample size

The study used two stage stratified sampling technique. The locations were sampled into Sub locations. Proportional to size method was used to obtain number of respondents in each sub location.

Watson (2001), formula was used to obtain the sample size. The formula was applied in this study since target population (N) is above 10,000 farmers (Miring'u, 2013).

$$n = \frac{\left(\frac{p(1-p)}{e^2 + \frac{P(1-P)}{N}} \right)}{R} \dots\dots\dots 1$$

n is the sample size

N - is 15,265 *p* - is the estimated variance (0.3), *e* - desired precision (0.05), *z* - confidence level (95% = 1.96), *R* - response rate – 90% (0.9).

Computations; $n = [0.3(1-0.3) \div (0.05^2 / 1.96^2) + (0.21/15,260)] \div 0.9[0.21 \div 0.0006] \div 0.9000$

$n = 346 \div 0.9 = 384$

384 farmers were sampled from the target population. A summary for each Sub location showing the total number of farms and respondents sampled is given in table 3.1.

Table 3. 1: Summary of Sub-locations interviewed

Location	Sub-location	Number of farmers	Number of respondent interviewed
Muruka	Kiranga	970	62
Ng'araria	Naaro	989	64
Ithiru	Kaguthi	972	63
Gaichanjiru	Kagumoini	504	32
Ruchu	Gacharage	1110	72
Kagundu-ini	Githunguri	675	44
Kigumo	Githima	734	47
Total		5954	384

3.5 Data collection instruments and procedure

The interview schedules were administered to smallholder avocado farmers. Stratified sampling procedure was used to collect data from 384 farmers. The first step involved identifying the seven avocado producing locations in Murang'a County. The second step involved selecting seven sub-locations randomly from the identified locations. Proportionate to size formula was applied to determine the total number of farmers to be interviewed in each village, the total population of farmers in each village was divided by the total number of farmers in the selected villages and then multiplied by the expected sample size. Finally, the interval between the farmers to be interviewed was estimated by dividing the total number of farmers in the village by the required number of farmers.

3.6 Preliminary tests

Before running the analysis, multicollinearity test was done to check for correlation within variables. For Multinomial logit model, Hausman test was run to check for violation of independence of irrelative alternatives assumption.

Multicollinearity test was applied using correlation matrix. The rule of thumb is that if the pairwise correlation between the variables is greater than 0.5, multicollinearity problem exist (Gujarati, 2007). The results showed no multicollinearity problem that was present (Appendix 2).

The Hausman test was done to check for Independence of Irrelevant Alternative assumption (IIA). The IIA Property requires that the relative probabilities of two options being selected are unaffected by the introduction or removal of other alternative. The first two set of choices involves brokers and direct to market while the second set is brokers and local traders. The result of Hausman test was positive with χ^2 of 0.00 and all are insignificant indicating that the IIA assumption was not violated (Hausman & Mc-Fadden, 1984). The results are given in Appendix 3.

3.7 Data analysis methods

This study used both descriptive and quantitative data analysis methods. Mean and frequencies are the descriptive statistics used. Quantitative analysis was further applied to evaluate effect of transaction costs on market participation and factors affecting choice of marketing channels among smallholder avocado farmers.

3.7.1 Estimating gross margins across different channels

Gross margin per season was computed based on Onoja *et al.* (2012) formula as given below,

$$\text{Gross Margin (GM)} = \text{total revenue} - (\text{Total variable costs} + \text{marketing costs}) \dots 2$$

The general equation for estimating gross margin is;

$$GM_i = P_y Y - (P_{x1} X_1 + P_{x2} X_2 + P_{x3} X_3 + X_4) \dots 3$$

GM_i is the gross margin for i^{th} farmer, $P_y Y$ is the revenue received by i^{th} farmer when he/she sell to various avocado marketing channels, $P_{x1} X_1$ is the total cost of fertilizer, $P_{x2} X_2$ is the total cost of pesticides, $P_{x3} X_3$ is the total cost of labour, X_4 is the total marketing costs.

3.7.2 Assessing the effect of transaction costs on export market participation

Heckman two stage selection models were used to determine avocado farmers’ market participation and extent of participation in export market. Heckman two stage model

assumes that one or more variables must appear in the first equation but not in the outcome equation (Alene *et al.*, 2008; Bwalya *et al.*, 2013; Goetz, 1992). In this case, fixed transaction costs were expected to affect the first stage while proportional transaction costs were expected to affect the extent of participation. The extent of participation was observed for only farmers that participated (i.e export market participation =1) but was unobserved for non-participants in the export market i.e zero sales in the export market. Also, the farmer's decision on export market participation and extent of participation was expected to occur simultaneously. Therefore, these assumptions made the Heckman model to be the most appropriate model for the study over other regression models such as Tobit model and the double hurdle model. The model was specified as,

$$pr\left(Y_i = \frac{1}{w_i\alpha}\right) = \Phi[h(w_i, \alpha)] + \varepsilon_i \dots\dots\dots 4$$

Where Y_i is export market participation, Φ is standard normal cumulative distribution function, h, w_i, α are transaction costs and farmer characteristics, variable Y_i takes 1 for export market participation and 0 if otherwise. ε_i is error term.

$$Y_i^* = \alpha W_i + \mu_i \dots\dots\dots 5$$

Where;

Y_i^* is the latent dependent variable that is unobserved.

$\mu_i \sim N(0,1)$ and,

$$Y_i = 1 \text{ if } Y_i^* > 0$$

$$Y_i = 0 \text{ if } Y_i^* \leq 0$$

In the second stage Heckman OLS regression equation was used. An inverse mills ratio (IMR) is given in the second equation of the model to correct for potential selection bias.

Computed as;

$$\frac{\varphi[h(\omega_i, \alpha)]}{\varphi(\omega, \alpha)} \dots\dots\dots 6$$

Where;

φ is the normal probability density function. Therefore the second stage equation is given by;

$$E\left(\frac{y_i}{Y_i} = 1\right) = f(x_i, \beta) + \lambda \frac{\varphi[h(\omega_i, \alpha)]}{\varphi(\omega, \alpha)} \dots\dots\dots 7$$

Where;

E is the expectation operator, y_i is the proportion of avocado sold, x_i is the vector of the independent variables affecting the proportion of avocado marketed and β is the vector of the corresponding coefficient to be estimated. Therefore y_i is specified as follows;

$$Y_i^* = \beta \cdot x_i + \gamma + \mu_i \dots\dots\dots 8$$

Where;

$\mu_i \sim N(0, \sigma\mu)$, y_i^* is those farmers that choose to participate in export market,
 $z = 1$ if $Y_i = y^*$.

The first stage is given as follows;

$$Pr_{EMP} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon_i^* \dots\dots\dots 9$$

Where Pr_{EMP} show the probability of export market participation is, β_0 is constant, β_1 to β_n are parameters to be estimated, X_1 to X_n are the vector of transaction costs and factors while ε_i is the error term.

The second stage of heckman is given as follows;

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon_i \dots\dots\dots 10$$

Where;

Y_i indicate the proportion of avocado marketed in export market, β_0 is constant, β_1 to β_n are parameters to be estimated, X_1 to X_n are the independent variables and ε_i is the error term.

The two equations are specified as follows;

Step 1 Heckman first regression equation

$$Pr_{EMP} = \beta_0 - \beta \text{ cost of infor search} + \beta \text{ distance local market} + \beta \text{ education} + \beta \text{ intercrop with cofee} + \beta \text{ intercrop with macadamia} + \beta \text{ organ member} + \beta \text{ training} + \beta \text{ size avocado} + \beta \text{ access mrk info} + \varepsilon_i \dots\dots\dots 11$$

Step 2 Heckman second stage OLS regression equation

$$\text{Proportion of avocado sold in export market} = \beta_0 - \beta \text{ harvesting cost} - \beta \text{ age} - \beta \text{ family size} + \beta \text{ experience in avocado mrketing} - \beta \text{ education} + \beta \text{ farm size} + \beta \text{ farm income} + \varepsilon_i \dots\dots\dots 12$$

3.7.3 Determining factors affecting choice of marketing channels

Multinomial logit model (MNL) was used to analyse factors affecting choice of avocado marketing channels. The model was preferred since it allows for measurement of multiple

decision of dependent variable (Maina *et al.*, 2015). The MNL model was specified as follows;

$$\text{Prob}(Y_j = i) = \frac{\exp(X'_j \beta_i)}{\sum_{k=1}^m \exp(X'_j \beta_k)} \dots\dots\dots 13$$

Y_j is the probability of farmer j choosing avocado marketing channels i (brokers, farmer marketing organizations, local traders and direct to market sales). X is vector of households socioeconomic, market and transaction costs variables. β is the vector of coefficients associated with the choice of marketing channels. Maximum likelihood estimator was used to determine the parameters in the model (Greene, 2000). The summary of the model was as follows;

$$\text{prob}(Y_j = i) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots\dots\dots + \beta_n x_n \dots\dots\dots 14$$

Where;

$\text{prob}(Y_j = i)$ is the probability choosing avocado marketing channels. β_0, β_1 to β_n are parameters to be estimated by the model. X_1 to X_n are the factors.

Multinomial logit model is given below;

$$\begin{aligned} \text{choice of avocado marketing channels} = & \beta_0 + \beta_{\text{gender}} + \beta_{\text{education}} + \\ & \beta_{\text{experience}} + \beta_{\text{intercropping avocado}} + \beta_{\text{growing organic avocado}} + \\ & \beta_{\text{delayed buying of avocado}} + \beta_{\text{buyer check quality}} + \\ & \beta_{\text{buyer check varieties}} + \\ & \beta_{\text{farm gate price}} \dots\dots\dots 15 \end{aligned}$$

3.8 Operationalizing the study variables

Table 3.2 shows the study variables, their description, how they were measured and their expected sign. Positive effect is shown by (+) signs while negative effect is shown by (-) sign.

Table 3. 2: Variables description

Variable	Description	Measurement	Sign
Dependent variables			
Export participation	Market Export chain or domestic market	1= export market 0= domestic market	None
Extent of participation	Extent of participation	Proportion of avocado sold	None
Marketing channel choice	Direct sales to market Local traders Marketing organizations and brokers	1= broker 2= marketing organization 3= local trader 3= direct sales to market	None
Gross margin	Gross income less variable costs	KES	None
Independent variables			
Transaction costs	Transaction costs	KES	-
Age	Age in years	Number of years	+/-
Gender	Respondent gender	1=Male 0=Female	+/-
Experience	Number of years spent in avocado farming	Years in farming	+
Family size	Number of people	Number of people	+/-
Farm size	Land size	Number of hectares	+
Farm gate price	Price	KES /Kg	+
Quantity harvested	Quantity harvested	Kilograms harvested	+
Avocado varieties	Avocado varieties	1= Fuerte 2= Hass 3= Other local varieties	-
Number of avocado trees	Number of avocado trees	number of trees	+
Education	Years spent in education	years	+
Income	Total annual household income	KES	+
Intercropping avocado with coffee	If farmer has intercropped avocado with coffee	1= Yes 0=No	+/-
Intercropping avocado with macadamia	If farmer intercropped avocado with macadamia	1=Yes 0=No	+/-
Having dairy cow	If farmer owns dairy cow	1=Yes 0=No	+/-
Access to extension services	Whether the respondent has access to extension services	1= Access to extension services 0= Do not access	+
Access to credit	Whether households access credit	Amount in KES	+
Training	Whether farmer was trained	Number of agricultural training	+/-
Access to market information	Whether respondent has access to market information	1= Yes 0=No	+
Marketing organization membership	Belonging to a marketing group	1=Yes 0=NO	+

Distance to local market	to	local	Distance to local market	KM	+
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CHAPTER FOUR

RESULTS

4.0 Overview of the chapter

This chapter presents the analysis of the major avocado marketing channels in the study area, farmer characteristics across avocado marketing channels, transaction costs, and gross margin analysis across various marketing channels. The results of multiple regression models on selected factors affecting export market participation and choice of marketing channels are also presented.

4.1 Description of main avocado marketing channels in the study area

The main marketing channels used by smallholder avocado growers in the study area were identified in terms of the flow of avocado products and market participants in each channel. The results are presented in Figure 4.1.

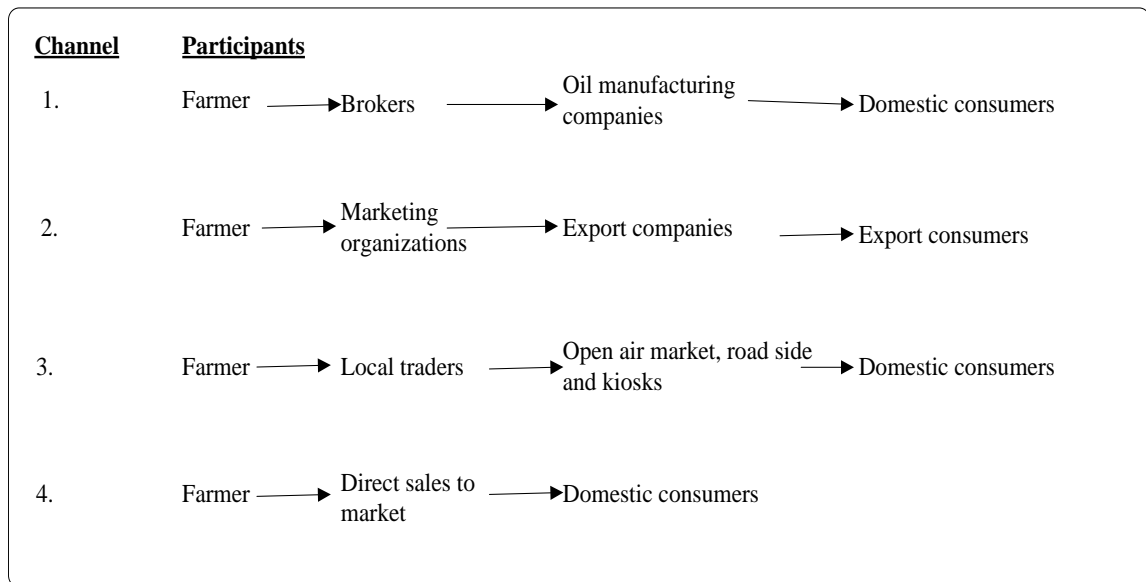


Figure 4.1: Main marketing channels in the study area

Marketing channel 1: The channel entails the flow of avocado from the smallholder avocado farmers to brokers. These brokers buy the rejected avocado in export market and sell them to oil manufacturing companies or to markets in the nearby towns like Thika, Ruiru and Nairobi, and eventually to the domestic consumers.

Marketing channel 2: The channel involves flow of avocado starting from the smallholder farmers. Then the avocado flows to farmer marketing organization sub-contracted by the exporting companies in the study area for instance Kakuzi Limited, Jungle Nut Company, Kenya Horticultural Exporters (K.H.E). The major functions of these organizations are to link farmers with the exporting companies, and facilitate collective bargaining on prices. The marketing organizations also make sure that farmers are trained on qualitative standards such as organic farming, minimum use of chemicals and harvesting maturity and techniques. Ultimately, the avocado ends in export markets.

Marketing channel 3: The channel involves flow of avocado from smallholder avocado farmers to the local traders. These local traders collect avocados from farmers in small quantities and then sell them to nearby local retail markets such as Kandara, Kagunduini, Kigumo, Muruka and Murang'a. Avocados in this chain are mainly packed in 90 Kg bags. Finally, the avocado reaches the domestic consumers.

Marketing channel 4: This entails flow of avocado starting from the smallholder avocado farmer to markets which are in close proximity to the farmer and finally the domestic consumer. In most cases avocado in this chain are sold to nearby centres that are accessible by the farmer. In this chain the farmer is the producer and seller. He/she bears the transport cost.

4.2 Farmer characteristics across main avocado marketing channels

Farm and farmer characteristics were collected and characterized across the four identified marketing channels mainly used by smallholder farmers in terms of socio economic and institutional characteristics. The findings on the factor categories are given in the following subsections.

4.2.1 Socioeconomic characteristics

Smallholders were categorized on the basis of the marketing channels used. The mean values and frequencies were computed for the selected socioeconomic variables. The Analysis of Variance (ANOVA) was used to test the significance of the variations in the mean values while chi-square was used for frequencies (Table 4.1).

Table 4.1: Socioeconomic characteristics of avocado farmers along various marketing channels

Socioeconomic factors	Marketing channels				F/ χ^2 -value
	1 n=320 83.33%	2 n=106 27.60%	3 n=39 5.21%	4 n=36 7.03%	
Age (years)	59.72	64.38	59.20	45.59	2.03(0.00***)
Marketing experience (years)	13.93	17.25	16.35	10.59	2.11(0.00***)
Gender: Male (%)	77.81	83.02	90	59.26	2.52 (0.47)
Female (%)	22.19	16.98	10	40.74	
Family size	5.15	4.76	4.35	4.63	1.64 (0.09*)
Education level (years)	7.11	7.40	7.80	7.78	0.85 (0.62)
Farm Income (KES)	97,911.40	190,301	106,590	85,203.70	3.58 (0.00***)
Off-farm income per year (KES)	105,382	99,105.30	56,250	113,429	1.19 (0.23)
Farm size (Ha)	0.66	0.96	0.69	0.35	1.46 (0.06*)
Farm area under avocado trees (Ha)	0.21	0.34	0.26	0.13	1.19 (0.01***)
Number of avocado trees in production stage	16.59	22.49	17.75	14.63	3.21 (0.00***)
Quantity of avocado harvested (Kg)	1,815.41	2,722.26	3,440.60	1,239.56	3.27 (0.00***)
Farm gate price per Kg (KES)	23.95	64.53	14	48.15	12.41 (0.00***)

Asterisks*** and * indicate significance at 1% and 10% levels respectively

Results given in Table 4.1 indicate that the mean age of the farmer was high (64.38 years) in marketing channel 2, implying that elderly farmers prefer to sell through the marketing organizations. The mean marketing experience was highest in marketing channel 2 (17.25 years), implying that farmers who are more experienced in avocado marketing sell through marketing organizations while farmers with less experience in avocado marketing make

direct sales to the market. Farmers selling through channel 2 had the highest family size (5.15) while those with small household size sell through channel 3.

Results further indicate that farmers who sell through marketing organizations (channel 2) receive the highest farm income (KES 190,301) while those selling through brokers and direct sales to market (channels 1 and 4) had the lowest level of farm income. Farm size in hectares was largest for farmers selling through channel 2 (0.96 Ha) while it was lowest for farmers making direct sales to market. Farmers who sold their produce through market organizations (channel 2) had the largest land under avocado trees (0.34 ha) and number of avocado trees at production stage (22.49 trees), these implies that the relatively large scale avocado producers prefer to sell through marketing organizations. The farmers making direct sales to market (channel 4) had the lowest acreage under avocado and number of trees in production. Farmers who sell through local traders (channel 3) had the highest volume of avocado produce harvested, while those who make directly sales to the market (channel 4) had the lowest volume of avocado harvested (Table 4.1). Farmers selling through market organizations (channel 2) received highest farm gate price (KES 64.53) whereas those selling through channel 3 received lowest farm gate price (KES 14.00).

4.2.2 Institutional characteristics

The frequency of accessing selected institutional services for farmers across the identified marketing channels was analysed (Table 4.2).

Table 4.2: Institutional characteristics of farmers across avocado marketing channels

Institutional variables	Marketing channels				F/ χ^2 -value
	1	2	3	4	
Access to information					
Yes (%)	97.81	98.11	95	100	0.31 (0.96)
No (%)	2.91	1.89	5.00	0.00	
Access to extension services					
Yes (%)	33.13	97.13	80.00	29.63	81.22 (0.00***)
No (%)	66.18	2.83	20.00	70.37	
Number of extension visits per year	0.85	2.75	1.85	0.89	0.94 (0.47)
Phone contacts of extension officers	0.52	1.52	0.75	0.19	18.79 (0.00***)
Access to credit					
Yes (%)	1.88	3.77	10.00	0.00	3.55 (0.31)
No (%)	98.13	96.23	90.00	100.00	
Amount of credit used (KES)	406.25	943.4	1500.00	0.00	1.27(0.28)

Asterisks*** indicate significance at 1% level

Results given in Table 4.2 shows that marketing channel 2 (selling through marketing organization) had the highest proportion of farmers accessing extension services (97.13%) followed by marketing channel 3 (local traders) (80.00%). The marketing channel three (direct marketing) had the lowest proportion of farmers accessing extension (29.63%). Extension agents from farmer marketing organization visit farmers time to time to train them on various avocado farming practices, thus improving farmers' access to extension. On average farmers selling through marketing channel 2 had the highest access to phone contacts from extension providers followed by those who sell through marketing channel 3 (selling through local traders).

4.3 Gross margins analysis across the marketing channel

To estimate gross margins, transaction costs and other costs incurred and total revenue across the marketing channels were analysed. The results are presented in the following subsections.

4.3.1 Transaction costs across marketing channels

Transaction costs incurred under various marketing channels were estimated. The transaction costs thus included cost of information search, cost of travelling to buyers' location, marketing organization's joining fee, subscriptions and harvesting costs incurred. ANOVA was used to test for variations across the channels (Table 4.3).

Table 4.3: Transaction costs across marketing channels

Transaction costs per Kg	Marketing channels				F value
	1	2	3	4	
Cost of information search (KES)	0.02	0.05	0.02	0.01	16.47(0.00***)
Travelling cost to buyers location	0.21	0.19	0.13	1.74	3.63(0.00***)
Marketing Organization joining fee (KES)	0.00	0.06	0.00	0.00	13.88(0.00***)
Marketing organization subscriptions (KES)	0.00	0.06	0.00	0.00	12.53(0.01***)
Harvesting cost (KES)	4.17	1.17	0.36	2.61	3.82 (0.00***)
Total cost per Kg (KES)	4.40	1.53	0.51	4.36	

Asterisks *** indicate significance at 1% level

Table 4.3 indicates that farmers who sell through marketing organizations (marketing channel 2) incurred the highest cost of information search, while those who make directly sales to the markets (marketing channel 4) had the lowest. Cost of travelling to buyers' location was higher for farmers making direct sales. A farmer selling to channel 2 (through marketing organization) incurs cost of joining the marketing organizations and market organization fee. Channel 1 (through brokers) had the highest harvesting cost while channel 3 (local traders) had the lowest harvesting cost.

4.3.2 Fertilizer, pesticide and labour costs across marketing channels.

Mean pesticide, fertilizer, labour and market costs across the marketing channels were analysed using a bar graph (Figure 4.2).

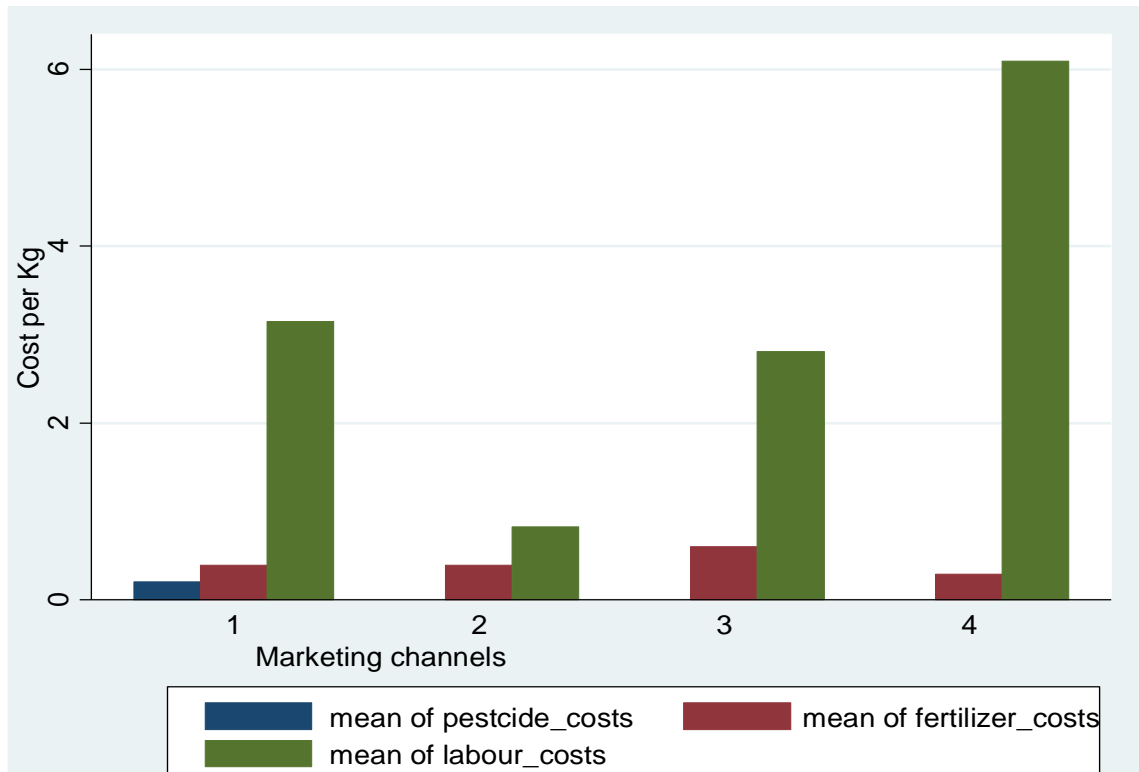


Figure 4.2: Fertilizer, labour and pesticide costs across the channels

Results in Figure 4.2 shows that Channel 3 (through local traders) also had the highest cost of fertilizer per Kg while channel 4 (direct sales to market) had the lowest cost of fertilizer per Kg. Marketing channel 4 had the highest labour cost while channel 2 (through farmer marketing organization) had the lowest labour cost. Cost of pesticide was only observed in channel 1 (sale through brokers) implying that there is minimum pesticides application among farmers in the study area.

4.3.3 Gross margins

Average revenue per kilogram and average total cost per kilogram were used to calculate the gross margins across the major marketing channels (Table 4.4).

Table 4.4: Gross margins per kilogram

GM variables	Marketing channels				F value
	1	2	3	4	
Average revenue (KES)	23.95	64.55	14.00	48.15	12.41(0.00***)
Average total costs (KES)	6.03	2.8	2.5	12.46	3.85(0.00***)
Gross margins per Kg (KES)	17.92	61.75	11.5	35.69	34.73(0.00***)

Asterisks*** indicate significance at 1% level

Table 4.4 shows that farmers selling to channel 2 (farmer marketing organization) received the highest revenue while channel 3 (local traders) had the lowest average revenue per kg. Channel 4 (direct sales to market) had the highest total costs per Kg while channel 3 had the lowest total costs. Gross margins per Kg were high in channel 2 (through marketing organization) while channel 3 (through local traders) had the lowest gross margin per Kg, implying that smallholders trading in export market earned the highest profits compared to other channels.

4.3.3 Mapping of the major marketing channels

The study mapped the main marketing channel used in the study area on the basis of gross margins per Kg, transaction costs per Kg and market shares (Figure 4.3).

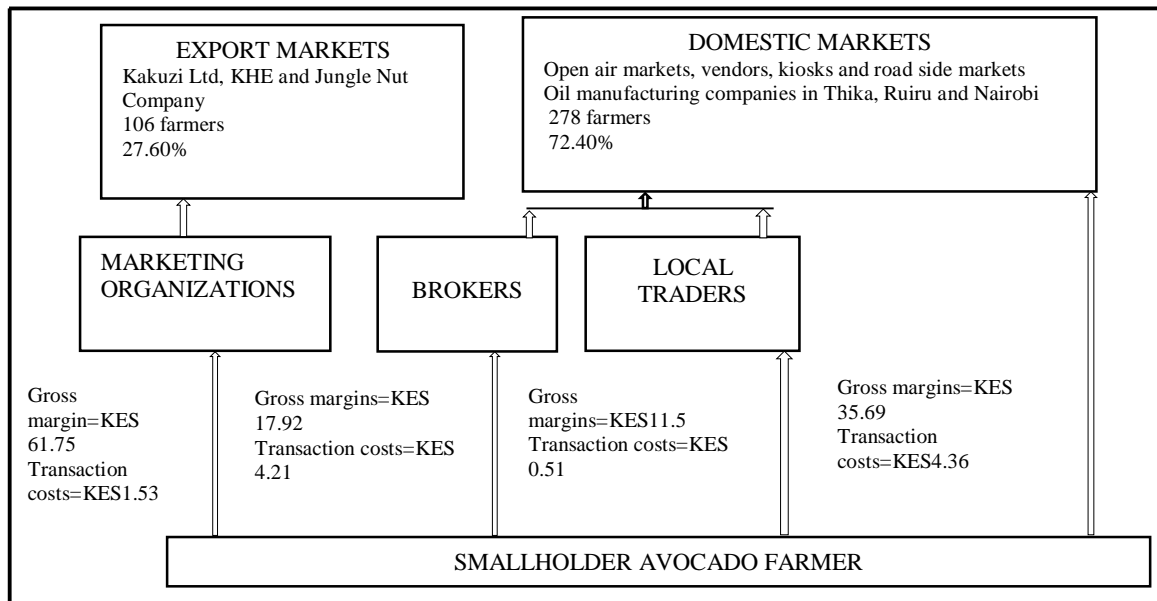


Figure 4.3: Mapping of avocado marketing channels in the study area

Results in Figure 4.3 indicate that a majority of farmers (72.4%) sell to domestic markets, while 27.6% of farmers sell to export market. These results imply that domestic market (278 smallholder avocado farmers) has the highest market share as compared to export market (106 smallholder avocado farmers).

4.4 Market participation in the study area

Smallholders' market participation was analysed for both the export and domestic markets and the results are given in the following subsections.

4.4.1 Export and domestic market characteristics

Market characteristics were grouped on the basis of export market, domestic market and pooled data for the whole sample collected. To allow for comparisons of the results in the two markets, t-test and chi-square test were applied (Table 4.5).

Table 4.5: Characteristics of export and domestic markets

Market factor		Export market n=106	Domestic market n=278	Pooled data N=384	t/χ^2 test
Farm gate price per kg (KES)		64.53	28.72	37.68	57.60 (0.00)** *
Quantity sold per season (Kgs)		2275.15	1556.90	1755.17	3.65 (0.00)** *
Distance to the local market (KM)		7.45	6.14	6.50	2.21 (0.03)**
Reasons for choosing the buyer					
Offer better price (%)	Yes	92.45	5.40	29.43	280.05 (0.00)** *
	No	7.55	94.60	70.57	
Preferred buyer delayed buying (%)	Yes	18.87	72.66	57.81	91.05 (0.00)** *
	No	81.13	27.34	42.19	
Payment period for avocado delivered (days)		1.73	1.00	1.200	27.10 (0.00)** *
Things that buyers look at					
Checks at size of avocado (%)	Yes	99.06	96.76	97.40	1.59 (0.21)
	No	0.94	3.24	2.60	
Must be in marketing organizations (%)	Yes	79.25	0.00	21.88	349.61 (0.00)**
	No	20.75	100.00	78.13	

Asterisks***and ** indicate significance at 1% and 5% level respectively

Results in Table 4.5 indicate that the mean farm gate price for export market was KES 64.53 while in domestic market was KES 28.72. This implies that international markets offers relatively higher price than domestic markets. The analysis shows that the mean quantity of avocado sold was higher under export marketing (2275.15 kilograms) compared to that of the domestic market (1556.90 kilograms), implying that the marketed avocado in the export market was significantly more than in the local market. The distance to local markets was higher among export market participants (7.45 Km) as compared to

non-participants (6.14 Km), showing that increased distance to local markets increases chances of participating in export marketing.

Approximately 92.45% of farmers in the export market indicated that they prefer the buyers because of better price. These findings imply that better prices attract farmers to participate in the export market. In addition, 18.87% of farmers in the export market indicated that there was delayed buying of avocado by the preferred buyers. The same was true in the domestic market with 72.66%. The average payment period in days for avocado delivered among participants in export marketing was 1.73 days while in the domestic market was found to be 1 day. This shows that export buyers took a longer time to pay farmers for avocado delivered but the domestic market buyers most cases pay within one day.

The results further showed that buyers in the export market requires farmers to belong to well organized marketing organizations (79.25%) which are not the case in the domestic market. These institutions play a vital role in coordinating the trade between avocado farmers and exporting companies. Farmers' are trained on good agricultural practice for the production of avocado that meets Global GAP standards for the groups. Membership also facilitates collective buying of inputs and ultimately reduces transactional costs at the export market.

4.4.2 Effects of transaction costs on export market participation

The effects of transaction costs on farmer's export market participation were modelled using the first stage Heckman regression model. The export participation is measured as export market participation= 1 and non-participation= 0 in the first stage. Transaction costs and other factors hypothesized to affect export market participation were run in the model as the independent variables. In the second stage the extent of participation was measured in terms of the proportion of avocado sold in export market. The results of the analysis of the first stage are given in Table 4.6, while those of the second stage analysis are given in Table 4.7. Inverse mills ratio is positive and significant at 5% level. This suggests that the error term in the first regression results and second stage OLS regression analysis are positively correlated. The marginal effects were used for interpretation since they have direct interpretation (Heckman, 1979). This is because coefficients of first regression

results have no direct interpretation as they are values that maximize the likelihood function.

Table 4.6: Heckman first stage regression results

Export market participation	Marginal effects	Coef.	std. err	Z	P>|z|
Transactional costs					
Cost of information search(KES)	-0.0001	-0.0005	0.0002	-2.4900	0.0130** *
Traveling cost to buyers location (KES)	-0.0002e ⁻²	-0.0007e ⁻²	0.0001e ⁻¹	-0.6600	0.5070
Farmer organization membership fee(KES)	-0.0001	-0.0002	0.0001	-0.1410	0.1590
Harvesting cost (KES)	-0005e ⁻¹	-0.0002e ⁻³	0.0008e ⁻³	-0.2100	0.8300
Distance to local market (Km)	0.0013	0.0049	0.0016	3.0700	0.0020** *
Type of road (tarmac, marram, dry weather)	0.0033	0.0129	0.0097	1.3300	0.1820
Socioeconomic factors					
Age in years	0.0001	0.0006	0.0008	0.7500	0.4520
Education in years	0.0021	0.0082	0.0031	2.7100	0.0070** *
Experience in avocado marketing (years)	0.0005	0.0018	0.0012	1.5800	0.1130
Family size	0.0001	0.0004	0.0057	0.0700	0.9410
Farm size (Ha)	0.0021	0.0082	0.0190	0.7800	0.4380
Farm income (KES)	-0.0002e ⁻⁵	-0.0008e ⁵	0.0004e ⁻²	-0.3900	0.7000
Number of avocado trees	-0.0002	-0.0006	0.0005	-1.3500	0.1750
Farm gate price (KES)	-0.0001	-0.0004	0.0004	-0.9700	0.3300
Sources of off farm income	0.0018	0.0069	0.0044	1.5500	0.1210
Intercropping avocado with coffee (0=No, 1=Yes)	0.0108	0.0418	0.0171	2.4500	0.0140** *
Intercropping avocado with macadamia (0=No, 1=Yes)	0.0503	0.1949	0.0331	5.8800	0.0000** *
Institutional factors					
Membership to farmer organizations	0.0110	0.0426	0.0180	2.3700	0.0180**
Training on avocado farming	0.0131	0.0506	0.0264	2.9200	0.0550*
Access to market information	0.0363	0.1405	0.0411	3.4200	0.0010** *
Market factors					
Delayed collection of avocados	-0.0020	-0.0076	0.0195	-0.3900	0.69600
If the buyer offer better price	0.0085	0.0330	0.0264	1.2500	0.2110
Payment delays for avocado delivered	0.0005	0.0018	0.0171	0.1100	0.9140

Checks on avocado size	0.0869	0.3370	0.0553	6.1000	0.0000** *
Inverse mills ratio		0.0647	0.0278	2.3300	0.0200**

Asterisks***, ** and * indicate significance at 1%, 5% and 10% level respectively

The findings presented in Table 4.6 show that cost of information search was found to significantly and negatively affect farmer's participation in the export market. Cost of information search was measured in terms of amount of airtime used to call avocado buyers. Analysis showed that cost of information search reduces the probability of farmer's participation in export market by 0.01%.

With regard to transaction costs factors, distance to local market was found to positively and significantly affect farmer's decision on export market participation. Increase in distance to the nearest market by 1 Km increases the probability of export market participation by 0.13%. Also results showed that households head's level of education in years positively and significantly affected farmer's decision to participate in export markets. Increase in education by 1 year increases the probability of farmer's participation in export market by 0.21%.

With respects to economic factors hypothesized, findings indicate that intercropping coffee with avocado and also intercropping macadamia with avocado positively affect farmers' participation in export market. Coffee increase probability of participation in export market by 1.08% whereas intercropping macadamia nut trees with avocado increases the probability of farmers' participation in export market by 5.03%. These results imply that intercropping avocado with tree crops attracts farmers to export markets.

Membership to farmer organization was found to positively affect the probability of farmer's participation in export market by 1.10%. Results further show that Access to market information positively affects farmers' participation in the export market. Household head's access to market information increases probability of participation in export market by 3.63%.

Trainings on avocado farming methods significantly and positively affected farmer's participation in export markets. A farmer having trainings on avocado farming methods increases the probability of export market participation by 1.31%.

Among the selected market factors, the size of avocado fruits significantly and positively affects farmers' participation in export markets. The size of avocado increases farmers' participation in export market by 8.69%.

4.4.3 Extent of participation in the export market

The results of second stage Heckman OLS regression results were obtained (Table 4.7).

Table 4.7: The results of second stage of Heckman OLS regression analysis

Proportion of avocado sold in export market(Kgs)	Coef.	std. err	Z	P>|z|
Transaction costs				
Harvesting costs (KES)	-0.0002e ⁻¹	0.0009e ⁻²	-2.1500	0.0320**
Distance to nearest market (KM)	0.0235	0.0157	1.4900	0.1360
Road type	-0.0345	0.1046	-0.3300	0.7410
Socioeconomic factors				
Age in years	-0.0106	0.0052	-2.0200	0.0430**
Education in years	-0.0550	0.0278	-1.9800	0.0480**
Experience in avocado marketing (years)	0.0254	0.0113	2.2500	0.0240**
Family size	-0.1620	0.0456	-3.5500	0.0000***
farm size (Ha)	0.5072	0.1644	3.0900	0.0020***
Farm income	0.0005e ⁻²	0.0001e ⁻²	4.6600	0.0000***
Intercrop avocado with coffee	0.2483	0.1877	1.3200	0.1860

Asterisks *** and ** indicate significance at 1% and 5% level

Results in Table 4.7 indicate that harvesting cost negatively affects the proportion of avocado sold in export market. Increase in harvesting cost decreases the proportion of avocado sold in export market by 0.002%.

The analysis shows that household's age in years decrease the proportion of avocado sold in export market by 1.06%. Education in years reduces the proportion sold in export market by 5.50%. Household head's experience in avocado marketing increases the proportion of

avocado sold in export market by 2.54%. Family size reduces the proportion of avocado sold in export market by 16.20%.

Farm size in hectares increase the proportion of avocado sold in export market by 50.72%. Household's farm income also showed positive effect on proportion of avocado sold in export market. Farm income increase by 1 unit increases the proportion of avocado sold in export market by 0.00005%.

4.5 Factors affecting choice of avocado marketing channels

Multinomial Logit model was used to determine the factors influencing the choice of avocado marketing channels among smallholder avocado farmers in Murang'a County. Marketing through farmer marketing organization fetched the highest average farm gate price, and was therefore used as a reference category. The likelihood ratio (χ^2) value was 441.74 and significant at 1% level. The likelihood ratio test confirms that all the variable coefficients are significantly different from zero (Ojo *et al.*, 2013). The pseudo R² was 0.5242 indicating that the selected factors collectively and significantly explain 52.42% of the observed variations in the choice of avocado marketing channels. The marginal effect from the multinomial regression analysis measures the expected change in the probability of a particular choice being made with respect to a unit change in an independent variable (Gujarati, 2007), and therefore was used in the interpretation of the results (Table 4.8).

Findings revealed that farm size positively affects the choice of brokers at 5% level of significance. Increase in farm size increases the probability of choosing brokers by 13.98% against that of choosing farmer marketing organizations. Results further showed that gender of the household head had a negative effect on the choice of marketing through brokers at 5% level of significance. This indicates that male-headed households decrease the likelihood of choosing brokers by 12.47% in favour of sale through marketing organization.

The household's level of education had a positive coefficient and significantly affected the decision to choose brokers at 10% level of significance. This indicates that an increase in number of years spent in education increases the probability of farmers' decision to choose brokers by 1.76% against that of choosing farmer marketing organization.

Table 4.8: The results of Multinomial regression analysis

Variables	Broker Marginal effects	Std. Err.	Direct sales to market Marginal effects	Std. Err.	Local Trader Marginal effects	Std. Err
Socioeconomic factors						
Farm size (Ha)	0.1398 (0.0480)**	0.0708	-0.0365 (0.4420)	0.0475	-0.0061 (0.9020)	0.0496
Gender (Male , Female)	-0.1247 (0.0250)**	0.0555	-0.0670 (0.1170)	0.0427	0.0291 (0.4900)	0.0421
Education level (years)	0.0176 (0.1250)*	0.0115	0.0038 (0.6470)	0.0082	-0.0011 (0.8930)	0.0082
Farm income (KES)	-0.0836e ⁻⁵ (0.0520)**	0.0431e ⁻⁵	0.0148e ⁻⁵ (0.5920)	0.0277e ⁻⁵	0.0310e ⁻⁶ (0.9160)	0.0294e ⁻⁵
Access to extension services	-0.2703 (0.0350)**	0.1279	0.1166 (0.2080)	0.0926	0.0727 (0.4790)	0.1027
Training on avocado farming	-0.0309 (0.6940)	0.0786	-0.0214 (0.6950)	0.0546	-0.1180 (0.0390)**	0.0571
Dairy cow kept by farmer	-0.0531 (0.5940)	0.0994	0.2149 (0.0080)***	0.0814	0.0206 (0.7430)	0.0630
Intercropping avocado with coffee	-0.1505 (0.0020)***	0.0477	-0.0648 (0.0630)*	0.0348	-0.1277 (0.0000)***	0.0354
Growing organic avocado	0.4249 (0.2320)	0.3553	-0.4314 (0.0580)**	0.2279	-0.2854 (0.3110)	0.2819
Market factors						
Time taken to sell avocado	0.0923 (0.0610)*	0.0493	0.0071 (0.6540)	0.0158	-0.1132 (0.0530)**	0.0585
Delayed collection of fruits	0.0299 (0.6970)	0.0768	-0.0019 (0.0.9670)	0.0463	0.1584 (0.0090)***	0.0607
Farm gate price	-0.0049 (0.0020)***	0.0034	-0.0014 (0.0010)***	0.0021	0.0026 (0.3780)	0.0030
Distance to market	-0.0090 (0.1080)	0.0056	0.0044 (0.2860)	0.0041	0.0066 (0.1100)*	0.0041
Transactional costs						
Farmer organization registration fee	0.0017 (-0.1190)	0.0011	0.0015 (0.0380)**	0.0007	-0.0006 (0.3770)	0.0007
Farmer organization subscriptions	-0.0012 (-0.2560)	0.0010	0.0013 (0.0430)**	0.0007	0.0005 (0.4750)	0.0007
Travelling to buyer location cost	0.0001 (0.7000)	0.0002	0.0003 (0.0030)***	0.0001	-0.0003 (0.2370)	0.0003

Reference category =farmer market organizations, Asterisks ***, ** and * indicate significance at 1%,5% and 10% level respectively. LR χ^2 =441.74, Prob > χ^2 = 0.0000, Pseudo R² =0.5242.

Results revealed that farm income negatively affects the probability of choosing brokers by 0.0008% in favour of farmer marketing organization. In addition, the household heads' off-farm income positively affected choice of local traders and direct sales to market at 5%. This analysis implies that increased household's head level of off-farm income increases the likelihood of making direct sales and choice of local traders by 2.89% and 2.31% respectively against that of farmer marketing organization.

Access to extension services negatively affects choice of marketing through brokers at 5% level of significance and decreases the probability of choosing brokers by 27.03% in favour of farmer marketing organization. Extension visits also decreases the probability of choosing brokers by 8.69% in favour of farmer marketing organization. The findings also indicated that exposure to trainings on avocado farming methods negatively affected the choice of marketing through local traders at 5% level of significance. Increased trainings on avocado farming methods reduce probability of choosing local traders by 11.80% in favour of farmer marketing organization.

The practice of dairy enterprise in the farm positively affected the farmer's decision on direct sales to market at 5% level of significance. Existence of dairy enterprise increased the likelihood of making direct sales by a 21.49% against that of choosing farmer marketing organizations. Further, the findings show that Intercropping avocado with coffee negatively affects farmer's choice of brokers, local traders and direct sales to market at 1% and 10% level of significance respectively. Intercropping avocado with coffee was found to decreases the probability of choosing brokers, local traders and direct sales to market by 15.05%, 6.48% and 12.77% singularly in favour of farmer selling through marketing organization.

Based on the results, production of organic avocado was found to negatively affect choice of brokers and direct sales to market at 5% level of significance. It decreases the probability of direct sales to market by 43.14% in favour of farmer marketing organizations, implying that growing organic avocado increased chances of selling to farmer marketing organization.

Time taken to collect avocado positively and significantly affects the decision to choose brokers at 10 % level of significance. Prolonged time in collecting avocados increases chances of sales through brokers by 9.23%, against the probability of selling through farmer marketing organizations. Further, the results showed that time taken to collect avocado decreases likelihood of choosing local traders by 11.32% in favour of farmer marketing organizations.

Delayed buying of avocado by the targeted buyers positively affects the decision to choose local traders at 1% level of significance. This implies that delayed buying of avocados increases the probability of choosing local traders by 15.84% against that of farmer marketing organizations. Also results indicated that farm gate prices negatively affected farmer's decision on choice of brokers and direct sales to market at 1%. Increase in farm gate price offered reduces the farmer's likelihood of choosing brokers and direct sales to market by 0.49% and 0.14% respectively in favour of farmer marketing organizations.

With regard to transaction costs hypothesised, farmer marketing organization membership and farmer marketing organization subscription fees increases the probability of making decision in inclined to direct sales to market by 0.15% and 0.13% respectively against that of marketing through farmer marketing organizations. In addition findings revealed that travelling costs to buyer locations positively affects the decision on marketing through direct sales to market at 1%. This indicates that increased travelling cost to buyer location increases the likelihood of making direct sales to market by 0.03% against that of farmer marketing organization. Findings also indicated that the distance to market increases the likelihood of choosing local traders by 0.66% against farmer marketing organization.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussions

This section discusses the study results related to the objectives and compares with the findings of other studies

5.1.1 Gross margins across different avocado marketing channels

Cost of information search, traveling cost to buyers' location, farmer organization membership fee, farmer organization subscription charges, harvesting costs were found to be the main transaction cost across the avocado marketing channels considered in the study. These findings are similar to results of a number of studies, for instance Jagwe, (2011) found that cost of information cost, negotiation cost, monitoring costs were incurred by farmers selling through various outlets. A study by Mabuza *et al.* (2014) also indicated that cost of information was higher for farmers selling to retail market but low for farmers selling at farm gate. Farmer market organization fee and annual subscriptions charges were incurred by farmers selling through marketing organization but none was incurred for farmers selling through other channels (Table 4.3). This observation is due to the fact that farmers' participating in marketing organizations is required to contribute organization subscription fees (Catherine, 2017).

Cost of fertilizer, labour and pesticide were the production costs incurred by avocado farmers across the main marketing channels. Labour cost was higher for farmers selling across the four main marketing channels considered in the study (Figure 4.2). This is because most of avocado production operations in the study area are done manually which escalates labour costs for instance manures application, pruning and grafting. Similar findings were reported by Onyango *et al.* (2016) that labour cost was higher than other costs of production like fertilizer, pesticides and fungicides across various marketing channels.

Gross margins analysis revealed that farmers selling through marketing organization had the highest gross margin. This is explained by the fact that farmers that sell through this channel received the highest farm gate price than other channels (Table 4.1). Similar

findings by Muthini *et al.* (2017) indicated that sales to formal traders earned higher gross margins to farmers while was lower for farmers selling to informal traders like brokers and local traders. Also sales through intermediaries such as rural assemblers was found to have low gross margins received by green gram farmers in Mbeere South (Kihoro *et al.*, 2016).

5.1.2 Export market participation and extent of participation

Heckman model results showed that cost of information search negatively affects farmers' participation in export market. This implies that increase in cost of airtime used to call buyers increase farmers participation in local markets since informal traders move around the farms during harvest time searching for avocados. These results collaborate with those found by Jagwe, (2011); Mabuza *et al.* (2014); Macharia *et al.* (2014), that cost of information search negatively affects farmers' market participation.

Findings showed that distance to local markets positively affected participation in export market. Farmers nearer to local avocado market have many alternatives as compared to ones in far distances where they have limited alternatives. Mwambi *et al.* (2016) in addition, noted that being in close proximity to the market confers an advantage to the households since they have many alternatives than households located in the peripheries. These results are inconsistent with findings of Abayneh & Tewodros, (2013); Kyaw *et al.* (2018); Mariyono (2019) that found negative relationship in market distance and market participation. In this study export market participants are found in distances far from the local markets, hence positive relationship between distance and farmer participation in export market.

Household head education in years positively affects decision on export market participation. The plausible explanation is that households with higher education levels are better informed in terms of off- farm decision-making. This finding is consistent with those of Sigei *et al.* (2014); Adeoti *et al.* (2014); Cuevas & Clarete, (2015), that indicated education has positive effect on market participation however they contradict findings of Harrizon *et al.* (2016) that education of the household head negatively affects farmers participation in export market.

The analysis showed that having coffee trees positively affects participation in export market. Findings further show that intercropping avocado with macadamia increased likelihood of avocado farmer' export market participation. Plausible explanation for this observation is that income received from sale of macadamia nuts and coffee is used to meet some of the transactional costs incurred in the export market. In addition, farmer marketing organization help farmers to market the coffee and macadamia outputs, thus farmers having macadamia and coffee in most cases would also grow avocado. Crops diversification positively affect farmers' market participation, farmers are able to spread the risk in the event that one crop fail or they enjoy the benefit of marketing the crops together thereby reducing marketing costs (Kondo, 2019).

Results also indicated that membership to farmer organization was found to positively affect export market participation. These results imply that farmer organizations promote networking of farmers in agricultural marketing therefore, promoting ease of access to marketing services. These organization help avocado farmers in bargaining for better prices. They also help farmers to meet export standards required in European markets and provide them with improved avocado seedlings. These results are similar to those by Okoye *et al.* (2016), that being a member of farmer cooperative had significant and positive effect on market participation. Kyaw *et al.*, (2018) also reported that membership to a farmer organization positively affects market participation.

Training on avocado farming methods significantly and positively affects farmer participation in export market. This observation can be explained by the fact that increased trainings on avocado farming methods such as organic avocado increase productivity and quality standards of the produce thereby increasing participation in export market. Similar findings were reported by Ingabire *et al.* (2017); Cuevas & Clarete, (2018), who found positive relationship in agricultural trainings received and farmer's market participation.

Results showed that access to information on avocado marketing had a positive effect on export market participation. These results suggests that access to market information enable farmers to analyse market situation in respect to market prices and level of market demand for the output (Osebeyo & Aye, 2014). Several studies have found positive

relationship between accesses to marketing information such as price. For instance results of Yohannes *et al.* (2014) indicate that access to market information enable farmers to know the prevailing prices in the market thereby enhancing farmers' decision on participation in various markets. Osebeyo & Aye, (2014) found that market information positively affects farmers' participation in agricultural marketing. Also results of Lefebo *et al.* (2016) and Kyaw *et al.* (2018) indicated that access to market information positively affects market participation.

Size of avocado fruit positively affects farmer's participation in export market. These results show that size of avocado harvested is integral when it comes to export markets since packing and grading for export market depends on size of avocado. Farmers that produce avocado that has size traded in international market have higher probability of participation in export market. These results are similar to findings of Oyekale, (2014) that size of produce positively affects farmers' participation in markets.

With regard to extent of export market participation, the findings showed that harvesting cost negatively affects proportion of avocado sold in export market. Harvesting of avocado involves three activities in the farm level; picking, sorting and grading of avocado to meet quality standard in export market. These make the farmer to spend extra costs in meeting the export standards. Therefore it may serve to discourage farmers to sell through export market. Similar findings were reported by Macharia *et al.* (2014) that costs such as sorting and grading reduces the proportion of output sold in the markets.

Age negatively affects proportion of avocado sold in export market. As farmer's age increases the probability of producing more for export market decreases. This is explained by the fact that older farmers tend to be risk averse and are reluctant in adopting new avocado farming technologies, hence their inability to sell more in export market. This concurs with findings of Lefebo *et al.* (2016) who found negative relationship between age in years and extent of farmer participation in marketing, but also are inconsistent with results of Harrizon *et al.*, (2016) that found a positive relationship between age and the extent of participation.

The findings also revealed that household head education negatively affect proportion of avocado sold in export market. The possible reason for this observation is that educated household are attracted to other jobs other than avocado farming which subsequently reduce the intensity of farm production. Similar findings were reported by Mariyono,(2019) that formal education negatively affects the quantities of produce marketed.

Results further shows that avocado marketing experience positively affects the proportion of avocado sold in export market. This indicates that years spent in avocado farming have positive relationship with the proportion sold to export market. Households with more market experience have knowledge about market dynamics which help them in making decisions on the quantity to export. These results agree with those by Adepoju *et al.*, (2019) that market experience positively affect amount sold in the market.

Family size negatively affects the proportion of avocado sold in export market. Household size has two opposing effects; as household size increases the high demand for food reduce the amount of output marketed. On the other hand increased amount of produce marketed may imply high labour supply in production by family members (Bwalya *et al.*, 2013). Family size in this case reduces the proportion of avocado sold in export market because of sales to local markets to meet the demand for food. These findings concur with findings of Henson *et al.* (2013); Apind *et al.*, (2015); Tura *et al.* (2016) that reported negative effect between family size and extent of market participation.

Farm size in hectares positively affected the proportion of avocado sold in export market. Land is the main production asset that has direct bearing on the production of marketable output. Household head in export marketing chain had high number of avocado trees under production as compared to farmers selling in other markets (Table 4.1) thereby explaining the reason for higher effect of this variable on extent of participation in the market. These findings are similar to results of Abayneh & Tewodros (2013); Tura *et al.* (2016); Adepoju *et al.* (2019) that indicated household head farm size affects amount of output sold in market positively.

Findings indicate that total farm income positively affects the proportion of avocado sold in export market. This is because farm income has positive impact on the ability of farmers to meet some of the transaction costs involved in avocado marketing. Households with high value of agricultural out are likely to participate more in market than those with reduced income (Osmani & Hossain, 2015). Total farm income was found to increase the amount sold in market and consecutively increasing smallholder participation in agricultural marketing (Gebremedhin & Jaleta, 2010)

5.1.3 Factors affecting choice of marketing channels

The multinomial results showed that farm size positively affected choice of brokers. This is because large farm size leads to increased avocado output and thus farmers may choose to sell to brokers as a way of reducing marketing costs incurred if selling through farmer organizations. The large producers may also not need the benefits that accrue from farmer organizations since they operate independently. Similar results were reported by (Dessie *et al.*, 2018; Kumar, 2018), that farm size positively influenced choice of informal traders such as assemblers and retailers.

Gender negatively affected choice of brokers in favour of farmer marketing organization. Male headed households possess marketing network unlike women who are in most cases restricted to household tasks (Maina *et al.*, 2015). These findings are consistence with those of (Muthini *et al.*, 2017; Kihoro *et al.*, 2016), that found gender had negative effect with regard to decision to marketing through brokers.

Household head education in years positively affects decision to choose brokers. The possible explanation for this observation is because highly educated household may have more preference to off- farm jobs thereby reducing their investment on avocado farming which consecutively leads to choice of local channels. These results are similar with findings of Mango *et al.* (2018) that education positively affect decision on selling the groundnut produce at the farm gate than in far distant markets.

It was establish that farm income negatively affected choice of brokers. This is because the endowed farmers are more likely to procure farm inputs which would in turn enable them to obtain the high grade quality of avocados that satisfy requirements of the export market.

Results of Muthini *et al.* (2017) showed that household head's income negatively affected choice of brokers in favour of export market. Also the results indicated that household heads' off-farm income positively affected choice of local traders and direct sales to market. This means that most farmers with off-farm income are occupied by off-farm jobs thus decreased effort in avocado farming, consequently leading to low avocado production that is sold through local markets. Similar findings by Dessie *et al.* (2018) showed that availability of off-farm income increases the probability of choosing local traders and direct to consumer channel than other channels.

Access to extension services and number of extension visits were found to negatively affect choice of brokers. This might have been as a result of information obtained by the farmer on avocado farming that improves the avocado productivity and quality, thus favouring choice of farmer marketing organizations. These results agree with Melese *et al.* (2018); Tarekegn *et al.* (2017) that access to extension services negatively affects choice of informal traders such as brokers.

Exposure to trainings on avocado farming methods negatively affected the choice of marketing through local traders. Trainings on avocado farming methods increase skills and knowledge that improves the quality of avocado that is marketed in export market. Tarekegn *et al.* (2017) reported that trainings on farming methods negatively affects choice of local assemblers.

The practice of dairy enterprise in the farm positively affected the farmer's decision on direct sales to market. This is because farmers with dairy cows in most cases had direct interactions with consumers while selling milk products that also could have resulted to direct sale of avocados to them. Similar findings were reported by Dessie *et al.* (2018); Kumar (2018), that having cattle unit in the farm affects the likelihood of selling the output direct to market since the cattle produce such as milk requires spot markets.

Intercropping avocado with coffee negatively affects farmer's choice of brokers, local traders and direct sales to market. Farmers who grow coffee have previous marketing experience through farmer marketing organizations, which leads to formation of avocado marketing groups that facilitate marketing of avocados. Research shows that having a

marketed intercrop encourages group formation and thereby choice of marketing groups, while having no intercrop leads to choice of direct marketing (Adanacioglu, 2017).

Production of organic avocado negatively affects choice of brokers and direct sales to market. Organic farming results to no chemical residues in avocados produced, thus making the output meet the European global gap standards. Hence, increasing chances of selling in export market. Similar findings were reported by Corsi *et al.*, (2018) that organic farming had positive effect on choice of marketing outlets.

Time taken to collect avocado positively and significantly affected the decision to choose brokers. This implies that increased time taken to transact through farmer marketing organization encourages marketing through brokers. Increased bargaining time encourages farmers to use other channels other than market cooperatives (Maina, *et al.*, 2015). Further, the results showed that time taken to collect avocado decreases likelihood of choosing local traders. This was so because local traders harvest avocado produce but not assemble them the same day, thus increasing the chances of loss due to perishability. Similarly the increase in time of transacting affects the likelihood of selling through marketing organizations (Fischer & Wollni, 2018).

Delayed buying of avocado by the targeted buyers positively affects the decision to choose local traders. These findings imply that farmers may prefer to sell through farmer marketing organizations, however delayed buying of avocados results to choice of other channels such as local traders. According to Fischer & Wollni (2018), delayed buying of the produce negatively affects the likelihood of selling through marketing organizations.

Farm gate prices negatively affected farmer's decision on choice of brokers and direct sales to market. Price is an important aspect when choosing marketing outlets among farmers in rural areas. Farmer marketing organizations offered the highest farm gate price among the channels, therefore attracting farmers to use the channel. Results by Zhang *et al.* (2017); Kihoro *et al.* (2016) revealed that price satisfaction had an impact on farmer marketing decision.

With regard to transaction costs hypothesised, farmer marketing organization membership and farmer marketing organization subscription fees increased the probability of making decision inclined to direct sales to market. These costs were collected in terms of the amount of money smallholder spent while registering and maintaining the contract with farmer marketing organization. These findings imply that the transaction costs reduce avocado farmers' potential of selling through farmer marketing organizations (Maina *et al.*, 2015).

Travelling costs to buyer locations positively affects the decision on marketing through direct sales to market. Findings also revealed that the distance to market increases the likelihood of choosing local traders. These results imply that long distance to markets increases the cost of marketing, and thus farmers may choose to sell to nearby markets or sell to traders at the farm gates. This is in line with Honja *et al.* (2017); Temesgen (2017), that distance to market and travelling costs positively affected choice of local traders and direct sales to market.

5.2 Conclusions

The study sought to evaluate the transaction costs and market participation among smallholder avocado farmers in Murang'a County.

The first objective was to estimate gross margins under different avocado marketing channels. Selling through brokers emerged to be the predominant marketing channel implying that the channel had the highest market share over other marketing channels. Selling through farmer marketing organization had the highest gross margins per kilogram. This indicates that farmer marketing organization is the most profitable marketing channel.

The second objective was to assess the effect of transaction costs on smallholder avocado farmers' participation in export market. The Heckman first regression results showed that cost of information search negatively affects farmers' participation in export market. This implies that limited access to information on avocado market conditions crowd out farmers from participating in export market. Farmer characteristics such as membership to farmer organization, trainings on avocado farming methods, size of avocado, access to market information, intercropping avocado with coffee, intercropping avocado with macadamia,

household head education in years and distance to local markets positively affect farmers' participation in export market. Intercropping avocado with other tree crops such as coffee and macadamia and trainings were the outstanding variables that increased farmers' participation in export market with respect to meeting the transaction costs.

The Heckman second stage OLS regression results showed that harvesting cost negatively affects farmers' extent of participation in export market implying that farmers incur extra costs in sorting and grading avocado to meet export market standards on size and quality of avocado. In addition farm size, total farm income, and experience in avocado marketing positively affect farmer's extent of participation in export market. Farm size had the highest effect on proportion of avocado sold in export market. Education, family size and household head age negatively affects the extent of participation in export market. This implies that improvement of these variables will increase the proportion of avocado sold in export market.

The third objective of the study was to determine the factors affecting choice of avocado marketing channels among smallholder farmers in Murang'a County. Multinomial logit model results showed that the probability of choosing brokers was significantly affected by farm size household head's gender, education level in years, time taken to collect avocado, access to extension, farm income and intercropping avocado with coffee. Likewise, the probability of farmers making direct sales to the market was influenced by off farm income, dairy cattle kept by the farmer, intercropping avocado with coffee, growing organic avocado, travelling costs to buyer locations, farmer organization membership fees and subscriptions. Trainings on avocado farming methods, Time taken to collect avocados, delayed buying of avocados and off farm income were among the factors that significantly affected the probability of choosing local traders. It was noted that farm gate price reduced the likelihood of selecting brokers and direct sales to market in favour of farmer marketing organization.

5.3 Recommendations

Based on findings the study made the following recommendations;

5.3.1 Estimation of gross margins across avocado marketing channels

Findings suggested that farmer marketing organization had the highest gross margins per kilogram while local traders had the lowest gross margins across the marketing channels. Thus, the Ministry of Agriculture and the county government should strengthen farmer marketing institutions. This will attract more farmers to trade through farmer marketing organizations.

5.3.2 Effect of transaction costs on export market participation

Results showed that cost of information search reduce export market participation, thus this study recommends that timely market information should be provided to the smallholder avocado farmers participating in the export market. This information may include avocado produce collection dates that will reduce airtime used to call the export produce collectors.

Intercropping avocado with macadamia trees and coffee trees increase farmers' participation in export market. Income received from sale of output in macadamia and coffee is used to meet some of transactional costs thereby increasing farmers' participation in export market. Therefore, interventions that promote production of avocados alongside coffee and macadamia nut will increase export market participation among smallholder avocado farmers in the long run.

Trainings on avocado farming methods were found to increase farmers' participation in export market. Training gives farmers necessary skills and knowledge required for produce avocado that conforms export standards. Therefore, this study recommends that more training programs to be conducted to avocado growers by stakeholders such as exporters and the Ministry of Agriculture in order to increase production of avocados that are marketable in export market.

Findings indicated that harvesting costs reduces the extent of participation. Introduction of avocado harvesters through farmer marketing organizations can play a vital role in reducing harvesting cost. These technologies would help in decreasing the cost of picking, sorting and grading avocados for export market standards. They will also reduce incidences of fruit loss due to handling damages caused by hand pickers.

Findings indicated that age of the households reduces the proportion of avocado sold in export market. The county government should incentivize young people to engage in avocado farming because they have high potential of learning new technologies on avocado farming. Land size increase the proportion of avocado sold in export market, however majority of farmers in the area are small scale farmers with land holding of less than 2 hectares. Thus, development of improved hass and fuerte varieties that do well in smaller pieces of land will help in increasing quantities of avocados sold in export market.

5.3.3 Factors affecting choice of marketing channels

Based on the results, the study recommends that, increased trainings on avocado marketing will enhance farmers' skills on avocado marketing. This will also promote farmers' knowledge on the various worthwhile marketing channels that ultimately contribute to reducing poverty levels among smallholders in rural areas. Also male-headed households dominated in marketing through farmer marketing organizations, thus developing policy interventions that support more female-headed households' participation in avocado marketing will be appropriate in enhancing gender parity.

The findings showed that intercropping avocado with coffee was found to be a good blend for farmer involvement in export marketing. Therefore, interventions that promote production of avocados alongside coffee or with other cash crops may require further investigation. Time taken to collect avocados and delayed buying of avocados promoted sales through avocado in local channels. Hence, there is need to provide information on fruits collection calendar to smallholder farmers that shows the expected picking dates. Farm gate price was found to affect the choice of marketing channels. Thus, interventions by the Ministry of Agriculture through Agriculture, Food and Fisheries (AFFA) should formulate policies that protect farmers from exploitation by the avocado traders in the region.

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APPENDICES

Appendix 1: Avocado Production in Kenya

County	2016			2017		
	Area (Ha)	Volume (Tons)	Value (KES)	Area (Ha)	Volume (Tons)	Value (KES)
Murang'a	4,310	118,356	2,438,827,000	4,319	120,645	2,537,654,000
Kisii	1,519	29,383	487,573,500	1,529	31,383	497,573,500
Kiambu	677	12,382	407,352,500	1,505	29,004	570,675,000
Nyamira	1,454	24,435	198,640,199	1,474	28,435	298,640,199
Meru	458	4,671	66,462,112	743	15,253	225,268,512
Embu	702	13,388	204,125,000	692	13,180	195,000,000
Kirinyaga	422	5,023	100,172,000	433	5,282	120,532,000
Bungoma	266	4,275	78,103,900	268	3,802	105,552,100
Machakos	519	4,172	112,439,000	526	3,467	104,964,000
Migori	297	3,365	72,589,182	407	4,585	88,778,515
Elgeyo Marakwet	276	2477	58,821,600	277	2,992	72,063,400

Source :(USAID, 2017)

Appendix 2: Correlation matrix

	sources of farm income	farm size(ha)	if keeps livestock	farmer organiz membership	trainings	delayed b usiness	offer be tter price	payment d elay	size of avo cadamia	market inform	knowledge o f	information se ctor	farm g ate price	membership fi nancial	age	education	experien ce
sources of off income	1.00																
farm size(ha)	-0.08	1.00															
If have macad amia	-0.08	0.19	1.00														
farmer organiz membership	-0.18	0.08	-0.06	1.00													
Trainings	-0.09	0.18	0.13	-0.01	1.00												
Preferred	0.01	-0.11	-0.24	0.08	0.11	1.00											
offer better pri ce	0.10	0.04	0.11	-0.06	0.10	-0.04	1.00										
payment delay	0.05	-0.04	-0.18	0.29	0.05	0.59	-0.05	1.00									
size of avocad mia	-0.04	0.10	0.14	-0.05	-0.02	0.05	0.34	0.07	1.00								
market inform ation	0.15	0.13	0.05	-0.07	0.30	0.07	-0.04	0.09	-0.01	1.00							
Intercrop with macadamia	-0.05	0.13	0.05	-0.07	-0.03	0.07	-0.04	0.09	-0.01	-0.02	1.00						
information se ctor	0.06	0.05	-0.11	0.15	-0.02	0.21	0.03	0.20	0.20	0.09	0.21	1.00					
farm gate price	0.10	-0.16	-0.05	-0.04	0.18	0.32	0.58	0.23	0.36	0.10	-0.04	0.17	1.00				
membership fi nancial	0.11	-0.08	-0.12	0.20	0.03	0.11	0.00	0.15	0.06	-0.08	0.08	0.05	0.08	1.00			
Age	0.09	0.35	-0.12	0.02	-0.14	-0.17	0.09	-0.29	0.18	-0.10	0.20	0.05	-0.03	0.06	1.00		
Education	-0.23	0.01	0.20	0.20	0.19	0.02	-0.02	0.16	0.13	0.07	-0.06	0.19	0.03	0.02	-0.58	1.00	
Experience	0.12	0.22	-0.08	0.13	0.00	0.32	0.12	0.19	0.13	-0.21	0.13	0.09	0.11	0.16	0.36	-0.25	1.00
transport cost	-0.10	0.18	0.02	0.07	-0.08	0.00	-0.03	-0.24	0.06	-0.26	0.07	0.11	0.02	-0.08	0.13	0.04	0.10
proximity to collection point	0.32	0.00	0.05	-0.45	-0.19	0.02	0.11	-0.23	-0.07	0.02	0.02	0.02	0.12	-0.10	0.23	-0.37	0.17
Income	-0.01	0.13	0.14	0.06	0.06	-0.04	0.07	-0.05	0.03	0.04	0.04	0.11	-0.03	0.14	-0.03	0.33	0.10
family size	0.06	0.04	-0.14	0.00	0.17	0.09	0.00	0.10	-0.02	0.08	0.03	0.20	0.02	-0.07	-0.13	0.20	0.19
intercrop with road type	-0.10	0.39	-0.04	0.07	0.06	0.07	-0.34	-0.11	-0.14	0.10	0.10	0.11	-0.23	0.11	0.24	-0.09	-0.09
road type	0.28	-0.13	-0.14	0.11	0.05	0.23	-0.15	0.04	-0.09	-0.03	-0.03	0.11	0.03	0.23	0.01	-0.16	0.15
harvesting cos t	-0.04	0.35	0.01	0.07	0.10	-0.17	0.15	-0.12	0.10	-0.04	0.08	0.19	-0.02	0.08	0.11	0.09	0.05

Appendix 3: Hausman test




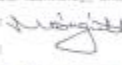

Choice	χ^2 value	P>z
Broker and direct sale to market	3.30	0.65
Broker and local traders	5.44	0.99
Local traders and direct sales to market	0.62	0.98

Appendix 4: Multinomial logistic model full results

Variables	Broker Marginal effects	Std. Err.	Direct sales to market Marginal effects	Std. Err.	Local Trader Marginal effects	Std. Err
Socioeconomic factors;						
Farm size (Ha)	0.1398 (0.0480)**	0.0708	-0.0365 (0.4420)	0.0475	-0.0061 (0.9020)	0.0496
Farm area under avocado	-0.0635 (0.7060)	0.1682	0.0035 (0.9870)	0.1253	-0.1480 (0.2450)	0.1272
Gender (Male , Female)	-0.1247 (0.0250)**	0.0555	-0.0670 (0.1170)	0.0427	0.0291 (0.4900)	0.0421
Family size	0.0011 (0.9230)	0.0116	-0.0120 (0.1900)	0.0092	0.0077 (0.2800)	0.0072
Age (years)	0.0002 (0.9060)	0.0020	-0.0016 (0.2870)	0.0015	0.0001 (0.9520)	0.0013
Education level (years)	0.0176 (0.1250)*	0.0115	0.0038 (0.6470)	0.0082	-0.0011 (0.8930)	0.0082
Experience in avocado marketing (years)	-0.0030 (0.3980)	0.0035	0.0015 (0.5760)	0.0027	-0.0017 (0.5250)	0.0027
Farm income (KES)	-0.0836e ⁻⁵ (0.0520)**	0.0431e ⁻⁵	0.0148e ⁻⁵ (0.5920)	0.0277e ⁻⁵	0.0310e ⁻⁶ (0.9160)	0.0294e ⁻⁵
Intercropping with macadamia	-1.2700 (0.9780)	45.5253	1.5758 (0.9800)	62.6760	-0.1810 (0.9850)	9.8663
Access to extension services	-0.2703 (0.0350)**	0.1279	0.1166 (0.2080)	0.0926	0.0727 (0.4790)	0.1027
Access to market information	0.2352 (0.3520)	0.1439	-0.0690 (0.4960)	0.1013	-0.0268 (0.7750)	0.0936
Access to credit on avocado farming	1.0496 (0.9980)	525.0695	0.3563 (0.9970)	98.8094	-1.1905 (0.9990)	655.9655
Training on avocado farming	-0.0309 (0.6940)	0.0786	-0.0214 (0.6950)	0.0546	-0.1180 (0.0390)**	0.0571
Dairy cow kept by farmer	-0.0531 (0.5940)	0.0994	0.2149 (0.0080)***	0.0814	0.0206 (0.7430)	0.0630
Intercropping avocado with coffee	-0.1505 (0.0020)***	0.0477	-0.0648 (0.0630)*	0.0348	-0.1277 (0.0000)***	0.0354
Number of avocado trees in production stage	0.0029 (0.3170)	0.0029	-0.0008 (0.7180)	0.0022	-0.0011 (0.6290)	0.0022
Quantity of avocado harvested	-0.0270e ⁻⁴ (0.3470)	0.0287e ⁻⁴	-0.0723e ⁻⁵ (0.7380)	0.0216e ⁻⁴	0.0212e ⁻⁴ (0.3110)	0.0020
Growing organic avocado	0.4249 (0.2320)	0.3553	-0.4314 (0.0580)**	0.2279	-0.2854 (0.3110)	0.2819
Market factors;						
Time taken to sell avocado	0.0923 (0.0610)*	0.0493	0.0071 (0.6540)	0.0158	-0.1132 (0.0530)**	0.0585

Time taken to receive payment	0.0484 (0.6030)	0.0932	-0.0063 (0.9160)	0.0603	0.0529 (0.4810)	0.0750
Delayed collection of fruits	0.0299 (0.6970)	0.0768	-0.0019 (0.0.9670)	0.0463	0.1584 (0.0090)***	0.0607
Quality checks by the buyer	-0.1219 (0.2340)	0.1025	0.0735 (0.2760)	0.0674	0.0833 (0.3070)	0.0815
Farm gate price	-0.0049 (0.0020)***	0.0034	-0.0014 (0.0010)***	0.0021	0.0026 (0.3780)	0.0030
Variety checks	-0.1607 (0.3370)	0.1672	-0.0858 (0.3540)	0.0925	0.0214 (0.7330)	0.0626
Buyer not reliable	0.0422 (0.7520)	0.1337	-0.0321 (0.7010)	0.0835	-0.0441 (0.7270)	0.1261
Distance to market	-0.0090 (0.1080)	0.0056	0.0044 (0.2860)	0.0041	0.0066 (0.1100)*	0.0041
Type of road	0.0159 (0.6550)	0.0355	-0.0126 (0.6270)	0.0258	-0.0302 (0.2890)	0.0285
Transactional costs;						
Farmer organization registration fee	0.0017 (-0.1190)	0.0011	0.0015 (0.0380)**	0.0007	-0.0006 (0.3770)	0.0007
Farmer organization subscriptions	-0.0012 (-0.2560)	0.0010	0.0013 (0.0430)**	0.0007	0.0005 (0.4750)	0.0007
Travelling to buyer location cost	0.0001 (0.7000)	0.0002	0.0003 (0.0030)***	0.0001	-0.0003 (0.2370)	0.0003

Appendix 4: Research permit

 <p style="text-align: center;">REPUBLIC OF KENYA</p> <p style="text-align: center;">National Commission for Science, Technology and Innovation</p> <p>Ref No: 409886</p>	 <p style="text-align: center;">NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION.</p> <p style="text-align: right;">Date of Issue: 16/August/2019</p>
RESEARCH LICENSE	
	
<p>This is to Certify that Mr., kelvin karungu of University of Embu, has been licensed to conduct research in Muranga on the topic: <u>TRANSACTION COSTS, MARKET PARTICIPATION AND CHOICE OF MARKETING CHANNELS AMONG SMALLHOLDER AVOCADO FARMERS IN MURANG'A COUNTY, for the period ending : 16/August/2020.</u></p>	
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National Commission for Science, Technology and Innovation
off Waiyaki Way, Upper Kabete,
P. O. Box 30623, 00100 Nairobi, KENYA
Land line: 020 4007000, 020 2241349, 020 3310571, 020 8001077
Mobile: 0713 788 787 / 0735 404 245
E-mail: dg@nacosti.go.ke / registry@nacosti.go.ke
Website: www.nacosti.go.ke

Appendix 5: Questionnaire

This questionnaire aim at collecting data on transaction costs and market participation among smallholder avocado farmers in Murang'a County. This questionnaire is only for academic purpose. Therefore, information provided herein is treated with utmost confidentiality.

IDENTIFICATION DETAILS

Interview Schedule NO

GENERAL INFORMATION

Enumerator	
Location	
Sub-location	
Village	

SECTION A:

1.) Household Socioeconomic Characteristics

A1. Household head gender	1=male 0=female
A2 Marital status of household head	1=married 2= widow 3=single 4=divorced 4= widower
A3 Household head age in years	.....years
A4 Household family size	.....
A5. i) household head Education level	1=primary 2= secondary 3= college 4= university 3= non formal
ii) Household head years spent in education	.....years
A6. Household head years spent in avocado farming	.....years
A7. Household head income per year in KES	..... KES
A8. Household head sources of income	1= avocado 2= macadamia 3= bananas 4 coffee 5 dairy 6= others
A9. Household head income from sources in A7 above per year in KES	From 1.....2.....3.....4.....5.....6.....
A10. Household sources of off farm income per year	1=business 2= salary3=self employment4=others (specify)
A11. Household off farm income in KES	.....
A12. Total farm size owned	.....acres
A13. land size under avocado production in hectares	..... acres

A14. Number of avocado trees in production stage	.....
A15. Avocado Varieties grown	1= fuerte 2= hass 3= other varieties (specify)
A16. Quantity of avocados harvested last season in kg or pieces per acre	.....
A17. Assets owned	1= warehouses 2= vehicles 3= livestocks 4= others (specify)

SECTION EXPORT MARKET PARTICIPATION, MARKETING CHANNELS AND TRANSACTION COSTS

2.) Do you sell your avocados to marketing group?

1= Yes () 0=No () [If No please go to roman iv & v]

i) If **yes** please indicate the amount, duration in years, how you joined, group services, and reason for leaving the group if you have ever left

Duration(years)	Amount sold	Joining	Group services	If left group at any time , give reason(s)
.....	1= Free 2= charges	1=marketing avocados 2= training on avocado farming 3=market information 3=bulk input sourcing 4= any other (specify)	1= mismanagement 2= Favoritism 3= High cost 4 any other (please specify)

ii) Have you signed a contract with any buyer through the group? **Yes () Never () Left contract ()**. If yes or left contract fill the table below

Name of the buyer	Terms of contract	If left the contract what was the reasons for leaving
	1=quality 2=price 3=grading 4=transport 5=size 6=others	1= could not meet terms 2= buyer violated the terms 3=Group disintegrated 4=not enough to sell 5= others specify

iii) Please indicate transaction costs you incur in the following marketing activities

Marketing activity	Cost in KES
Maintaining contract with buyer (membership fees)
Group membership(registration fee)
Harvesting, packaging and grading avocados
Transporting to collection point
Looking for markets(airtime, travelling costs and time spent in hours)
Any other (please specify)

iv). Please indicate the channels you use in selling your avocados.

Channels	Amount sold
1= direct to the market - farmers selling avocado to intermediate markets.
2= brokers - buyers who buy and sell to the exporters or local traders.
3= local traders – buyers who buys and sell to nearby markets like Murang’a, Thika, Nairobi and Nyandarua.

v.) Please indicate the transaction costs you incur in the following marketing activities.

Marketing activity	Cost (KES)		
	Direct to market	Brokers	Local traders
Negotiating price (fares/transport, airtime)
Looking for markets (transport and hours spent)
Cost of transporting to market
Packaging (bags, boxes)
Harvesting,grading and packging cost
Any other(please specify)

SECTION C: GROSS MARGINS INFORMATION

3) Labour cost on avocado production

C1. Type of labour	1= family labor 0= hired labor
C2. Labour availability	1=very good 2= good 3 bad
C3. Who undertake the work	1=men 2= women 3= children
C4. Hours taken per day	.....Hours
C5. Number of labor personnel used in;	Fertilizer/manure.....spraying.....prunning.....
C6. Wages per day in KES	Fertilizer/manure application.....spraying.....prunning.....
C7. Total amount spent on labor in the last season	.....KES

4) Fertilizer cost

Fertilizer	Month of year applied 1= January 2= February 3= March 4 = April 5 = May 6= June 7=July 8= August 9 September 10=October 11 = November 12= December	Amount in Kg/ acre Or debes per acre	Costs per acre
MOP (Moraine of Potash)			
Borax			
CAN			
Solara			
ZnSo ₄			
TSP			
Organic manure			
Any other(specify)			
Cost of Pesticides			
Roundup			
Dusburn			
Smoking			
Any other(specify)			

5.) Total gross income from avocado in the last season.....KES

SECTION D: MARKETING CHANNELS AND MARKET FACTORS

6.) Please fill the relevant information.

D1. Buyer	1=broker 2=marketing groups 3=local traders 4= direct to market 5= any other (please specify)
D2. Price offered by the buyer per piece/kg	1..... 2... 3..... 4 5.....

D3. Payment period in days	1..... 2..... 3..... 4..... 5.....
D4. Waiting time for fruit collection	1..... 2..... 3..... 4..... 5.....
D4. Packaging	1=boxes 2=90 kg bags 3 any other(please specify)
D5. Reasons for choosing the buyers	1.....2.....3.....4.....5..... 1= better price 2= reliable (will always purchase) 3= accessible 4= Only channel available 5= pay on spot 6= Give bonus 7 avoid being stolen 8=preferred buyer delay buying fruits
D6. Mode of payment	1= bank 2=cash 3 others specify
D7. Requirements of the buyer	1.....2.....3.....4.....5..... 1= quality 2= sizes 3= spraying regime 4= group member 5= variety 6= others
D10. Quantity not able to sell	.....pieces/kgs

Access to Market Information

7.) Do you access market information? Yes () No ()

8.) What are your means of accessing market information (please indicate with a tick)

Means	Response
Radio	
Extension officers	
Neighbors	
Buyer	
Ministry of Agriculture	
Newspapers	
Phone	
Any other (please specify)	

Distance to market

9.) What are the means of transport that you use to transport avocados to the market?

Means of transport Code 1= bicycle 2= motorbike 3= pickup 4= lorry 5 =Human porters	Cost of transport per unit	Distance to market in Km

SECTION E: INSTITUTIONAL FACTORS

Information on farmer's access to extension officers

10.) Are you visited by extension officers in your area?

Yes () No ()

11.) If yes how many times are you visited in a year?

12.) What services have you received from them?

Codes: 1= Market demand information 2= Price information 3=Buyer location. 4= others specify

13. How many phone contacts for extension officers do you have?

14. What are the sources of the extension services in your area?

Codes 1= government 0= Non-government Organizations (NGOs)

15.) Please indicate the areas you have been trained by the extension officer.

Farm operations	Annual cost	Post-harvest operations	Annual cost
Fertilizer application		Picking	
Grafting avocado trees		Packing	
Pruning		Grading	
Manure application		Storage	
Spraying		Organic avocado production	
Record keeping			
Others			

Information on access to credit

16. Do you access credit **Yes () No ()** if yes pleas fill the table below

E1. Sources of credit	1=bank 2= SACCO 3= merry go round 4= the avocado buyer 6 others(specify)
E2. Amount of credit borrowed in KES	.....KES
E3. Purpose of credit	1= school fees 2= avocado farming 3= medical 4=Others (specify)
E4. Activities carried out with the loan	1= school fees 2= avocado farming 3= medical 4= others(specify)
E5. Constraints in obtaining credit	1= fear of default 2= high interest rate 3= lack of collateral 4= others (specify)

Road Infrastructure

17.) What is the type of the road from your homestead to nearest market place?

Type of road	
Tarmac road	

Marram	
Dry weather	

Thank you