

**ANALYSIS OF TRANSACTION COST AND TRANSACTOR  
CHARACTERISTIC EFFECT ON MARKET OUTLET CHOICE AND  
GROSS MARGINS AMONG IRISH POTATO FARMERS IN KINANGOP  
SUB-COUNTY, KENYA**

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Requirements for the Award of the Degree of Master of Science in Agricultural  
Economics of Chuka University**

**CHUKA UNIVERSITY**

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## DECLARATION AND RECOMMENDATION


### Declaration


This thesis is my original work and has not been submitted for the award of a diploma or conferment of a degree in this or any other institution.

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## **DEDICATION**

This thesis is dedicated to my parents, Joseph Kamau and Lucy Kamau, my sister Sophia Kamau and brothers Elijah Kamau and James Kamau.

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## ABSTRACT

Irish potato ranks second after maize as an important food crop in Kenya. It has the potential to enhance food security and alleviate poverty among smallholder farmers. Irish potato market outlet choice is among the key decisions in every household since it determines the profits attained by the households. About, 90% of smallholder Irish potato farmers in Kinangop sub-county sell their produce to brokers at the farm gate which result in low (12%) gross margins. On the other hand, brokers sell the produce purchased from farmers to various market outlets earning up to 26-50% profit. Farmer's profits are reduced by high transaction costs and transactor characteristics. This study therefore aimed at analyzing the transaction cost and transactor's characteristic effect on market outlet choice and gross margins among smallholder Irish potato farmers in Kinangop sub-county, Nyandarua County. The study employed descriptive research design to collect cross-sectional data from a population of 14,000 smallholder Irish potato farmers. A sample of 241 smallholder Irish potato farmers were selected using a cluster sampling technique. Data on the transactor's characteristics, transaction cost factors, market outlets, and gross margins was collected using a semi-structured questionnaire. A multivariate probit model determined the transaction cost and transactor's characteristics effect on market outlet choice. Gross margin analysis and quantile regression models were employed to analyze the effects of transaction costs on gross margin. The results showed that majority (92.95%) of Irish potato farmers sold their produce to brokers, 4.56% sold to local market, 2.01 to urban and 1.66% to contracts. Study showed that Irish potato farmers incur an average of Ksh. 8265.14 per acre as transaction cost and information search (50%) contributed to the highest cost. From the multivariate probit results, Age, land size, market distance and phone access were significant ( $p < 0.05$ ) and positive on sale of potatoes through brokers. However, information access was significant ( $p < 0.05$ ) and negative on sale of Irish potato to brokers. Information access ( $p < 0.05$ ) was significant and positive on sale of potato in the local markets. However, land size, market distance, gender and extension service access were significant ( $p < 0.05$ ) and negative on sale of potatoes in the local market. The sale of potatoes in the urban market was significant ( $p < 0.05$ ) and positive for age, information and phone access. Contract markets were significant ( $P < 0.05$ ) and positive for land size, credit access and main occupation but significant ( $P < 0.05$ ) and negative for age, information and phone access. Indirect and direct input transportation cost, indirect market information cost direct market bargaining costs were significant ( $p < 0.05$ ) and negative on the likelihood of selecting brokers. Indirect market transport costs significantly ( $p < 0.05$ ) and positively influenced the likelihood of selling through the brokers. The likelihood of choosing the local market was significant ( $p < 0.05$ ) and positively influenced by direct input transport and direct market bargaining costs. At the first regression (25%) and median (50%) quantile; indirect input transportation, indirect market bargaining, indirect contract marketing, direct contract search, direct market bargaining and direct contract marketing costs positively and significantly ( $P < 0.05$ ) influenced gross margins. At 75% quantile indirect input transport, indirect market bargaining, direct market bargaining and indirect market information search costs significantly ( $p < 0.05$ ) and positively influenced farmers' gross margins. Therefore, smallholder farmer's characteristics and transaction costs can determine smallholder farmer's market outlet decisions and profits. Therefore, the study recommends smallholder Irish potato farmers should be provided with adequate information and be encouraged to form active collective action groups to help in sharing information and collective marketing of Irish potato to minimize the transaction costs and maximize profits.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

<b>FAOSTAT</b>	Food and Agriculture Organization Statistics
<b>IDR</b>	Indonesian Rupiah
<b>KBS</b>	Kenya Bureau of Standards
<b>MC</b>	Market Contract
<b>MFRC</b>	Modern Food Retail Chain
<b>MIS</b>	Market Information System
<b>MNL</b>	Multinomial Logit
<b>MVP</b>	Multivariate Probit
<b>NACOSTI</b>	National Commission of Science, Technology, and Innovations
<b>NPCK</b>	National Potato Council of Kenya
<b>OLS</b>	Ordinary Least Squares
<b>PPMC</b>	Pearson Product-Moment Correlation
<b>PSM</b>	Propensity Score Matching
<b>SDGs</b>	Sustainable Development Goals
<b>SUR</b>	Seemingly Unrelated Regression model
<b>TC</b>	Transaction Cost
<b>TCE</b>	Transaction Cost Economics
<b>TZS</b>	Tanzanian Shillings

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background to the Study**

Irish potato is ranked the third most essential food crop globally after wheat and rice, consumed by over 1.3 billion persons globally (Jo *et al.*, 2022). The crop is a cultivated tuber domesticated in the Central Andes area near Lake Titicaca approximately 8000 years ago (Aksoy *et al.*, 2021). The crop's shorter maturity time (less than 120 days) and high productivity per unit area, makes Irish potato a global food security crop (Degebasa, 2019). The estimated world potato production stands at 359,071,403 metric tons, which shows an increase of about 1.2 percent from 2019 (FAOSTAT, 2022). China, Ukraine, and India are the leading producers worldwide, contributing 14.3%, 12%, and 5.8% of Irish potato produced, respectively (Awogbemi *et al.*, 2022). Increased production in China is attributed to cheap labor costs, low taxes, and minimal regulatory compliance (Mburu *et al.*, 2020). Algeria leads in production in Africa, with 4,928,028 metric tons, and Kenya, with 2,192,885 metric tons, is ranked sixth (FAOSTAT, 2022).

Global consumption of Irish potato attained its maximum in 2017 when 248,366,000 metric tons were consumed, with an annual average growth of 1.44% since 1962, which recorded the lowest consumption of 106,356,000 metric tons (FAOSTAT, 2022). Belarus has the largest per capita consumption of Irish potato globally, consuming 176 kilograms per person annually (Llorca-Jaña *et al.*, 2022). France and Netherlands are the largest Irish potato exporters, with an export share of USD 693 and 446 million, respectively (Prajapati *et al.*, 2022). Africa's Irish potato export has been growing over time. For instance, Egypt exported over 759,200 tons of ware potatoes valued at USD 259 million in 2018, ranking it the fifth largest exporter globally (Muthoni *et al.*, 2022). However, Kenya's Irish potato exports are negligible because those produced are consumed locally, where 90% of Irish potato farmers sell through brokers (Nyasulu, 2021).

The sale of Irish potatoes by farmers through intermediaries is attributed to; price uncertainties, long market distance, information asymmetry, bounded rationality, and asset specificity, which give rise to transaction costs (Bijman *et al.*, 2020; Nyasulu,

2021). Additionally, the smallholder farmer characteristics, including the farmer's experience, age, gender, and the extent of extension service access, and group membership influence the farmers' marketing decisions (Wakaba *et al.*, 2022; Abate *et al.*, 2019; Wosene *et al.*, 2018). Irish potato has the potential to enhance food security and alleviate poverty particularly among the smallholder farmers; however, Irish potato farmers in Kenya are still battling with brokers who have dominated the market, and shielding market information from farmers (Korir, 2018). Irish potato farmers are, thus, obliged to operate as price takers and with no direct communication with buyers (Bagchi *et al.*, 2022). Irish potato farmers spend money on transport when marketing their produce and procuring inputs like fertilizer. Transportation costs rise significantly due to inadequate roads to convey the products to the markets during the wet seasons (Kimutai, 2019).

Transaction cost economics (TCE) argues the basic unit of economic activity is a transaction, and transpires after a good, service or product is exchanged over a technically separate medium (DaSilva-Glasgow, 2020). Transaction costs significantly influence how much profits farmers accrue (Otekunrin *et al.*, 2019). Low transaction costs help maximize farmers profits from selling their produce at various market outlets (Sasongko *et al.*, 2021). Information search cost enables farmers to decide where to purchase their inputs and the market outlets to participate in or expand their production. Conversely, bargaining and negotiation costs help farmers and buyers to draw agreements that benefit both parties (Kumarathunga *et al.*, 2022). Enforcement and policing costs ensure individuals who engage in an agreement or a contract comply with the terms (Fauzin, 2021).

A farm's system effectiveness is assessed by the sum of production and transaction costs if the benefits are constant (Schmitt, 2021). Smallholder farmers face increased transaction costs in accessing output and input market channels, a vital problem resulting in lack of profits (Kurniawan *et al.*, 2021). Irish potato farms experience high transaction costs frequently because they have little information access and lack efficient potato markets which significantly reduce their profits (Sultan *et al.*, 2021). Most of the Irish potato farmers usually calculate the production costs of running their farm activities and do not consider transaction costs (Saidah *et al.*, 2019). The time

farmers spend in search of information to facilitate a transaction negatively influences their participation in the urban markets (Baraka *et al.*, 2021). The farmers incur high costs in terms of time and money to transport Irish potatoes to the market (Momanyi, 2021). Many farmers prefer selling their Irish potato at the farm gate, resulting in reduced profits (Nyasulu, 2021). Despite, transaction cost playing a vital role in the economy, it has various drawbacks in the agricultural sector since farmers make decisions subject to transaction cost constraints. Therefore, farmers' production and transaction costs must be analyzed concurrently.

Strategies employed by developing countries on poverty reduction are laid on strengthening agriculture productivity and integrating smallholder farmers in formal markets through promoting market access (Ume, 2023). Improved access to a high-value market provides production and specialization incentives among smallholder farmers. However, Irish potato smallholder farmers in Kenya struggle to obtain market access due to lack of market information, face barriers when venturing into high value markets or reduced benefits from entry (Mariyono, 2018). Farmers will compare the benefits of entry into a new market using gross margin analysis from the current market outlet. Gross margin is the difference between the total revenue derived from a particular market and the variable costs farmers incurred during production (Aliyi *et al.*, 2021). Gross margins will help smallholder farmers to assess their farming practice effectively and decide on efficient resource allocation, and select markets that will yield the highest returns (Rahman *et al.*, 2020).

In Nyandarua County, Irish potato is ranked second after dairy, Households near markets have adequate access to market information, which makes it easy to sell Irish potatoes (Wakaba *et al.*, 2022). However, farmers far away from the market face significant transaction costs which hinder them from participating in Irish potato marketing (Tura and Hamo, 2018). In Kinangop sub-county, brokers exploit Irish potato farmers and accrue high (29-50%) gross margins compared to 12% attained by the farmers (Kimutai, 2019). Farmer group membership, off-farm income, extension services, experience, input, and labor costs are some of the factors that affect profitability and market outlet choice (Mbembe, 2020; Fred *et al.*, 2019; Mwatawala *et al.*, 2020; Kebede *et al.*, 2017).

In Kinangop Sub-County, transaction costs were not considered among the factors that affected the choice of market outlet among smallholder Irish potato farmers. A gap also exists on how farmers' gross margins are affected by transaction costs in both output and input markets, and how these costs and some specific transactor characteristics such as; experience, market frequency, market information access, and trust, affect market outlet choice. This study was thus, aimed at quantifying the transaction costs incurred by Irish potato smallholder farmers in Kinangop sub-county and their effects and selected transactor's characteristics on farmers' choice of market outlet and gross margins.

### **1.2 Statement of the Problem**

Market outlet choice is among the key decisions in every farming household since it determines the profits accrued by individual households. However, farmers have little information access and lack efficient potato markets which significantly reduce their profits. Smallholder Irish potato farmers lack access to rewarding markets in the city, export markets, and institutions, which make them sell their potatoes to brokers. In Kinangop sub-county, about 90% of the smallholder Irish potato farmers sell their potato to brokers at the farm gate resulting to low profits of about 12%, compared to 29-50% attained by the brokers from the same produce. Smallholder Irish potato farmers are faced with increased transaction costs in accessing input and output market channels which significantly influence how much profits farmers accrue. Transaction costs also contribute to low input use among smallholder Irish potato farmers which result in low yields and poor returns. However, studies on the effect of transaction cost on market outlet choice and gross margins among smallholder Irish potato farmers in Kinangop Sub-county has received very little attention. Therefore, the current study aimed at investigating the effects of transaction costs and transactor's characteristics on market outlet choice and gross margins among smallholder Irish potato farmers in the Kinangop sub-county to enhance their incomes and food security.

### **1.3 The Main Objectives**

To analyze the contribution of transaction cost and transactors' characteristics on market outlet choice and gross margins among smallholder Irish potato farmers.

### **1.3.1 Specific Objectives**

- i. To quantify the transaction cost along different market outlets among smallholder Irish potato farmers in the Kinangop sub-county.
- ii. To determine the effects of the transactor's characteristics on the choice of market outlets among smallholder Irish potato farmers in Kinangop sub-county.
- iii. To determine the effects of transaction cost on the choice of market outlets among smallholder Irish potato farmers in Kinangop sub-county.
- iv. To determine the effects of transaction cost on gross margin among smallholder Irish potato farmers in Kinangop sub-county.

### **1.3.2 Research Questions**

- i. What quantity of transaction costs are incurred by smallholder Irish potato farmers along different market outlets in Kinangop sub-county?
- ii. How do transactor characteristics affect the choice of market outlets among smallholder Irish potato farmers in Kinangop sub-county?
- iii. How does transaction cost affect the choice of market outlets among smallholder Irish potato farmers in Kinangop sub-county?
- iv. How do transaction costs affect gross margins among smallholder Irish potato farmers in Kinangop sub-county?

### **1.4 Significance of the Study**

The study results provide a better understanding of the effects of transaction costs on Irish potato smallholder farmers' gross margins and market outlet choice. Smallholder Irish potato farmers will benefit from the study findings by helping them reduce transaction costs to maximize their profits. Agricultural policymakers will use the results of this study to establish relevant programs and policies to guide Irish potato marketing to help farmers maximize profits by minimizing transaction costs and accessing profitable markets. The study results if adopted by the government will contribute towards attaining 10% per annum economic growth under Kenya's Vision 2030 through Irish potato production, efficient input supply and marketing.

The study findings are also expected to contribute towards achieving SDG 1 on Zero hunger, SDG 2 on poverty reduction, and SDG 3 on good health and well-being; by

improving smallholder farmers' livelihoods. When Irish potato farmers' profits are maximized, and they have access to better production inputs and a market for their output, farmers will be motivated to produce more and will maximize Irish potato production. As a result of these increased Irish potato production, the national government's food security pillar under the big four agenda will be achieved. The study findings could be used to guide the Nyandarua County government in shielding Irish potato farmers from brokers who limit farmers from receiving high incomes, and market information and resulting in poverty cycles in the County. Academicians, extensionists and researchers will also benefit since the study will give insight into the contributions of transaction cost on gross margins and market outlet choices among farmers.

### **1.5 Scope of the Study**

The research was confined within Kinangop sub-county and concentrated on smallholder Irish potato producers. The study was conducted from April to May 2023, covering the 2022 production season. The research targeted 14,000 smallholder Irish potato producers in Kinangop sub-county. Smallholder farmers selected for the study had practised Irish potato farming for commercialization for at least two production seasons on land that is less than five acres. The elements of the study included the transaction costs; information search, bargaining, contractual, and transportation costs in output and input markets and the transactor's characteristics.

### **1.6 Assumptions**

The study assumed smallholder Irish potato farmers were aware of the transaction cost elements. The relevant transaction cost elements affecting Irish potato farmers' gross margins and market outlet choice were assumed to have been included in the study. The study assumed the time set aside per day for farm activities was used for all production and marketing activities. Furthermore, the study assumed the sampled farmers practised Irish potato production only. As a result, smallholder farmers used the working days in Irish potato production. The assumption was very necessary for calculating the opportunity cost of time.

### **1.7 Limitations**

The study was limited by the ability of some of the Irish potato smallholder farmers to recall past events to give accurate information concerning production and transaction costs due to inadequate record keeping. The farmers were given enough time to recall the information and given a chance to consult other family members.

## 1.8 Operationalization of Terms

- Contracting costs:** Money and opportunity cost of time smallholder Irish potato farmers incur while bargaining and negotiating for an agreement with Irish potato buyers.
- Direct transaction costs:** These are the money expended by Irish potato farmers while implementing an institutional arrangement including bargaining and negotiating, contracting, transporting and controlling Irish potato buyers.
- Indirect transaction cost:** These are the opportunity cost of time expended by Irish potato farmers while implementing an institutional arrangement including bargaining and negotiating, contracting, transporting and controlling Irish potato buyers.
- Small-holder Irish potato farmer:** A farmer who cultivates Irish potato for commercial purposes on land owned or leased and has a total land size of less than five acres.
- Transaction cost structure:** These constituted the elements that made up the total transaction cost. The study considered information search, negotiation, transportation, contraction, and transportation costs.
- Transaction cost:** These are the resources expended by Irish potato farmers while implementing an institutional arrangement, including the money and time spent negotiating, contracting, transporting and searching for Irish potato buyers.
- Transactor's characteristics:** These are selected social-economic and institutional characteristics among Irish potato smallholder farmers that are related to the transaction cost.

## CHAPTER TWO

### LITERATURE REVIEW

#### **2.1 Overview of Irish Potato Production**

Irish potato is an essential food crop in both developing and developed countries. The crop's production is significantly increasing in developing countries, where the ease of production and nutritional value has made the crop important to millions of farmers for food security and income generation (Ahmadu *et al.*, 2021). The world's Irish potato production is estimated to be 359,071,403 metric tonnes with China being the leading producer. Irish potato is an essential cash and staple food crop in China, where its production continues to increase, from 75,657,850 tons in 2019 to 78,236,596 tons in 2020 (FAOSTAT, 2022). Since the introduction of Irish potato in Africa in the late 19th century, its production has increased gradually, from 2,000,000 tons in the 1960s to 26,229,159 tons in 2020 (FAOSTAT, 2022). Irish potato production is common in African highlands, with most countries producing below their potential, due to inadequate high-quality seed and a lack of management practices (Akoto, 2021).

Algeria leads in Irish potato production in Africa with an estimated production of 4,928,028 tonnes, while Rwanda leads in Irish potato production in East Africa. Irish potato has received significant attention from the government of Rwanda due to realized potential of the crop under the crop intensification program (CIP) (Nilsson, 2019). Irish potato production in Rwanda is mainly through cooperatives. Rwanda produces over 19,000 tonnes monthly during the crop seasons (Nilsson, 2019). In Kenya, Irish potato follows maize as the most important food crop (Gikundi, 2021). The crop is grown twice a year, boosting Kenya's production by up to 1.5 million tons, in 161,000 hectares of land (Ogola and Ouko, 2021). Shangi variety is the most adapted, widely produced variety in Kenya due to its excellent yield and faster maturity (Thiele *et al.*, 2021).

Nyandarua County is the leading potato producer in Kenya, producing approximately 555,000 tonnes of the crop per year (Wakaba *et al.*, 2020). Kinangop sub-county Irish potato production faces challenges such as pests and diseases, lack of high-quality seed, poor storage and processing facilities (Chepkoech, 2022). Other challenges include, inadequate or lack of access to information on good quality seed, negotiation of better

input prices with suppliers, poor roads and infrastructure that result in higher transportation costs (Wakaba *et al.*, 2022). Brokers continue to exploit Irish potato farmers by shielding them from receiving market information (Nyasulu, 2021). Reduced transaction costs and enhanced market participation by Irish potato farmers may increase their motivation to produce more due to assured higher returns.

## **2.2 Concept of Transaction Cost and Market Outlets Choices**

The transaction cost approach is the foundation for logically analyzing market obstacles and participation (Cuypers, 2021). The approach contends that the markets can not be ideal if left uncontrolled because of several issues, including information asymmetry. To reduce uncertainty, opportunism, and risk, market actors incur transaction costs in terms of money and time when using price mechanisms (Baraka *et al.*, 2021). Transaction costs can broadly be categorized into four categories: information search, negotiation, monitoring, and enforcement (Dinku *et al.*, 2020). Transaction costs can be direct or indirect, ex-ante or ex-post, depending on when the cost is incurred in a transaction system (Ali *et al.*, 2018). Information searching, negotiating, and contractual agreements costs have been classified as ex-ante costs, while enforcement, monitoring, and compliance costs are considered ex-post (Ali *et al.*, 2018). Transaction costs can also be fixed or proportional (Otekunrin *et al.*, 2019).

Several studies have been carried out to provide a picture of the transaction cost structure in agriculture. For instance, the probit model measured transaction costs' effects on Indian farmers' profitability (Vishnu and Rai, 2022). Monitoring costs constituted the highest share (more than 54% share), followed by bargaining costs (more than 29% share) and Information costs (less than 17% share) for all the Modern Food Retail Chain (MFRC) farmers. The transaction costs incurred to re-enforce the contract included information search, design, conclusion, negotiating, and monitoring and enforcement costs. In India, contracted farmers had fewer transaction costs than independent farmers (Vishnu and Rai, 2022). In Indonesia's transaction cost-to-profit ratio was 2.78%, where information, negotiation, implementation, and coordination were incurred (Rachmadina *et al.*, 2021). However, transaction costs among soybeans farmers in Indonesia were low compared to chili farming, where soybean farmers participated in markets (Sultan *et al.*, 2021).

In Kenya, Baraka *et al.* (2021) surveyed the magnitude of transaction cost, market participation, and profitability in the vegetable supply chain profitability using Heckman's two-step model. Information search, negotiation, and monitoring costs were among the transaction expenses incurred by vegetable producers when selling produce in urban markets. In Kinangop Sub-county, information on the various transaction cost incurred by smallholder Irish potato farmers is not documented, hence, this study sought to identify and quantify the various transaction costs incurred along different markets outlets in Kinangop Sub-county to help smallholder Irish potato farmers maximize on their profits and incomes to alleviate poverty.

Market outlet selection is an individual household decision, and several aspects must be considered when making such a choice (Tarekegn *et al.*, 2017). Farmers select different market outlets depending on various constraints on individual households, like prices and transportation costs. According to Tarekegn *et al.* (2017), market outlet selection is an important farming household decision when marketing farm products and significantly influences farmers' returns. Irish potato marketing in Kenya involves farmers (producers), brokers, wholesalers, transporters, retailers, processors, and consumers as players in the value chain (Nyasulu, 2021).

In Kenya, farm gates, local markets, brokers, farm-group and institutions such as schools and hospitals are among the market outlets where farmers sold their Irish potatoes (Momanyi, 2021). Studies by Nyasulu (2021) on the influence of the choice of market outlet and group rules on collective marketing participation among small-scale potato farmers in the Molo sub-county in Kenya, reported that most farmers sell their potatoes through brokers at the farm gate (90%), and the remaining 10% were sold at local and urban markets. Conversely, a study by Kirui, (2017) on the participation of farmers in value-added activities in Arror ward, in Elgeiyo Marakwet County, reported that most farmers sold their potatoes directly to consumers (41%), wholesalers (32%), at the farm gate (15%), to consumer-supported agriculture (10%), and 2% to restaurants and hotels.

In Nyandarua County, various market outlets choices by farmers include market centres, farm gates, other farmers, and neighbours (Wakaba *et al.*, 2022). However,

Scollard *et al.* (2022) reported major market outlets used by Irish potato smallholder farmers in Nyandarua County to include; the intermediaries who collected Irish potato at the farm gate and the retailers to whom they sold directly. In Kinangop Sub-county, information on the market outlets utilized by smallholder Irish potato farmers is limited. Hence, this study sought to find out the markets outlets utilized by smallholder Irish potato farmers in Kinangop Sub-county to help them maximize their profits and incomes.

## **2.3 Effects of Transactor Characteristics on Market Outlet Choice**

### **2.3.1 Education Level, Experience, and Land Size**

Education is quantified by the number of years the farmer attended formal education. It can affect the market outlet choice in that the more years of education, the greater knowledge on the various market outlets because the farmer is quite informed. Multinomial regression utilized by Nxumalo *et al.* (2019) to assess market channel choice determinants among sunflower farmers, education level positively and significantly affected market outlet choice among smallholder maize farmers in South Africa (Nxumalo *et al.*, 2019). These findings agreed with Oppong-Kyeremeh *et al.* (2022) results on a contract farming strategy to expand the poultry marketing sector in Ghana. The propensity score matching (PSM) revealed education level influenced farmer's choice of contract farming as a market outlet. Mohammed Kassaw *et al.* (2019) Multivariate probit model revealed education status influenced the probability of potato farmers choosing between whole-sellers, retailers, collectors, and consumer market outlets in Ethiopia. Similarly, Education level significantly influenced the choice of market outlet among avocado farmers when the Multinomial logit (MNL) model was employed to study determinants of market outlet choice among smallholder farmers in Kenya (Njuguna *et al.*, 2022).

Farmer experience is the ability of the farmer to estimate costs, returns, and net profit on a farm and involves managerial principles of input and output to production (Ainembabazi and Mugisha, 2014). Analysis by Hung Anh and Bokelmann (2019) on market preference determinants among coffee farmers using the Seemingly unrelated regression (SUR) model showed farming experience had a significant positive effect on the choice of market preference in Vietnam. Experience in marketing had a negative

and significant influence on dairy farmers' choice to sell to dairy cooperatives when a binary probit model was employed to study the factors influencing market outlet choice among dairy farmers in Thailand (Jitmun and Kuwornu, 2019). These findings agreed with Ntow *et al.* (2023), that farming experience positively influenced the choice of market outlet among rice farmers in Ghana. In Ethiopia, the Multivariate probit (MVP) model revealed farming experience in garlic farming significantly affected the retailer's selection of a market outlet (Chekol and Mazengia, 2022). Ng'ang'a *et al.* (2022) using Multivariate probit model (MVP) model found farming experience in bean production to have positive and significant effects on market outlet choice in Kenya.

The size of land affects market outlet choice because of the quantity and quality of the produce and the available inputs. Studies by Dessie *et al.* (2018) on aspects that affect the market outlet choice among wheat farmers in Ethiopia found that land significantly influenced market outlet decisions, and those by Vu *et al.* (2018) using a multinomial logit model in Thai Nguyen in Vietnam revealed that land size significantly influenced farmers' decisions in selecting market outlets. The results of the Multivariate probit model revealed that farm size significantly influenced the choice of retailers and assemblers at a 5% significant level. In Ethiopia, Multivariate probit model revealed that land significantly influenced smallholder coffee farmers' decision to sell their produce through processors and wholesalers negatively (Alemayehu and Alemu, 2022). Magogo *et al.* (2015) found land to significantly influence the choice of market outlet positively among agropastoral farmers in Kenya when a multinomial logistic model was employed to examine the market outlet choice determinants among indigenous vegetables farmers in Kajiado and Narok counties in Kenya.

### **2.3.2 Transaction Frequency and Distance to the Market**

Transaction frequency is the repeat of a comparable transaction and is a factor in transaction costs (Li and Fang, 2022). Studies by Ayari and Boulila (2022) on the calculative self-interest and emotional roles on trust perception along the value chain of dairy in Tunisia reported transaction frequency to influence market choice due to increased transaction costs. Nyamamba *et al.* (2022) studied side-selling behaviours along the sorghum supply chain using a fractional response model revealed the frequency of contact between farmers and side buyers affected marketing outlet

selection in Kenya. Jebesa (2019) assessment of market distance as a proxy of transaction cost, influencing market participation found that the longer the distance was, the more the farmers were discouraged from participating in the markets and hence they preferred other alternatives.

Studies by Amfo *et al.* (2022) which employed Multivariate probit model and Propensity score matching to examine marketing outlets, rice commercialization, and the well-being of Ghana rural farmers reported that distance to the district capital reduced market participation. Kangile *et al.* (2020) using a multinomial logit model to survey the determinants for staple food commodities among farmers in Tanzania reported that market distance had a significant effect on market outlet choice. Long travel distances and poor road conditions increased transaction expenses; therefore, farmers sold their products at low prices at farm gates, limiting their returns (Mulbah *et al.*, 2021). Kurgat *et al.* (2023) employing the Multinomial logit model among dairy smallholder farmers found that distance to the market influenced milk marketing outlet choices significantly in Kenya.

### **2.3.3 Information and Phone Access**

Market Information is an electronic document or paper located on the trading platform which sets out the commercial details for each market. It is critical in decision-making as it influences market participation (Nyein *et al.*, 2018). Access to market information reduces transaction costs incurred in transportation, search for buyers and negotiation for prices, thus enhancing farmers' participation in the market (Vroegindewey *et al.*, 2021). Studies by Nyein *et al.* (2018) employing Heckman two-stage selection model on a sample of 150 rice farmers stated that factors that limit the farmers' participation in the market included market information in central Myanmar. Moreover, institutional sellers had fewer losses due to access to market information and they sold at higher prices when compared to other farmers, as information cost was halved (Seifert *et al.*, 2021).

A multivariate Logit model revealed factors influencing access to the local market to include logistics and price information in China (Zhu *et al.*, 2022). A binary probit model employed by Uduji *et al.* (2019) showed that the e-wallet initiative on mobile

phones had significantly increased farm entrepreneurship in rural Nigeria. In improving farmers' knowledge, information, and use of better agriculture inputs, increased mobile phone services encouraged rural informal sector economic activity (Uduji *et al.*, 2019). These clearly show that market information and phone access influence market outlet choice significantly. In Kinangop sub-county, a gap exists in the cost of obtaining market information. Therefore, the current study sought to determine the cost of market information among smallholder Irish potato farmers in the Kinangop sub-county.

#### **2.3.4 Extension Service, Group Membership, and Trust**

Agricultural extension is a formal organization with authorized structural activities to ensure farmers continuously have access to agricultural information (Khalid & Sherzad, 2019). Numerous studies have been conducted to portray the influence of extension services and farmers' groups on market outlet choice. A farmer organization's membership positively impacts the amount of produce sold in the market through social networks that help farmers obtain information and lower fixed transaction costs. Additionally, extension services enhance farmers' understanding of farming techniques and offer information about the crop market, thus improving profits (Kyaw *et al.*, 2018).

A farmer belonging to a group can easily get information from other farmers or through seminars organized by groups than it would be individually. Abdulai *et al.* (2018) stated that farmers belonging to farmer groups were more likely to use more cultivation techniques and have positive peer impact and the chance to learn excellent habits from peers. Farmer groups reduce the cost of information for improved market timings, hints, and access to technology. By giving smallholders access to agricultural inputs, credit facilities, post-harvest agricultural logistics like transportation services, and a platform for pooling their produce, farmer-producer organizations have the potential to increase smallholders' market reach, strengthen their bargaining power, hence achieving higher standards in food safety (Verma *et al.*, 2019).

Results of the first hurdle model in a study to determine market participation among 381 smallholder farmers in southwest Ethiopia revealed that membership in a cooperative and access to extension service are among the factors that determined market participation among smallholder maize producers (Haile, 2022). A survey by

Aku *et al.* (2018) on the effects of market access provided by farmer organizations on smallholder vegetable farmers' income in Tanzania using a sample of 250 smallholder vegetable farmers, results of propensity score matching revealed that farmers in groups incur fewer information search costs than those not within a farm group or organization hence easy market access. A survey by Mbembe, (2020) on the determinants of market participation by smallholder soybean farmers using the triple hurdle model employed on 148 farmers in Kenya revealed that the probability of not selling at the farm gates was influenced by the education level of the farmer, belonging to a farmer group, extension service access, price of soybeans, and the quality and quantity produced.

Trust is a firm belief in the reliability, truth, or ability of someone or something. A study by Jebesa (2019) revealed trust is among the factors that smallholder farmers consider before choosing a market outlet to sell their produce to buyers. Connelly *et al.* (2018) stated that integrity-based trust impacts different transaction costs. By lowering transaction costs, trust will increase efficiency ten times. A survey by Jebesa (2019) on factors that determine market outlet choice and participation among farmers in Ethiopia, revealed that trust was important in market outlet choice and influenced market participation.

In other studies, trust in buyers among honey producers in Ethiopia influenced market outlet choice (Tarekegn *et al.*, 2017). A study by Bannor (2021) examined commercialization influence on market outlet choice among smallholder poultry farmers in Kenya and trust and safety were among the factors that controlled market outlet choice. In Kinangop Sub-county, information on transactor's characteristics influencing the market outlets choices by smallholder Irish potato farmers is unavailable or not documented, hence, the current study sought to find out the transactor's characteristics affecting market outlet choices among smallholder Irish potato farmers in the Sub-county.

## **2.4 The Effects of Transaction Costs on Farmer's Choice of Market Outlet**

### **2.4.1 Information search costs**

Information search costs are the time and money farmers spend to find buyers and exchange with them (Rafoneke, 2020). Information access is relevant to farmers since

it enables them to decide which market outlet to choose. When the costs of looking for information are high and farmers need access to information, they will be limited in the markets they can select (Dinku *et al.*, 2020). Several studies have found that information access and the costs of searching for information affect market outlet choice. Studies by Fan and Salas Garcia (2018) on market participation information access among smallholder farmers in Peru using the triple-hurdle model revealed a direct and positive influence of internet and phone use on market outlet participation in different markets outlets among farmers.

Other studies by Nyein *et al.* (2018) using Heckman's two-stage model on the determinants of market participation decisions among smallholder rice farmers in Myanmar agricultural markets found the cost of market information significantly influences market outlet access. Findings by Dinku *et al.* (2020) on the choice of beef marketing outlets among smallholder cattle farmers in Ethiopia, revealed that the probability of market participation depended on transaction cost. A survey by Dinku *et al.* (2020) employing multinomial logit model stated that the decision to sell at the farm gate, village, and secondary markets relied on information and mistrust about buyers. Baraka *et al.* (2021) reported high transaction costs for producers who sold to the urban market directly compared to those who used intermediaries using Heckman's two-step model. However, studies by Karing'u (2020) using the same model reported the costs incurred in searching for Information negatively affected export market participation probability.

#### **2.4.2 Negotiation and Bargaining Costs**

Negotiation costs are the costs incurred by farmers involved in discussions with buyers to resolve product price differences up to a point when both parties agree (Mutayoba and Ngaruko, 2018). On the other hand, bargaining costs are the costs required to come to an acceptable agreement with the other party to the transaction, drawing up an appropriate contract and so on. Negotiation costs help farmers influence buyers' prices (Sasongko *et al.*, 2021). However, farmers with low bargaining power receive low prices (Sasongko *et al.*, 2021). High negotiation costs limit market participation among smallholder farmers. A study by Hung Anh and Bokelmann (2019) who used

Seemingly unrelated regression model found that negotiation costs incurred with buying agents negatively influenced farmers' preference for buying agents in Vietnam. A survey conducted in Lesotho by Rafoneke (2020) found that negotiation, grading and sorting negatively affected participation in market outlets. A study by Lee *et al.* (2020) on market information influence on market participation and bargaining power using pooled regression model among coffee smallholder farmers in Ethiopia revealed a difference in sales volume among the farmers belonging to the market information system (MIS) and the non-members. Maina *et al.* (2015) reported negotiation time to significantly influence the market outlet choice using multinomial logit model in Kenya.

### **2.4.3 Contractual and Monitoring Costs**

A contract is an arrangement between multiple individuals that establish legally binding or otherwise recognized obligations (Skotnica *et al.*, 2020). Contracts enhance market participation through market information provision and outlet for farmers to sell their produce Thindisa and Urban (2018). A study by Thindisa and Urban (2018) on Thindisa and Urban (2018) examined the market access and social capital factors affecting small-scale farmers participating in agro-processing reported contractual transaction costs resulting in farmers foregoing their participation in the formal agreements. Otekunrin *et al.* (2019) employing Heckman two-step model revealed that contract enforcement and monitoring costs influence the likelihood of farmers participating in markets, especially when sales are made on credit in Nigeria. Abdul-Rahaman and Abdulai (2020) using the multinomial logit model reported farmers within a formal or informal contract have a significant reduction in market transactions and an increase in sales.

Meemken, (2020) stated that time spent by farmers on post-harvest agreements with buyers had a significant effect on smallholder farmer participation in the market. Jebesa (2019) reported monitoring, negotiation, and information costs to significantly impact on the market outlet decision among smallholder banana farmers in Ethiopia. A survey by Gramzow *et al.* (2018) comparing vegetable producer groups and contract farming market arrangements in Tanzania found most smallholder farmer groups that practiced quality control to have increased monitoring costs which in the long run influenced the market outlet choice.

#### **2.4.4 Transportation Costs**

Transportation is essential in agriculture as it connects the farms and the markets. The time spent on transportation and the costs involved are very significant to farmers as it is the only way to sell their produce to the markets (Koome, 2017). When transportation costs are high, farmers are limited in accessing different markets to sell their produce (Koome, 2017). A survey by Levi *et al.* (2020) on the effects of unified markets in agriculture on farmers' profitability and prices using the difference-in-difference model revealed that farmers' lack of transportation and storage capacity influences smallholder farmers' market participation. Hung Anh and Bokelmann (2019) using the unrelated regression model revealed that transportation costs negatively influenced smallholder coffee farmer's access to different market outlets in Vietnam.

A study by Antia-Obong *et al.* (2021) using Craggy's double-hurdle model transaction cost effects on poultry smallholder farmers' market access in Nigeria reported that increased distance to the market and shorter tarred roads increased transportation costs and time spent to reach the marketplace, which affected the probability of participating in markets. Other studies on the efficiency of potato markets, on-farm value addition, and access to the market using Ordinary least squares (OLS) was examined by Kyomugisha *et al.* (2018). The study revealed that expenses incurred in potato transportation were attributed to the high cost of value addition which limited smallholder farmers' access to the market. Analysis by Keru (2021) on the choice of market outlet determinants and profitability among smallholder coffee growers using a regression model in Kenya, reported that ownership of means of transport increases the chances of selling at the market outlet as this may reduce transportation costs.

In kinagop sub-county, smallholder farmers who are a distance from the market face difficulties when selling their produce to the markets due to the poor roads associated in the area which increases the farmers transportation costs (Omenge, 2023) . The poor roads also extends the time taken by the farmers to reach the markets. All these studies show transaction costs significantly influence farmers' choice of market outlets. There is no information or documentation in Kinangop Sub-county on how transaction costs have affected the market outlet. Hence, the current study was intended to fill these gaps

and document how smallholder Irish potato farmers' market outlet choice decisions are affected by transaction costs in Kinangop Sub-county.

## **2.5 Transaction Costs Effects on Farmer's Gross Margins**

### **2.5.1 Information Search Cost**

The objective of every farmer is always to maximize profits (Zeman and Rodriguez, 2019). However, farmer profit maximization is always limited by several factors, including transaction costs (Rindfleisch, 2020). Studies by Kurniawan *et al.* (2021) revealed that transaction cost positively influences profitability. Most studies show that transaction cost adversely affects profits, resulting in diminished profits. Chen (2022) stated that profits and supplies fall when there is an increase in information search costs. A simultaneous equation was utilized by Sultan *et al.*, 2021) to analyze transaction cost influence on profits and capital formation among soybeans farmers in Lamongan East Java. The study revealed transaction expenses incurred when participating in the soybean market influenced profitability. Information search was the major transaction cost affecting profitability (Sultan *et al.*, 2021).

A survey by Zhang *et al.* (2021) using the Propensity score matching (PSM) model to determine if information technology and the internet help maximize farmers' profits among apple farmers in China, found that the costs incurred in information search significantly increased the efficiency of selecting the sales channel and these increased farmers' income by around 40%. A study by Saidah *et al.* (2019) using multiple regression and transaction cost analysis on the transaction cost structure and transaction cost effects on profits and revenue, revealed that red Chili farmers incur 23.1 % of the total transaction cost as the information search costs, contributing to lower profits and income. Findings by Baraka *et al.* (2021) using Heckman's two-step model revealed information search costs for the rural-urban vegetable supply chain market by farmers and traders influenced farmers' profits in Kenya.

### **2.5.2 Negotiation and Bargaining Costs**

Negotiation is an important aspect of the market governing process since it determines the price and percentage of profit farmers earn while participating in the market (KC and Jamir, 2018). Farmers incur negotiation costs when they try to agree with the buyers

to carry out a transaction (Ba *et al.*, 2019). Negotiation skills increase the price received by farmers for their produce from buyers (Soullier *et al.*, 2018). However, when negotiation costs are high, farmers may forego participating in the market, which results in low profits (Ba *et al.*, 2019). Quantitative analysis by Antia-Obong (2021) revealed that selling at farm gate involved high negotiation and bargaining by buyers, which negatively affects the profits.

A study by Courtois and Subervie's (2015) to assess farmers' MIS and bargaining power in Ghana, revealed that farmers who were beneficiaries of MIS had higher prices for their maize and groundnuts (about 12.7 and 9.7 %), respectively. The prices and profits were higher than for those farmers who didn't take risks of incurring the MIS costs but choose to bargain with buyers independently. Saidah *et al.* (2019) using multiple regression models and transaction costs analysis methods reported that negotiation costs affected profits and revenue negatively, as high negotiation costs reduced profits among chili farmers in Indonesia. In Kenya, Maina *et al.* (2015) study on transaction cost effects on income and market outlet choice using the multinomial logit model found that farmers' bargaining power increased their income due to reduced transaction costs.

### **2.5.3 Contractual and Monitoring Costs Effects on Farmers' Gross Margin**

Contract farming is one of the emerging issues and an essential governance structure within value chains in the agriculture sector (Dong *et al.*, 2020). Contracts assist farmers in lowering transaction expenses and increasing their income (Minot, 2018). However, the contract participation among the farmers is not cost-free, as farmers may incur a cost to be contracted or spend their time monitoring the contractor's activities (Murray *et al.*, 2021). Monitoring costs are the expenses incurred by farmers while overseeing and ensuring compliance with conditions and agreements with the buyers and contractors. Several studies have been done to portray the importance of contracts, the associated costs, and their influence on the farmer's profitability. Studies by Vishnu and Rai (2022) using the Probit model to analyze the transaction costs effects on farmers' profitability in India, reported that Market contract (MC) farmers realized higher profits (Rs 40,403) than independent farmers (Rs 34,288) per acre of chilli.

These findings show that contractual costs significantly influence farmers' profitability positively.

Contractual agreements and their effects on tobacco smallholder farmers as assessed by Shaba *et al.* (2017) using the transaction cost analysis methods revealed a difference between the non-contracted and contracted farmers in income, mainly attributed to the monitoring costs during sales at the auction. A survey by Mugwagwa *et al.* (2019) reported that monitoring contract compliance costs among farmers reduced transaction costs and increased profits in Malawi. Bijman *et al.* (2020) using the transaction cost approach to study contract farming typology arrangements among contracted farmers in Zimbabwe reported monitoring costs to significantly affect farmers' profits. Kyomugisha *et al.* (2018) using a regression model to analyze potential market efficiency and profitability determinants within potato market chains in Uganda found that farmers selling directly to the buyers experienced the highest levels of efficiency. However, the duration of contracts and market distance influenced farmers' profitability.

#### **2.5.4 Transportation Costs**

Studies by Quintana *et al.* (2021) employing ordinary least squares to study logistics effects on marketing margins in the Philippines, transportation costs, negatively affected farmers' profits. Wudad *et al.* (2021) using a multiple regression model to analyze the effect of improved road networks on vegetable marketing and income among farmers in Ethiopia revealed that poor road conditions resulted in high transportation costs which affected farmers' income. A study on transport networks' effects on farmers' returns by Olagunju, (2022) in Nigeria using Pearson product-moment correlation (PPMC) revealed that farmers faced high transportation costs that greatly affected the income generated.

The evaluation of the effects of value addition on income and profit margins among sweet potato farmers in Kenya, by Oluoch (2016) using multiple regression models and profit margin analysis found that transportation costs and training access affected farm income significantly among sweet potato farmers. Additionally, profit margins were lower for longer distribution channels than the shorter ones along the value chain. These

findings indicate that transaction costs influence profitability among farmers. However, despite the transaction costs negatively influencing profits among smallholder farmers, transportation costs and information search costs may positively influence farmers' profits. In Kinangop Sub-county, there is limited or lack of adequate information and documentation on how smallholder Irish potato farmers' profits are affected by these transaction costs. Additionally, a gap also exists in modelling farmers' profitability. For the current study, a quantile regression was used to model the effects of transaction costs on farmers' profitability.

## **2.6 Theoretical Framework**

### **2.6.1 Transaction Cost Theory**

The optimal organizational structure, according to transaction cost theory, facilitates economic efficiency while minimizing trade costs (Williamson, 1986). The main concept portrayed in the theory is that smallholder Irish potato farmers would forgo market involvement if transaction costs are considerably high, which is why resource-poor farmers cannot access markets. According to Williamson (1986), transaction costs are distinct from the cost of production. As a consequence, a farmer can compare transaction expenditures to internal production expenses before deciding whether to employ a firm structure or consider sourcing at the market. Irish potato farmers incur transaction costs in terms of money and time (Rindfleisch, 2020). Because most transaction costs are invisible, the concept of opportunity cost captures them.

Therefore, realizing or calculating the transaction costs necessitates abilities that most smallholder farmers lack (Ismail *et al.*, 2015). The described transaction costs include bargaining, negotiation, and searching for a trading partner, mainly when there is information asymmetry and enforcing supervision and contracts, especially when sales are made on credit. Furthermore, the costs are related to the costs of exchanging Irish potato, like transportation costs, intermediary fees, and time spent getting Irish potato to the market. The theory describes two assumptions regarding Irish potato farmer behaviour; opportunism and bounded rationality. The two assumptions are barriers to market outlet access, primarily among Irish potato smallholder farmers in rural areas far from marketplaces.

Transaction cost theory is faced with weaknesses including bounded rationality, non-variability, opportunism, transaction specific investments and assumes a common knowledge of payoffs (Grossman and Hart, 1983). Large quantities of transaction costs can partially or totally block smallholder Irish potato farmers from exchanging their produce to the most preferred market outlets hence preventing a Pareto optimum allocation of resources in an economy where maximum profitability cannot be obtained. These will allow markets to clear but not at the Pareto optimal level as the smallholder farmers will be worse off especially when selling through the brokers (Hart and Moore, 1990). Estimation of transaction costs among the smallholder Irish potato farmers is faced with difficulties as the transaction costs can be unobserved. For that case, the study captured both the indirect and the direct transaction costs among the smallholder farmers.

### 2.6.2 Maximum Utility Theory

In the study, five options of marketing outlets; brokers, local markets, urban markets, contracts, and the farmer groups were considered as the market outlet choice options. The farmers can make the decisions to maximize their utility, subject to transaction costs and farmer's specific characteristics constraints. As such, the utility-maximizing function was specified as in equation (1).

$$Max U = U (C_k, Rf_k, Rv_k, RU_k, RG_k, T_C) \dots\dots\dots (1)$$

where; Max U represents the utility derived from Irish potato production,  $C_k$  is Irish potato consumed by the household,  $Rf_k$  is revenue received from selling Irish potatoes at the farm gates,  $Rv_k$ ,  $RU_k$  and  $RG_k$  are the revenue from participating in the local, urban, contracts, and farm groups.  $T_C$  are transaction cost factors that shift the farmer's function from the maximum utility function. From the above function, it is evident that farmers make production, consumption, and marketing decisions considering transaction cost constraints. As a result, if the associated costs from selling to a market outlet are more than the utility derived from it, the farmers will forego participating in the outlet to maximize their utility. The quantity of Irish potato sold and consumed by a household should not exceed the amount produced.

$$k \leq C_k, f_k, v_k, U_k, G_k \dots\dots\dots (2)$$

Where;  $k$  is the total Irish potato produced and  $C_k, f_k, v_k, U_K, G_K$  are Irish potato consumed by the farming household or sold at various market outlets. Therefore, farmers' decisions to sell at a particular market outlet signifies the direction which maximizes utility, where they do so when the net advantage is larger than the result of not participating. The choice made by farmers to sell their products via a particular market outlet is taken into account within profit maximization (Song *et al.*, 2018). The function is specified in equation (3).

$$\pi = p_y \cdot y - w_x \cdot x = p_y \cdot y - \sum_{i=1}^m w_{x_i} - X_i \dots \dots \dots (3)$$

Therefore, profit maximizing market outlet is that which maximizes the profits in the farmer's outlet of choice i.e.,  $X^* > 0 \Rightarrow \pi = (P_y, w_x, X^*) > \pi = P_y, w_x, X$ .

Where;  $\pi$ = Profit,  $P_y$ =Price of produce,  $y$ = produce,  $w_x$ = price of input,  $x$ = input.

### 2.7 Conceptual Framework

The market outlet choice is essential in decision-making in every farming household, as farmers aim to maximize their utility. Input and output market transaction costs may affect smallholder Irish potato farmers' choice of market outlet and profits in line with government policies. The direct transaction costs were money value farmers incurred to exchange Irish potato in various market outlets and the indirect costs were the time the farmers spend to exchange their produce in the market. The government policies including the tax policies and government regulations can affect the relationships between the market outlets choice decisions, farmers's gross margins, transaction costs and the farmers characteristics. Furthermore, the farmer's selected characteristics, including education level, age, household size, occupation, land size, experience, transaction frequency, market information access, extension service and farmer group membership, may influence market outlet decisions as illustrated in figure 1. Proper management of transaction cost factors will increase profits among smallholder Irish potato farmers, raising motivation to produce due to better returns.

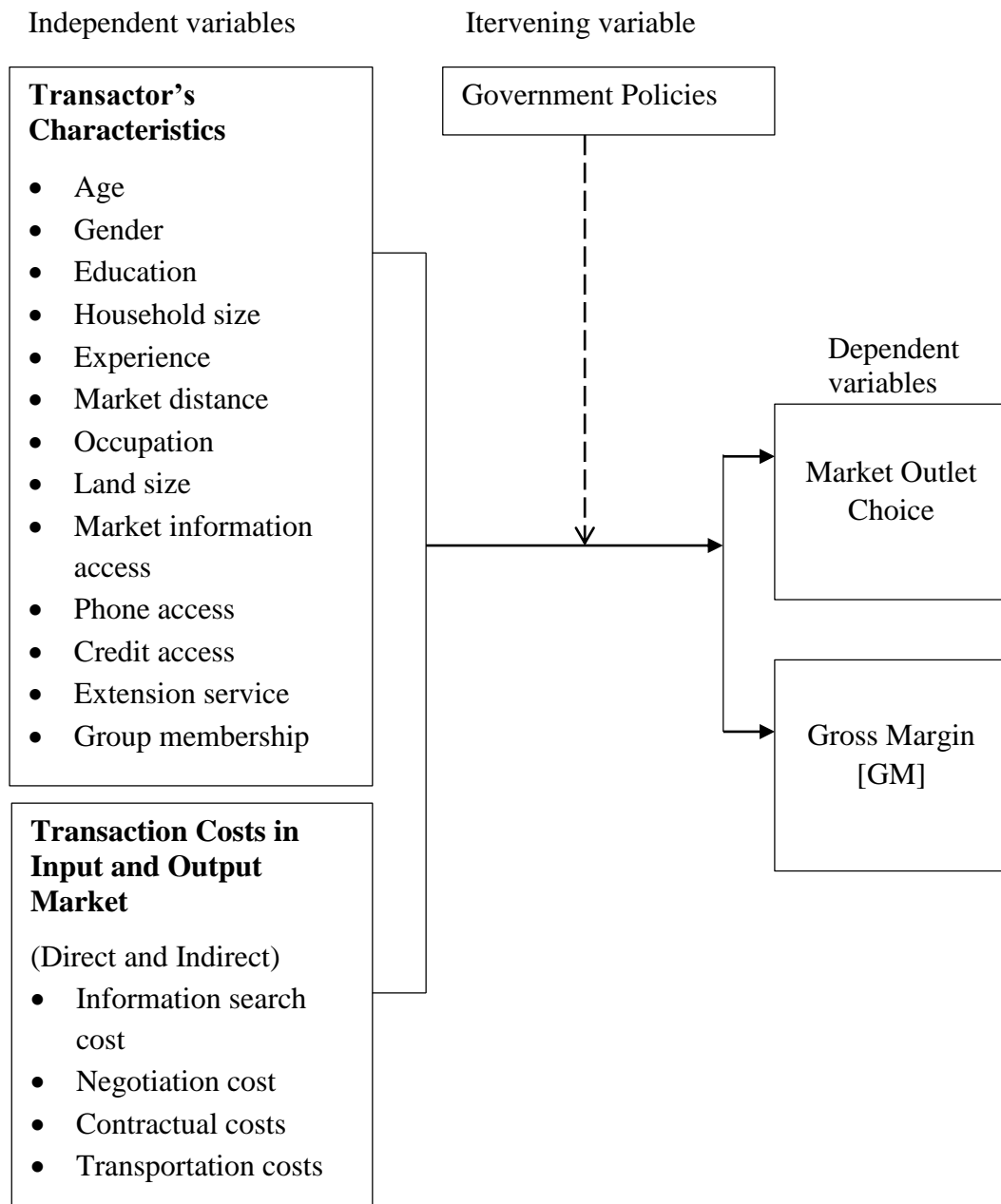


Figure 1: Conceptual Framework

Source: Author's conceptualization

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Study Area**

The research was carried out in Nyandarua County, Kinangop sub-county (figure 2). The sub-county was selected because it is the leading in Irish potato production in Nyandarua County. Nyandarua County, has five sub-counties; Kinangop, Ol’Joro Orok, Ol’karau, Ndaragua, and Kipipiri. Kinangop sub-county borders Kipipiri sub-county to the north, Nyeri and Murang’a Counties to the east, Kiambu County to the south, and Nakuru County to the west. The sub-county has eight wards; North Kinangop, Nyakio, Njabini, Murungaru, Magumu, Githabai, Gathara and Engineer. The sub-county lies between 0<sup>0</sup> 32’ North and 0<sup>0</sup> 50’ South, 36<sup>0</sup> 25’ East and 36<sup>0</sup> 42’ West, at elevations of 2667.11m above sea level and covers an area of 822 km<sup>2</sup>. The sub-county has a population of 193,379 people and a population density of 235 persons per km<sup>2</sup>. The mean annual temperature is 19.65<sup>0</sup>C, annual rainfall which is bimodal received range between 700 -1,700mm, with long rains starting from March to May and short rains from September to December. The primary soils are luvisols, planosols, andisols, and phaezems, and Irish potato is the major crop in the sub-county.

#### **3.2 Research Design**

A descriptive research design was employed for the study. The design allowed data collection from many respondents at one point (Wang and Cheng, 2020). The design enabled the description of smallholder Irish potato farmers’ characteristics, the transaction costs incurred and how transaction cost affects their profits, and the type of market they assessed. The design provided varied data gathering and offered comprehensive information. that necessitated use of quantitative and qualitative data (Al Hariri *et al.*, 2016).

#### **3.3 Target Population**

The study targeted 14,000 smallholder Irish potato farmers in Kinangop sub-county. The target population encompassed smallholder farmers who practiced Irish potato farming on land less than 5 acres. The selected farmers had practised Irish potato farming for more than two growing seasons.

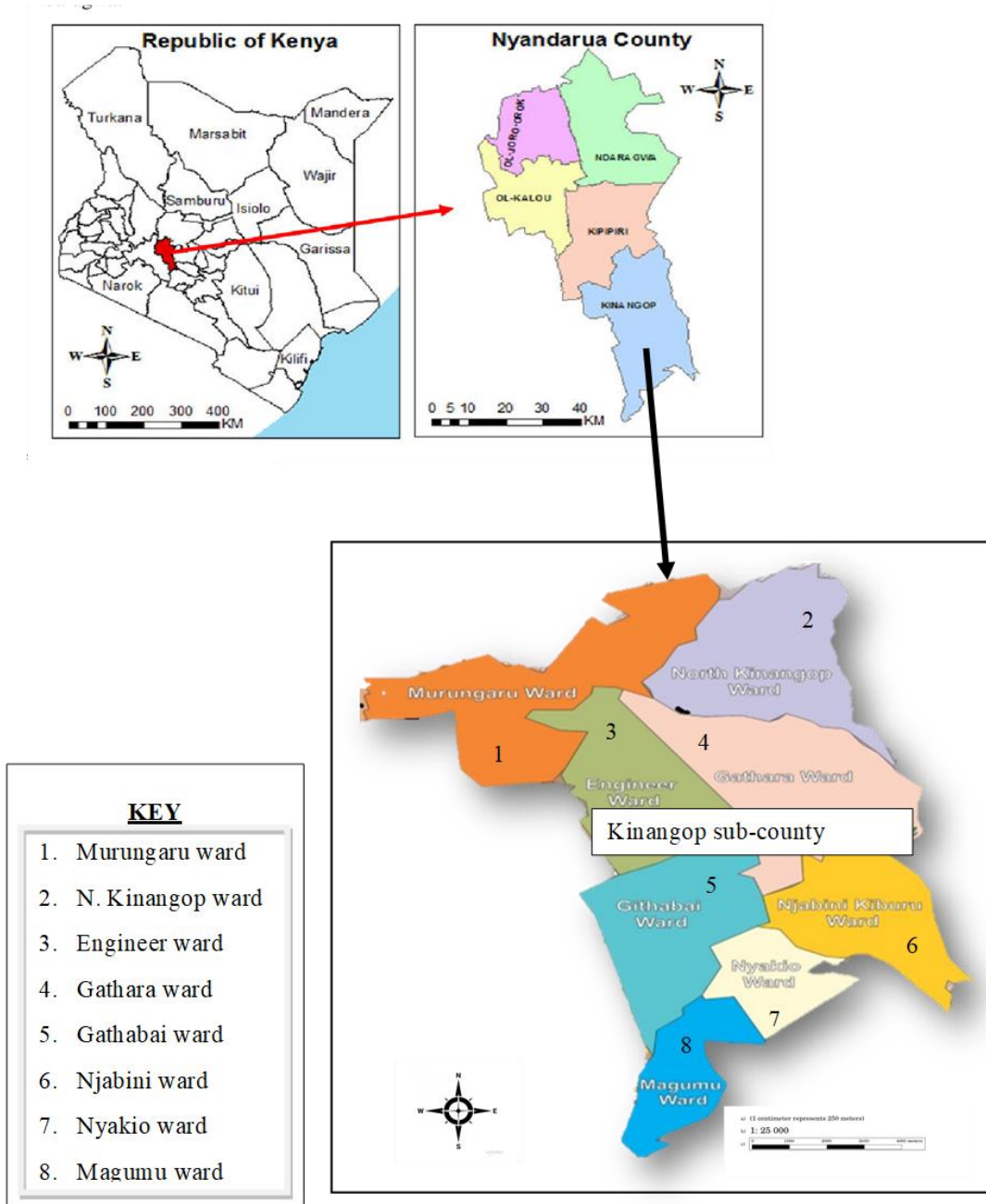


Figure 2: The map of Kinangop sub-county

Source: Geocurrents (2023)<sup>9</sup>

### 3.4 Sample Size Determination and Sampling Procedure

#### 3.4.1 Sample Size Determination

The sample size was determined using Kothari's (2004) sampling formula, as specified below;

$$n = \frac{Z^2 \cdot p \cdot q \cdot N}{e^2(N-1) + Z^2 \cdot p \cdot q} \dots \dots \dots (4)$$

where;  $n$  is the required sample size,  $p$ - population of interest proportion (0.8),  $q = (1 - p)$ ,  $N$ - population size,  $e$ - margin error, and  $Z$ -is 1.96 at the desired confidence interval (95%). The acceptance error was assumed to be within  $\pm 5\%$  population mean range with a probability of 95%. Therefore, the sample size was given by;

$$n = \frac{1.96^2 * 0.8 * 0.2 * 14,000}{0.05^2 (14,000 - 1) + 1.96^2 * 0.8 * 0.2} = 241 \text{ Smallholder Irish potato farmers..... (5)}$$

### 3.4.2 Sampling Procedure

The study employed a cluster sampling technique to select the sample size. Irish potato farmers in Kinangop sub-county were clustered into eight clusters based on the eight wards in the sub-county. A list of smallholder Irish potato farmers was obtained with the help of agricultural extension officers, and 241 smallholder Irish potato farmers were randomly selected from each ward (cluster). The proportion of Irish potato farmers sampled in each ward was calculated using equation (6) and distributed as shown in Table 1.

$$\text{Respondents per ward} = \frac{\text{Population in the ward}}{\text{Total population in the sub-county}} \times \text{sample size..... (6)}$$

### 3.5 Research Tool

A semi-structured questionnaire was employed for data collection (Appendix II). The tool was organized into sub-sections that included; household identification, characteristics of the farmers (education, age, household size, occupation, land size, information access, phone access, trust, experience, market distance, transaction frequency, extension service, and farmer group membership), market outlet access, transaction cost (Information search, negotiation, and bargaining, contractual and transportation costs) and Gross margin information.

### 3.6 Pilot Study

The piloting of the questionnaire was carried out in Kipipiri sub-county. The sub-county was selected because it borders the study area, and the area has almost similar conditions to those of Kinangop sub-county. Furthermore, farmers in Kipipiri sub-county had identical characteristics to those of the farmers in the study area. Ten percentile of the sample size (25 persons) were administered with questionnaires for piloting.

Table 1: Irish potato farmers' sample size distribution

Wards	Population in the ward	Sample size distribution
Magumu	25,638	32
North Kinangop	20,898	26
Engineer	26,977	34
Gathara	26,656	33
Githabai	19,485	25
Njabini	20,665	26
Nyakio	25,140	31
Murungaru	26,920	34
Total		241

Source: KHPC (2019) and Author's sampling design

### 3.6.1 Validity

The study employed a critical approach of content validation where academic supervisors and experts in Irish potato and agricultural economics, the Ministry of Agriculture extension officers, judged the instrument's validity. A scale of 1 (irrelevant) to 4 (extremely relevant) was used in a content validity index (Connelly, 2022). Only the contents that rated 3 or 4 were included in the questionnaire. The items that did not meet the critical values were revised or eliminated.

### 3.6.2 Reliability

Testing for reliability was relevant to check consistency throughout the questionnaire. Cronbach Alpha coefficient was employed for the instrument reliability test using George and Mallery's (2003) rule of thumb; if  $\alpha > 0.9$  is excellent,  $0.9 > \alpha > 0.8$  is good,  $0.8 > \alpha > 0.7$  is acceptable,  $\alpha = 0.6$  is questionable,  $\alpha = 0.5$  is poor, and less than 0.5 is not acceptable. The alpha coefficient was found to be 0.850 at 95% confidence level (Table 2), which is greater than 0.7; therefore, the instrument was considered reliable for the study.

Table 2: Cronbach alpha reliability test results

Variable	Value
Average interitem covariance	0.170
Number of items in the scale	33
Scale reliability coefficient	0.850

Source: Authors' results from field data (2023)

### 3.7 Data Collection

A semi-structured questionnaire (Appendix 2) was used to obtain primary data from smallholder Irish potato farmers via face-to-face interviews. Data was collected to identify the households, farmers' characteristics, transaction costs incurred and their costs, the market they participated, and information on gross margin elements.

### 3.8 Data Analysis

The collected data was analyzed using Stata version 17. Transaction cost analysis and descriptive statistics were employed to characterize smallholder Irish potato farmers' characteristics and transaction costs incurred. Central tendencies such as mean, mode, and frequencies were employed to draw inferences.

#### 3.8.1 Empirical Analysis and Model Specification

##### 3.8.1.1 To quantify the transaction cost incurred along different market outlets among smallholder Irish potato farmers in Kinangop sub-county

Transaction costs cannot be computed directly but must be approximated using several methods, with each transaction cost component experienced by farm households sometimes being different (Key *et al.*, 2000). Irish potato farmers faced implicit and explicit transaction costs, which were analyzed by computing total transaction costs. The total transaction cost per household was then calculated as per equation (7).

$$TrC = \sum z_i \dots\dots\dots (7)$$

where;  $TrC$  is the Total transaction cost,  $Z_i$  are the costs in the  $i$ th transactions. Total transaction costs were then divided into direct and indirect transaction costs. Monetary terms (KES) were used to directly value direct transaction costs incurred by the individual households to participate in different market outlets. Indirect transaction costs were expressed in terms of the opportunity cost of time as a product of Irish potato farmers' profits earned per hour multiplied by the time spent per hour in a season searching for information, contracting, bargaining, and monitoring contracts in both the input and the output market (Baraka *et al.*, 2021).

### 3.8.1.2 To determine the effect of transaction-cost and transactors characteristics on market outlet choice among smallholder Irish potato farmers in Kinangop sub-county

There was more than one market outlet for Irish potatoes where the farmers sold their produce (Wakaba *et al.*, 2022). The farmers could only decide on one market outlet or select a combination of outlets to maximize their utility, resulting in overlapping. Several studies have employed a multinomial logit model on farmers' market outlet choice (Abasimel, 2020; Dlamini and Huang, 2020; Arumugam *et al.*, 2022). However, failure to include unobserved elements and cross-relationship among market outlet choices has resulted in inefficient and biased estimates (Honja *et al.*, 2017).

The multivariate probit (MVP) model accounted for potential correlation in selecting possible market outlets and was considered the best model to fit the study at 5% significant level. The model assumed each farmer had different binary responses (equation 8) and a covariate matrix (equation 11) which may be any continuous and discrete variables mixture (Mihiretu *et al.*, 2019). The MVP model is an expansion of the bivariate probit model (Honja *et al.*, 2017) and jointly approximates various correlated binary dependent variables as specified in equation (8)

$$Y_{ij} = \beta_j x_{ij} + \varepsilon_{ij} \dots \dots \dots (8)$$

where;  $Y_{ij}$  ( $j = 1 \dots K$ ) represented the latent unobserved variable of the chosen market outlets by  $i^{th}$  farmer ( $i = 1 \dots n$ ).  $k =$  Farmgate, local market, urban market, and contract markets outlets.  $x_{ij} = 1 * k$  variables' vector affecting market outlet choice.  $\beta_j = k * 1$  parameters' vectors to be determined.  $\varepsilon_{ij}$  ( $j = 1, \dots, z$ ) are normally distributed error terms with a variance-covariance matrix  $V$  and a mean of zero. Matrix  $V$  has one value on the leading diagonal and the correlated market outlets (Honja *et al.*, 2017). The choice of market outlet  $i$  that farmer  $j$  can maximize utility is  $Y_{ij}$ , defined as  $i(Y_{ij} = 1)$  or otherwise ( $Y_{ij} = 0$ ) is defined by the equation;

$$Y_{ij} = \begin{cases} 1 & \text{if } Y_{ij} = x_{ij}\alpha_{ij} + \varepsilon \geq 0 \Leftrightarrow x_{ij} \geq -\varepsilon \\ 0 & \text{if } Y_{ij} = X_{ij}\alpha_{ij} + \varepsilon < 0 \Leftrightarrow X_{ij} < -\varepsilon \end{cases} \dots \dots \dots (9)$$

Since the market outlet choice by smallholder farmers is assumed to be affected by identical independent variables, the econometrics model was a system of equations (10)

$$\begin{cases} Y_1^* = x_1\beta_1 + \varepsilon_1 & Y_1 = 1 \text{ if } Y_1^* \text{ is } > 0, Y_1^* = 0 \text{ otherwise} \\ Y_2^* = x_2\beta_2 + \varepsilon_2 & Y_2 = 1 \text{ if } Y_2^* \text{ is } > 0, Y_2^* = 0 \text{ otherwise} \\ Y_3^* = x_3\beta_3 + \varepsilon_3 & Y_3 = 1 \text{ if } Y_3^* \text{ is } > 0, Y_3^* = 0 \text{ otherwise} \\ Y_4^* = x_4\beta_4 + \varepsilon_4 & Y_4 = 1 \text{ if } Y_4^* \text{ is } > 0, Y_4^* = 0 \text{ otherwise} \end{cases} \dots\dots\dots (10)$$

where;  $Y_{1-4}^*$  are farmgate, local, urban, and contract market outlets,  $\beta_4^1$ - estimated parameters and  $\varepsilon$  are normally distributed error terms. Since it was possible for Irish potato farmers to select two or more market outlets simultaneously, the  $\varepsilon$  will have an MVN (multivariate normal distribution) with a conditional mean of 0 (zero) and 1 (one) as the variance. Taking  $\rho_{ij}$  to represent market outlets correlation, the symmetrical covariance matrix was estimated as follows;

$$\begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{pmatrix} \dots \Omega \left\{ \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \begin{pmatrix} 1 & \rho_{12} & \rho_{13} & \rho_{14} \\ \rho_{21} & 1 & \rho_{23} & \rho_{24} \\ \rho_{31} & \rho_{32} & 1 & \rho_{34} \\ \rho_{41} & \rho_{42} & \rho_{43} & 1 \end{pmatrix} \right\} \dots\dots\dots (11)$$

Table 3: Measurements of transactors’ characteristics variables used in the MVP

Variable	Description	Variable measurement	Expected sign	
<b>Independent Variables</b>				
$x_1$	Age	Age	Continuous (Years)	+/-
$x_2$	EdLe	Education level	Continuous (years)	+
$x_3$	Hsize	Household size	Count	+
$x_4$	Exp	Experience	Continuous (years)	+
$x_5$	Occ	Occupation	Dummy (0= Agriculture, 1= Others)	+/-
$x_6$	Lsize	Land size	Count (acres)	+/-
$x_7$	Mrkd	distance	Count (km)	-
$x_8$	Gen	Gender	Count (0= Male, 1= Otherwise)	-/+
$x_9$	Inacc	Information	Dummy (0= Yes, 1= Otherwise)	+
$x_{10}$	Phnacc	Phone access	Dummy (0= Yes, 1= Otherwise)	+/-
$x_{11}$	Cred	Credit access	Dummy (0= Yes, 1= Otherwise)	+/-
$x_{12}$	Extserv	Extension	Dummy (0= Yes, 1= Otherwise)	+
$x_{13}$	Fgroup	Farmer group	Dummy (0= Yes, 1= Otherwise)	+

Source: Authors’ compilation from literature reviewed

Table 4: Measurements of transaction cost variables used in the MVP model

Variable	Variable Description	measurement	Expected sign
Profit levels	Dependent variable	Continuous	
Independent Variables			
$x_1$	Dinfo Direct information search cost	Continuous (KES)	+/-
$x_2$	InInfo Indirect information search cost	Continuous (Hrs.)	+/-
$x_3$	Dbarg Direct bargaining cost	Continuous (KES)	+/-
$x_4$	Inbarg Indirect bargaining cost	Continuous (Hrs.)	+/-
$x_5$	Dcont Direct contractual cost	Continuous (KES)	+/-
$x_6$	Incont Indirect contractual costs	Continuous (Hrs.)	+/-
$x_7$	Dtrans Direct transport cost	Continuous (KES)	+/-
$x_8$	Intrans Indirect transport cost	Continuous (Hrs.)	+/-
$x_9$	Dinfo Direct information search cost	Continuous (KES)	+/-
$x_{10}$	InInfo Indirect information search cost	Continuous (Hrs.)	+/-
$x_{11}$	Dbarg Direct bargaining cost	Continuous (KES)	+/-
$x_{12}$	Inbarg Indirect bargaining cost	Continuous (Hrs.)	+/-
$x_{13}$	Dcont Direct Contractual cost	Continuous (KES)	+/-
$x_{14}$	Incont Indirect contractual costs	Continuous (Hrs.)	+/-
$x_{15}$	Dtrans Direct transport cost	Continuous (KES)	+/-
$x_{16}$	Intrans Indirect transport cost	Continuous (Hrs.)	+/-

Source: Authors' compilation from literature reviewed

### 3.8.1.3 To examine transaction cost effects on gross margin among smallholder Irish potato farmers in Kinangop sub-county

Gross margin (GM) analysis was used to determine a farmer's profitability (Sulumbe *et al.*, 2010; Erbaugh *et al.*, 2010). It entailed calculating the difference between the farm's gross income and the total variable cost (TVC) a farmer spends (equation 15). The gross margin analysis assessed the GM gained per crop season by smallholder Irish potato farmers in Kinangop sub-county who participated in different market Outlets (Kotir *et al.*, 2022).

$$GM_j = GI_j - TVC_j \dots \dots \dots (12)$$

where;  $GM_j$ ,  $GI_j$ , and  $TVC_j$  are Gross Margin, Gross Income, and Total Variable costs of the  $J^{th}$  household farm respectively. A high gross margin indicated efficiency in production and transaction cost management of the farmers when participating in the markets.

A quantile regression model was used utilized at 95% confidence level to model the transaction costs' effects on the GM. The gross margin attained from equation (12) was divided into three Quantiles based on the individual households' gross margin percentiles, i.e., 0.25, 0.5, and 0.75. A quantile regression model was then specified as an extension of the OLS model, equation (13) (Steen *et al.*, 2020). Where  $\varepsilon_i$  is distributed normally with a mean of zero and one as a constant variance. The quantile regression model was selected as it provides various advantages over OLS models, including the fact that the estimated parameters were less sensitive to outliers (Johnson *et al.*, 2020).

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon_t \dots \dots \dots (13)$$

Where; Y is the dependent variable (GM)  $\beta_0 \beta_1 \dots \beta_n$  - coefficients were estimated,  $X_1^n$  - independent variables and  $\varepsilon_t$ - error term. Taking into account a random vector with chance  $F(y) = P(Y \leq y)$ , as given by Roger and Gilbert (1982),  $j^{th}$  quantile of Y was represented as;

$$Q_y(j) = \{\inf(y = F(y) \geq j)\} \dots \dots \dots (14)$$

Where  $j \in [0,1]$  represents the four different quantiles. Therefore, the regression coefficient will depend on the  $j$ . The conditional  $j^{th}$  quantile  $Q(\frac{j}{x})$  was the response variables' inverse conditional function. Thus, the quantile function from equation (13) was estimated as in equation (15).

$$Y_t = \alpha(j) + \beta(j)X_t + \varepsilon(j)_t \dots \dots \dots (15)$$

Where  $Y_t$  is GM,  $X_t$  are the independent variables,  $\alpha(j)$  and  $\beta(j)$  are regression coefficients and  $\varepsilon(j)_t$  is the error term. The conditional function of  $j^{th}$  quantile of Y was derived from maximizing problem (equation 16).

$$\text{Min} \sum_{t=1}^T (j - 1_{Y_t \leq \alpha + \beta X_t})(Y_t - (\alpha + \beta X_t)) \dots \dots \dots (16)$$

### 3.9 Ethical Considerations

The research obtained clearance from the Chuka university research ethics committee (Appendix III) and obtained a license from the National Commission of Science, Technology and Innovations (NACOSTI) to ensure the research met all requirements

before data collection (Appendix IV). Upon seeking the respondents' informed consent, an introductory letter that informed the farmers of the study's nature and objectives was provided to the respondents (Appendix I). The study upheld honesty, objectivity, and integrity throughout the survey and data reporting while avoiding biases. Furthermore, literature borrowed from previous studies was cited in the study appropriately. To prevent plagiarism, Turnitin's plagiarism checker was utilized to check the similarity index. Additionally, the study maintained due respect for the environment and the people.

Table 5: Measurements of transaction cost variables used in the Quantile regression model

Variable	Variable Description		Variable measurement	Expected sign
Profit levels	Dependent variable		Categorical	
Independent Variables				
$x_1$	Dinfo	Direct information search cost	Continuous (KES)	+/-
$x_2$	InInfo	Indirect information search cost	Continuous (Hrs.)	+/-
$x_3$	Dbarg	Direct bargaining cost	Continuous (KES)	+/-
$x_4$	Inbarg	Indirect bargaining cost	Continuous (Hrs.)	+/-
$x_5$	Dcont	Direct contractual cost	Continuous (KES)	+/-
$x_6$	Incont	Indirect contractual costs	Continuous (Hrs.)	+/-
$x_7$	Dtrans	Direct transport cost	Continuous (KES)	+/-
$x_8$	Intrans	Indirect transport cost	Continuous (Hrs.)	+/-
$x_9$	Dinfo	Direct information search cost	Continuous (KES)	+/-
$x_{10}$	InInfo	Indirect information search cost	Continuous (Hrs.)	+/-
$x_{11}$	Dbarg	Direct bargaining cost	Continuous (KES)	+/-
$x_{12}$	Inbarg	Indirect bargaining cost	Continuous (Hrs.)	+/-
$x_{13}$	Dcont	Direct Contractual cost	Continuous (KES)	+/-
$x_{14}$	Incont	Indirect contractual costs	Continuous (Hrs.)	+/-
$x_{15}$	Dtrans	Direct transport cost	Continuous (KES)	+/-
$x_{16}$	Intrans	Indirect transport cost	Continuous (Hrs.)	+/-

Source: Authors' compilation from literature reviewed

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Response rate

The sampled smallholder Irish potato farmers accepted to be interviewed after informed consent was attained from them. The response rate was in line with the Vergani *et al.* (2022) recommendation, which considers the response rate to be considered if it is above 80%. Therefore, in the current study, the response rate (100%) was adequate as shown in Table 6.

Table 6: Questionnaire response rate

Ward of the respondent	Frequency	Percent
Nyakio	31	12.86
Murungaro	32	13.28
North Kinangop	28	11.62
Engineer	31	12.86
Magumu	32	13.28
Njabini	26	10.79
Githabai	28	11.62
Gathara	33	13.69
Total	241	100

#### 4.2 Descriptive statistics for transactor's characteristics

##### 4.2.1 Gender

The majority of Irish potato-producing households were male-headed (62.24%), as illustrated in Table 7. These implied that the males were the major decision makers on Irish potato production in Kinangop sub-county. However, the findings are contrary to those of Wamuyu (2019), who reported majority (55.8%) of the decision makers among potato smallholder farmers in Kinangop sub-county are female. These results indicated that males are actively involved in agriculture production. The gender imbalance among Irish potato farmers in the study area could be attributed to African culture, where men are considered property owners and household decision-makers. Gender of the household could influenced market outlet choice decision as male headed households have better access to information, resources, easy mobility and better bargaining power compared to female headed household (Alvi *et al.*, 2021). These can help the male household heads to compare different market outlets prices, hence choosing the best market outlet.

Table 7: Household head gender

Gender of the household head	Frequency	Percent
Female	91	37.76
Male	150	62.24
Total	241	100

#### 4.2.2 Education level and years

The average years utilized by smallholder Irish potato farmers in Kinangop sub-county to acquire formal education was 10 years (Table 8). The low number of average years used in education implied that smallholder Irish potato farmers' level of education was not adequate, with the majority of them having only attained primary education (45.64%). These findings agreed with those of Kimutai (2019), who reported the majority of smallholder (54%) farmers having attained primary education. The findings revealed 5.81% and 2.9% of the farmers attained college and University education, respectively. These implied that the more the farmers were educated the less they engaged in agriculture activities and possibly they were involved in formal employment or business. These findings align with Rigg *et al.* (2020), who reported that young educated people in Asia left farming activities to engage in other activities, unlike the older generation, who lacked the education and qualifications to exit farming for other income-generating activities.

Table 8: Household head education level and number of years in formal education

Education level of the household head		Frequency	Percent		
No Education		4	1.66		
Primary		110	45.64		
Secondary		106	43.98		
Collage		14	5.81		
University		7	2.9		
Total		241	100		
Variable	Obs	Mean	Std. Dev.	min	Max
Education years	241	9.60	3.91	0	16

Education plays a key role in input combinations and market outlet choice decisions as the more learned farmers can be aware of the existing market outlets, have better access to market information due to technology exposure and information on risk managements. Majority of educated farmers can weigh the gross margins derived from alternative market outlets, therefore, choosing the best or a combination of market outlets that provide maximum utility. Anthony *et al.* (2021) reported more educated

farmers had better marketing skills, especially in urban areas which enhanced them to lower marketing transaction costs and become profit oriented.

#### 4.2.3 Age, Household size and Farming Experience

The findings indicated that the mean age of smallholder Irish potato farmers in the study area was 46 years (Table 8). These findings slightly differed from those of Karoga *et al.* (2022), who stated that smallholder farmers in Nyandarua County had a mean age of 52 years. Other studies by Mengui *et al.* (2019) reported that Irish potato farmers in Cameroon were relatively young, with a mean age of 34 years. These findings thus implied that most farmers in Kinangop sub-county were middle-aged adults in their prime phase of life. The findings also implied that young people in Kinangop preferred formal work as opposed to agricultural production. Younger farmers could be capable and willing to transport their produce to distant markets where they could reap higher profits due to their physical ability, whereas older farmers could prefer convenient and available markets which are not labour-intensive (Mashaphu, 2021). Generally, younger and educated farmers could be having better networking and possess better information access concerning consumer demand, market prices and trends. These could help them identify and utilize rising market opportunities.

The household size of smallholder Irish potato farmers in Kinangop sub-county had a mean of five people. The number of individuals per household ranged from 1 to 15 persons (Table 9). Studies by Mwangi (2022) reported similar results where the average household size in Kinangop sub-county was found to be 5 members. The household size of the rural family is essential, especially regarding labour supply for agriculture production. Labour is critical in Irish potato production, especially during planting, weeding, and harvesting. Therefore, a household with more family members could be saving money on hiring labour and directing the resources to other activities hence improving farm productivity.

Table 9: Household head age, Household size, and farming experience

Variable	Observation	Mean	Std. Dev.	Min	Max
Household head age	241	46.21	2.28	20	86
Household size	241	5.13	2.32	1	15
Farming experience	241	13.91	10.64	1	50

Improved productivity enhances the farmers' market access through reducing barriers to entry hence the farmers can choose the markets that can maximize their returns (Ruml and Qaim 2020). Smallholder Irish potato farmers in Kinangop sub-county mean farming experience was 13 years with the least experienced having 1 year and the most experienced 50 years (Table 9). These findings imply that Irish potato smallholder farmers in Kinangop sub-county had a high experience in Irish potato production. Hence the farmers were in a very good position of making sound decisions regarding the input sourcing and the market outlets for their potato produce. Findings by Wakaba *et al.* (2022), reported a higher experience (19 years) among Irish potato farmers in Nyandarua County.

The experience recorded by Irish potato farmers in Kinangop sub-county could be attributed to the high level of school dropouts at primary and secondary levels. As a result these farmers begin potato production at early age from their parents' land. The more experienced farmers could be aware of the alternative markets, and how to reach them to sell their produce over the years. The experience facilitates knowledge of various costs and benefits derived from different market outlets. Hence, the more experienced farmers can choose the market outlet that yields the highest returns and minimize the marketing costs.

#### **4.2.4 Main Occupation**

Majority (76.76 %) of smallholder Irish potato farmers in Kinangop sub-county spent most of their time practicing agriculture (Table 10). These imply that agriculture is the main economic activity creating employment for most farmers in Kinangop sub-county. The average hours spent by smallholder Irish potato farmers on agriculture which was the main occupation was 6 hours per day (Table 10). These findings agree with those of Gitau (2020), who reported agriculture drives the economy of Kinangop sub-county. The occupation of the farmer could influence the market outlet choice decisions as the farmers who entirely depend on agriculture could be determined to select a market that will maximize their returns. Meemken and Bellemare (2020) reported farmers depending on agriculture as their main source of income are likely to choose contract farming to stabilize their incomes.

Table 10: Household head's main occupation and Hours spent on Agricultural activities

Household head main occupation	Frequency		Percent		
Agriculture	185		76.76		
Government employed	14		5.81		
Self-employed	36		14.94		
Retired	2		0.83		
Casual laborer	4		1.66		
Total	241		100		
Variable	Obs	Mean	Std. Dev.	Min	Max
Hours spent on agriculture	241	6.16	1.39	3	10

#### 4.2.5 Access to Phone

More than half (85.89%) of the smallholder Irish potato farmers had access to mobile phones. However, only a small percentage (22.4%) used the internet to search for information on Irish potato production and marketing (Table 11). These findings concur with those of Andati *et al.* (2022), that most (93.4%) of potato farmers in Kenya had access to phones. The low percentage use of phones to search for information on Irish potato implies low access to production and digital market information by smallholder Irish potato farmers in Kinangop sub-county. Access to phones can facilitate smallholder farmers having access to a high value market by facilitating market research, accessing market information and communication between buyers and farmers (Parlasca *et al.*, 2020). Therefore, farmers can make informed decisions from the information received on the best market outlets to sell their produce and maximize returns.

Table 11: Access to and use of a phone for agriculture activities

Access to phone	Frequency	Percent
Accessed phone	34	14.11
Did not access	207	85.89
Total	241	100
Internet use for agricultural activities	Frequency	Percent
Did not use	187	77.59
Used	54	22.41
Total	241	100

#### 4.2.6 Extension Services Access

In the study, majority (82.16%) of smallholder Irish potato farmers in Kinangop sub-county did not have access to extension services. However, 17.84% of farmers had access to extension services, at least twice on average in the previous 12 months before

the study (Table 12). These study findings differed with those of Karoga *et al.* (2022), who reported 36.3% of the farmers in Nyandarua County had accessed and most farmers (45.83%) did not access extension services. The low access to extension services may be attributed to insufficient information by the farmers on demand-driven extension and failure by the County government to sensitize the farmers on the existence and the functions of the devolved agriculture extension services.

Additionally, the low percentage of farmers not receiving agricultural extension services could be a result of reduced funding and county government investment in agriculture extension services and staff in the study area. Through the dissemination of relevant production and marketing information to the smallholder farmers, extension access can influence smallholder farmers' market outlet choices. Extension can provide awareness, market information, exposure to new market opportunities, and market-driven varieties. Raj and Hall (2020) reported smallholder farmers required training on keeping records and market outlet planning such as unit cost calculations, expenditure and income records. These empower farmers with technical know-how that helps them select the best rewarding markets for their produce. Therefore, farmers receiving extension services could be having the potential of participating in higher value markets.

Table 12: Extension service access and number of extension contacts

Access to extension service in the last 12 months		Frequency	Percent		
Accessed extension		198	82.16		
Did not access extension		43	17.84		
Total		241	100		
Variable	Observation	Mean	std. Dev.	Min	Max
Number of extension contacts	43	1.65	0.65	1	3

#### 4.2.7 Farmer Group membership and credit access

Majority (74.27%) of smallholder Irish potato farmers were not members of a farmer group, however, 25.73% belonged to a farmer group (Table 13). These findings indicated that most farmers in Kinangop did not embrace group marketing and they solely marketed their produce. Despite majority of farmers in the sub-county not belonging to any farmer groups, studies by Andati *et al.* (2022), reported that 40.89% of potato farmers in Nyandarua County were members of other social groups. These

implied that farmers make their decisions based on the utilities they derived from the option they are facing; therefore, most farmers could not have joined the farmer groups the disadvantages of these groups outweighed the gains derived from them. Group membership can impact smallholder farmer’s market outlet choice ability through the provision of market information among the group members, enhancing collective action through group marketing and therefore, increasing the bargaining power of the members. Additionally, producer groups improve market participation among farmers by eliminating market challenges and thus improving the farmers’ income (Mwambi *et al.*, 2020). Farmer group membership can also facilitate financial access to its members through provision of credits. These can facilitate selling their produce to the most preferred market outlet as the credit can be used in the marketing activities like transportation to markets.

Majority (82.16%) of smallholder farmers in the study area did not access credits. However, 17.84% of farmers accessed credits (Table 13). The findings slightly differed from that of Kimutai (2019) who reported majority (75.61%) of the farmers in Kinangop sub-county did not receive credit. The low credit access among smallholder Irish potato farmers in the study area could have resulted from credits being offered at a high interest rates and uncertainties about the returns they will receive from the crops. Therefore, the farmers could have shied off from the credits. Additionally, majority of smallholder farmers in the study area were not members of farmer groups that could have been otherwise a source of credit with low interest rates to farmers.

Table 13: Farmer group membership and credit access

Group membership	Frequency	Percent
Not a group member	179	74.27
Group member	62	25.73
Total	241	100
Credit access	Frequency	Percent
Accessed credit	198	82.16
Did not access credit	43	17.84
Total	241	100

#### 4.2.8 Land size

In the study area smallholder Irish potato farmers owned land ranging between 0.125 to 5 acres, with a mean of 1.36 acres. Farmers without land and those who required additional land to increase their production (35.27%), rented land at a cost. Therefore, the size of land under Irish potato production in the study area ranged from 0.125 to 5 acres, with a mean of 0.9 acres (Table 14). Studies by Vergani *et al.* (2022) found majority of smallholder Irish potato farmers in Tanzania allocate less than 1 acre of land for Irish potato production. Kamau (2019), reported smallholder Irish potato farmers in Molo sub-county, Kenya, allocated 2.94 acres for Irish potato production.

The average land rented in the study area was approximately 1 acre, with a minimum of 0.125 and a maximum of 3.25 acres. The results on land ownership in the study area indicated that most smallholder Irish potato farmers owned land, and land ownership was not a limitation to Irish potato production. Farmers owning large land sizes are more likely to produce more compared to farmers with small land sizes. Increased productivity is associated with enhanced market entry chances and helps farmers to overcome market barriers and increase market access (Ruml and Qaim 2020). Thus, smallholder farmers with large land sizes could choose the market outlet that maximizes their returns.

Table 14: Land size, land under Irish potato, and size of rented land

Variable	Observation	Mean	Std. Dev.	Min	Max
Land size owned	215	1.36	1.22	0.125	5
Rented land	85	0.98	0.77	0.125	3.25
Land size under Irish potato	241	0.90	0.81	0.125	5

#### 4.2.9 Distance to market

From the study findings, market distance differed depending on the outlet and the place where individual farmers preferred selling Irish potato. However, the nearest preferred market distance ranged from 0.5 to 60 km (Table 15). The average distance to the local market for those who preferred selling to the local markets was 5.64 km with a minimum of 1km and a maximum of 15 km. Furthermore, the study findings revealed farmers who sold to urban markets had to travel long distances from 20 to 50 km, with an average of 39.8 km (Table 15). Therefore, the market distance where smallholder

farmers sold their produce ranged from 1 to 50 km with a mean distance of 17 km (Table 15). However, Andati *et al.* (2022) stated the average distance from the farm to the main market among potato farmers in Kenya was 5.59 km. The long market distance to the urban markets may be a very key element of consideration among smallholder Irish potato farmers and therefore, it may necessitate the farmers choosing other market outlets which are closer to avoid extra transaction costs that may arise due to long distance. The long market distance was also characterized by poor roads that could result in high transportation costs if the farmers were to sell in the urban markets. Therefore, the distance to the market could influence market outlet choice as smallholder farmers could prefer selling to closer market outlets.

Table 15: Distance to the nearest, local, urban and selling market

Variable	Observations	Mean	Std. Dev.	Min	Max
Nearest market distance	241	28.07	16.77	0.5	60
Local market distance	11	5.64	4.59	1	15
Urban market distance	5	39.8	11.82	20	50
Selling market distance	15	17	18.26	1	50

#### 4.2.9 Market Information Access

Market information is among the key element that can facilitate informed decisions among smallholder farmers and, as a result, make a rational decision leading to higher gross margins. The study findings revealed that most (71.37%) smallholder Irish potato farmers, had no access to market information (Table 16). The findings by Krell *et al.* (2021), reported 23% of smallholder farmers in Central Kenya received information on selling and buying of agricultural products where majority of the farmers accessed the market information through mobile phones. The low access to market information by Irish potato farmers in the study area could be attributed to brokers' presence, who shielded market information not reach to the farmers. When farmers access market information like the prevailing prices, they can compare the benefits derived from each market outlet and choose a market outlet that will maximize their returns. Piabuo *et al.* (2020) reported market information access places farmers in a position where they can bargain better with buyers. These give them confidence to negotiate prices because they know the prevailing market conditions and rates which can improve their returns hence, they choose the market outlet that maximizes profits.

Table 16: Market information access

Market information access	Frequency	Percent
Did not access information	172	71.37
Accessed information	69	28.63
Total	241	100

### 4.3 Evaluation of Gross Margins and Market Outlet Choices among Irish Potato Farmers

#### 4.3.1 Gross Margin Analysis

Gross margin (GM) is the difference between total revenue (TR) and total variable costs (TVC) used in production. It is an easy and dependable technique for evaluating a farm's financial profitability (Akongo *et al.*, 2021). The gross margins were employed as proxy of profits among the smallholder Irish potato farmers in Kinangop sub-county. Total production costs among smallholder farmers in the study area composed of; land rent, seeds, land preparation, crop protection and nutrition, planting, weeding and harvesting costs (Table 17).

Majority (89.21%) of the smallholder Irish potato farmers in the study area owned land which they utilized for Irish potato production (Table 17). However, the farmers who did not own land, or could have required extra land for production rented land at a cost. The land rent cost, therefore, constituted smallholder farmers' production costs. The mean rent cost incurred by smallholder farmers for Irish potato production was Ksh. 14,758 per acre. The high cost of land to rent in the study area could have resulted from land being scarce and face increased demand for Irish potato production and other agriculture activities due to population pressure. Land cost can significantly influence smallholder farmers' gross margins by increasing the overall costs used by smallholder farmers in production. The overall cost of production could increase, resulting to low gross margins among smallholder farmers hence, farmers who own land could be having a higher gross margin than those who rent land.

Majority (80.50%) of the farmers in the study area utilized the second-generation seeds that they had produced in the previous production season. Therefore, most of the farmers did not incur the seed costs. The findings show that only 19.50% of smallholder farmers purchased the seeds for Irish potato production. The mean seed cost was

approximately Ksh. 35625.82 (Table 17). The high cost of seed could explain why the majority of the farmers preferred using previous harvests as seeds to reduce the production costs. The purchase of certified seeds can increase smallholder farmers' gross margins by increasing productivity per unit land. However, the high costs of certified seeds can result in farmers utilizing the second generation seeds for production. Wasilewska *et al.*, (2020) reported, certified seeds account for 42% of Irish potato production costs in Kenya.

The use of tractors and manually were the major methods of Irish potato land preparation in the study area. The findings show that majority (73.44%) of the farmers incurred land preparation costs. However, 26.56% of smallholder farmers did not incur land preparation costs. These could have been attributed to farmers utilizing family labour in land preparation to reduce production costs. The findings show that smallholder Irish potato farmers in the study area incur approximately Ksh. 4533.76 to prepare land. The findings revealed that 68.88% of smallholder farmers in the study area incurred planting costs. Planting Irish potato was labour intensive and required a lot of labour. Results revealed that farmers incurred on average Ksh. 2667.17 in planting Irish potato (Table 17). Family labour played a key role during Irish potato planting explaining why 31.12% of farmers did not incur planting costs. Further, to reduce production costs during planting, weeding and harvesting smallholder farmers engaged in merry-go-rounds with friends to reduce the production costs and maximize the profits.

Crop nutrition and protection costs included the costs incurred by smallholder Irish potato farmers when protecting the crops from pests, diseases and frost and boosting crop productivity. Smallholder Irish potato farmers utilized D.A.P during planting and C.A.N for top dressing. The findings show that 95.85% of smallholder farmers incurred the costs in crop nutrition and protection. The small percentage of farmers (4.15%) who did not incur the cost could be a result of farmers using owned crop nutrition sources like owned manure and could have lacked funds to purchase agrochemicals for crop protection. The findings showed that smallholder Irish potato farmers in the study area incurred Ksh. 23489.26 in crop protection and nutrition (Table 17). The high costs could have been attributed to high costs of crop nutrients sources for example fertilizer

costs that cost an average of Ksh. 6000-6500 per 50kg bag as majority of the farmers did not receive the government subsidized fertilizer. High manure costs resulted from farmers preferring manure from the Maasai lands; including Narok and Kajiado. Therefore, the high transportation cost raised the cost of the manure farmers purchase for production which could have had a significant impact on the farmers' gross margins. Weeding and harvesting costs were important practices during Irish potato production. The results show that majority of farmers incurred the weeding and harvesting costs (62% and 90.04% respectively). The findings showed that smallholder farmers incurred Ksh. 4523 and 5161.29 on average for weeding and harvesting respectively (Table 17). These can be attributed to weeding and harvesting stages being labour intensive and therefore the farmers supplemented the family labour with the hired labour at a cost. When the laour available is well minimized, smallholder farmers gross margins can be increased due to reduced production costs.

Table 17: Gross margin analysis per acre of Irish potato

Variable (Ksh)	Obs	Mean	Std. Dev.	Min	Max
Land rent cost	85	14758.82	5364.46	6000	25000
Total seed cost	47	35625.82	17356.31	6533.33	96000
Land preparation	177	4533.76	3901.58	350	21000
Crop nutrition and protection	231	23489.26	23924.41	250	122800
Planting cost	166	2667.17	2416.61	300	14000
Total weeding cost	150	4523.00	5102.25	350	42000
Harvesting cost	217	5161.29	5113.72	250	32000
Revenue from Irish potato	241	134981.4	144590	11200	960000
Production cost	239	46860.08	49112	700	384954
Total gross margin	241	88759.18	109136.9	-26050	575046
Gross margin per acre	241	70198.22	35898.74	-53060	123140
Gross margin per hour	241	154.16	215.14	-58.96	1580.494

The revenue from Irish potato production was the total returns from the sales of Irish potato from various market outlets. The revenue was obtained from multiplying the number of 50kg bag sold at the market and the price per bag. The findings show that the mean revenue from Irish potato farmers in the study area was Ksh. 134981.40 with a mean production cost of Ksh. 46860.08. Therefore, the total gross margin among smallholder Irish potato farmers in Kinangop sub-county was calculated as the difference between the total revenue and total production costs. the findings revealed that smallholder farmers in Kinangop sub-county had a mean gross margin of Ksh. 70198.22 per acre. However, some farmers made losses of up to 53060 per acre in the

study area (Table 17). The losses could be attributed to damage by frost which is a major problem affecting smallholder Irish potato farmers in the area. Kimutai (2019) reported smallholder farmers in Kinangop sub-county attained a gross margin of Ksh. 32,341. The difference in the gross margins could be attributed to the price differences offered to smallholder Irish potato farmers per 50kg bag as farmers were offered a higher price ranging from 2000 to 6500 per 50kg bag due to low Irish potato supply at the point of sale. Additionally, smallholder farmers make, on average, Ksh. 154.16 per every hour utilized in Irish potato production (Table 17). The profit per hour was essential when calculating the opportunity cost of time utilized in calculating the indirect transaction costs.

#### **4.3.2 Market Outlet Choice**

Market outlet choice refer to the decision-making process used by smallholder Irish potato farmers to choose the channels through which they can sell their Irish potato. The choice is critical because it has the potential to significantly affect sales, and profitability among smallholder farmers (Adams *et al.*, 2021). The study results showed that majority (92.95%) of smallholder farmers in Kinangop sub-county sold their produce through brokers (Table 18). Selling through brokers can be attributed to lack of market information by smallholder farmers in the study area. Furthermore, most farmers (79%) preferred selling their produce to brokers because the long market distance (Table 18). In addition, 71.88% of the farmers used brokers for convenience and availability, whereas 33.04% feared the risks of taking the products to the markets. The study findings agree with Nyasulu (2021), who stated that 90% of smallholder Irish potato farmers sell their produce through brokers. The farmers who sold their produce through the local, urban, and contracts markets were 11%, 5%, and 4%, respectively.

Findings showed that smallholder Irish potato farmers in Kinangop sub-county did not use the farmer groups to sell their Irish potato. The study findings differed from those of Piabuo *et al.* (2020), who found that most Irish potato farmers in Cameroon sold their produce through farmer groups in major towns. The findings revealed majority (79.91%) of smallholder farmers sell their produce to brokers because the markets are far (Table 18). Further, smallholder farmers sold their produce to brokers was convenient as brokers were readily available. The findings imply that smallholder Irish

potato farmers could have foregone selling Irish potato to the markets due to the high transportation costs involved to transport Irish potato to far markets. However, 12.05% of smallholder farmers in the study area were not aware of any other markets and these could have resulted in lack of market information (Table 18).

Table 18: Market outlet choice by smallholder Irish potato farmers

Market outlet chosen	Frequency	Percentage
Brokers	224	92.95
Local Market	11	4.56
Urban Market	5	2.07
Contract	4	1.66
Total	244	101.24
Reasons for selling to brokers	Frequency	Percentage
For convenience and availability	161	71.88
To avoid market risks	74	33.04
Not aware of any other market	27	12.05
Markets are far	179	79.91
Total	442	197.32

#### 4.4 Quantification of Transaction Costs among Irish Potato Farmers

The quantity of transaction costs was taken to be the magnitude of transaction costs in both the inputs and the output markets (Table 19). The direct transaction costs were calculated as the monetary costs incurred by smallholder Irish potato farmers in searching for information, bargaining, engaging in contracts and transporting Irish potato inputs to the farm and output to the market. The indirect transaction costs were calculated as the opportunity cost of time that smallholder farmers forego in doing farm activities to search for information, bargain, engage in contracts and transport the inputs to the farm and Irish potato to the markets.

The study findings indicated that, 28.64% did not incur indirect information search costs to search for production inputs. However, 71.36% incurred information search costs when searching for production inputs. The mean indirect information search cost was Ksh. 7132.88 per acre, with a minimum and maximum of Ksh. 1008.518 and 25320 respectively (Table 19). Smallholder Irish potato farmers incurred Ksh. 448.44 directly when searching for information on the input market. However, 25.31% of the farmers did not incur direct information search in the input market. The findings implied

information is a key factor in every household's decision making. Saidah *et al.* (2019), found that information search cost contributed to 23.1% of the transaction cost among Chili farmers in Indonesia. Therefore, individual farmers could spend time and money searching for information to improve their input use and reduce input costs.

These could be attributed to majority of farmers in the study area not accessing information, and therefore, they had to spend extra costs to get the information as extension services were not available to majority of the farmers. Smallholder farmer spent their time and money in search of inputs like land to rent, seeds to use, fertilizers, labour, and agrochemicals. Studies by Bizikova *et al.* (2020) found fruit farmers in Tanzania and Uganda searched for information on inputs application, farming techniques, and production methods information, market information, farm management skills to overcome production challenges such as low quality and quantity. Direct and indirect input information search costs could influence market outlet choice as farmers could increase their production and quality of produce. These could give a farmer's bargaining power and can be driven to choose the market outlet that will give higher returns.

Majority of the farmers (74.27%) did not incur indirect bargaining costs in the input market. However, 25.73% (62 farmers) of smallholder farmers incurred the cost. From the findings, smallholder Irish potato farmers incurred approximately Ksh. 255.43 as indirect bargaining costs (Table 19). Smallholder farmers spent on average Ksh. 555 per acre directly on bargaining for inputs to use in production. The findings implied that majority of farmers were used to most input prices being fixed, with minimum bargaining possibilities. However, the costs of inputs could still be high and therefore, some farmers bargained to cut the costs of production. Smallholder Irish potato farmers in the study area negotiated for inputs like seeds, fertilizer, agrochemicals, manure, labour and tractor ploughing costs for production.

Mwangi *et al.* (2021) reported smallholder wheat producers in North-west Mt. Kenya collectively bargained for lower wheat input prices and better output prices for their produce. The bargaining costs in the study area could have resulted from majority of the farmers in the study area not belonging to farmer groups and therefore, they did not

have collective bargaining. The extra bargaining costs can influence smallholder farmers' gross margins if the costs will not yield a reduction in input prices. However, if the bargaining costs can reduce the input prices, it can influence farmers' gross margin positively. Ma *et al.* (2022). reported banana farmers in rural areas in China faced high information search and negotiation costs with input suppliers of inputs that had a significant negative impact on farmers' gross margins.

Table 19: Magnitude of transaction costs

Variable (Ksh.)	Obs	Mean	Std. Dev.	Min	Max
Indirect input information search	172	7132.88	6965.09	1008.52	25320
Indirect input bargaining cost	62	255.43	190.44	106.21	1000.06
Indirect input transportation	228	348.44	298.11	100.62	1404.81
Indirect contract search cost	4	4192.06	2907.80	125.49	7902.67
Total Indirect input transaction cost	230	5839.56	6958.99	110.06	25615.12
Indirect output market search	69	1256.30	1021.13	217.56	3657.78
Indirect market bargaining	195	593.45	530.42	133.50	2923.33
Indirect market transport cost	13	153.20	120.30	62.22	494.92
Indirect output contract cost	4	432.07	193.16	271.24	712.90
Total Indirect output transaction cost	205	1005.50	1071.74	133.50	5914.66
Direct input information search	185	448.43	390.53	120	2280
Direct input bargaining cost	241	555.00	60.29	100	1200
Direct input transport cost	203	752.49	616.15	200	3700
Direct contractual cost	4	533.33	124.72	400	700
Direct input transaction cost	241	1541.93	865.58	555	5635
Direct market search cost	53	176.42	142.04	100	800
Direct Market bargaining cost	56	117.28	98.66	10	400
Direct market transport cost	16	3167.54	2966.57	660.67	8000
Direct contact marketing cost	4	975.00	330.41	500	1200
Direct output transaction cost	88	807.60	1804.47	16.67	8600
Total transaction cost per acre	241	8265.14	7430.88	555	31641.92

The findings revealed majority of the farmers (94.60%) incurred indirect transportation costs to transport inputs to the farm for Irish potato production. However, 5.4% (13 farmers) did not incur indirect transportation costs. The study findings showed that smallholder farmers incur approximately Ksh. 348.44 per acre with a minimum and maximum of 100.62 and 1404.81 indirect transportation costs respectively (Table 19). Additionally, 84% (203 farmers) of smallholder farmers incurred direct transaction costs. The average direct input transaction cost was Ks. 752.49, with a minimum of Ksh. 200 and a maximum of Ksh. 200 and a maximum of Ksh. 3700 (Table 19). The

transportation costs resulted from majority of farms being far from the input purchasing centers. An increase in distance could have resulted in increased transportation costs charged by the transporters. Akite *et al.* (2022) reported rice farmers' gross margins being negatively affected by the costs of transporting inputs to the farm in Uganda.

Direct and indirect contract search cost was incurred by smallholder farmers who were engaged in a contract (1.66%). The findings revealed the mean indirect contract search costs were approximately Ksh. 4192.07; with a maximum and a minimum of Ksh. 271.24 and 712.90 per acre respectively (Table 19). Smallholder Irish potato farmers incurred Ksh. 533.33 directly when searching for a contract in Irish potato production and marketing with a minimum and a maximum of Ksh. 400 and 700 per acre respectively. Studies by Baraka *et al.* (2021) reported smallholder vegetable farmers in Kenya spend Ksh.1498.91 on contracts directly and Ksh. 2876.39 indirectly. The contractors could assure farmers of the stable prices of their produce and some provide inputs and training for production (Magati *et al.*, 2019). Therefore, farmers could have reduced production costs and have an assured market thereby increasing farmers' gross margins. Ncube (2020) reported contract farming is a means of creating new market opportunities that increase farmers income.

Majority of the farmers (71.37%) did not incur indirect information search cost for output market information. However, 28.63% of smallholder farmers incurred indirect output market information search costs. The findings revealed smallholder farmers incurred approximately Ksh. 1256.306 indirect market information per acre to search for market information (Table 19). Smallholder farmers in the study area spent Ksh. 176.42 directly on average when searching for market information. However, 78.01% of smallholder farmers did not incur direct market information search costs because most farmers preferred selling their produce to brokers to reduce the transaction costs. A study by Baraka (2019) reported higher indirect and direct information search costs (Ksh. 4349.72 and 2254.58 respectively) among smallholder vegetable farmers in Kenya when searching for price and market information. The high information search costs could have resulted from information asymmetry between the smallholder farmers and the market (Ullah *et al.*, 2020). These costs could influence smallholder farmers' market outlet decisions as the farmers could forego markets that involved higher search

costs. The findings can explain why smallholder farmers prefer selling their produce to brokers.

Smallholder Irish potato farmers incurred transportation costs to connect the farmers with their buyers at the various market outlets. The study findings showed a majority of smallholder farmers (94.61%) did not incur indirect transportation costs to the markets. However, from the 5.39% of farmers who incurred the cost, the mean indirect transportation cost was Ksh. 120.30 (Table 19). Furthermore, 6.64% of smallholder farmers incurred direct market transportation costs (16 farmers). The findings show that smallholder farmers incur on average Ksh. 3167.54 directly to transport Irish potato to the market (Table 19). However, majority of the farmers did not incur the cost (93.36%). The high transportation could be attributed to long market distances and poor roads in the study area, raising the transportation costs. The study implied that transportation costs are significant when participating in different market outlets. Therefore, farmers can forego a particular market if the costs exceed the benefits that can be derived from that market.

Smallholder Irish potato farmers who sold their produce to contract incurred contract marketing costs to sell Irish potato to the contractual party. From the findings, smallholder Irish potato farmers incur approximately Ksh. 432.07 indirectly per acre during the time of marketing (Table 19). Additionally, contracted smallholder farmers incurred Ksh. 975 per acre directly to market Irish potato during contracts. The costs were incurred by the contracted farmers when delivering Irish potato to the contractor. The contract marketing costs can influence smallholder farmers' market outlet decisions as the costs are low compared when marketing to other market outlets. Vishnu and Rai. (2022) reported the contracted Chili farmers in India incurred a lesser marketing cost of Rs 5394 compared to the independent farmers who incurred Rs. 9118. Therefore, the low marketing costs can influence smallholder farmers to select contracts as a market outlet.

The study findings revealed that smallholder Irish potato farmers in Kinangop sub-county spend Ksh. 8265.14 per acre as transaction cost to produce and sell their produce in various market outlets. The total transaction cost had a minimum of Ksh 7,430.88

and a maximum of Ksh. 31,641 per acre (Table 19). These implied that the transaction costs among smallholder Irish potato farmers can influence smallholder farmers' marketing outlet decisions and gross margin. The findings slightly differed from that of Baraka *et al.* (2022) who reported transaction costs among the vegetable farmers in Kenya being Ksh. 11,904. However, Saidah *et al.* (2019) reported smallholder chili farmers in IDR 3,990,727.74 per year.

#### **4.5 Effects of Transactor's Characteristics on the Choice of Market Outlet**

The study results indicated that Irish potato land, market distance, information and phone access significantly ( $p < 0.05$ ) affected the choice of brokers as the market outlet. Market distance, information access, land size, gender and extension services significantly ( $p < 0.05$ ) influenced the choice of local market outlet. Urban market was significantly influenced by age, information, and phone access ( $p < 0.05$ ). On the other hand, age, credit access, occupation, and phone access significantly ( $p < 0.05$ ) affected the choice of contract market outlet (Table 20).

Household head age positively and significantly ( $p < 0.05$ ) influenced the probability of choosing urban market, and negatively significantly ( $p < 0.05$ ) influenced the probability of choosing the contract markets (Table 20). These indicate that an increase in farmer's age by one year increased the likelihood of selecting the urban market outlet by 0.065, *ceteris paribus*. These imply that the more aged farmers were, the more the farmers preferred urban markets. The findings concur with those of Bannor *et al.* (2022), who reported age having a positive significant effect on farmers selling their agricultural produce in the urban markets in Ghana. The positive relationship between age and urban market choice can be attributed to the aged farmers having more experience and established market networks with traders and buyers in the urban markets. These help them to better understand market demands and access the urban market.

An increase in the farmer's age by one year showed a decrease in the probability of farmers choosing a contract market outlet by 0.20 when other factors were held constant (Table 20). The study findings differed from that of Bidzakin *et al.* (2020) among rice farmers in Ghana, who reported age having a positive and significant influence on contract farming participation. Majority of the aged farmers in the study area had

limited awareness of contracts farming, access to contract market opportunities and how contract operates, as a result of limited information access. Due to low credit access among smallholder farmers in the study area, the older farmers might lack capacity to comply with the contract terms and standards required by the contractors. Baraka (2019) reported older farmers are risk averse therefore, they prefer to use familiar market outlets to avoid contract market uncertainties.

Land size significantly ( $p < 0.05$ ) and positively influenced the likelihood of selling Irish potato to brokers and local markets negatively (Table 20). These findings indicate that when Irish potato farmers allocate one additional acre for Irish potato production, the likelihood of selling Irish potato to brokers increases by 0.73. On the other hand, an increase in land size by 1 acre showed a decrease in the likelihood of choosing the local market by 1.79, *ceteris paribus*. The findings imply that farmers with large land under Irish potato are less likely to select local markets, as they prefer selling their produce to closer market outlets. Generally, an increase in land increase smallholder farmers' productivity. Although increased productivity allows the farmers to access different market outlets due to economies of scale, the farmers might sell to brokers to avoid the high transportation costs resulting from poor roads in the study area.

These results can also be attributed to majority of the farmers not accessing market information in the study area. Thus, even though a farmer can produce more, they may end up selling their produce to brokers. Furthermore, smallholder farmers in the study area lacked modern storage facilities for Irish potatoes, farmers can therefore prefer selling their produce to brokers who bought them at once. The study findings concurred with that of Anthony *et al.* (2021), who found that land size significantly and negatively influenced rice farmers in Nigeria to sell their produce to local markets. Distance to the preferred near market had a positive and significant ( $p < 0.05$ ) impact on farmers' likelihood of selling to brokers. Furthermore, distance negatively and significantly ( $p < 0.05$ ) influenced the likelihood of selling to the local market (Table 20). These indicate that an increase in market distance by one km resulted in an increased likelihood of selling Irish potato to brokers by 0.03, *ceteris paribus*. An increase in distance by one km decreased the likelihood of selling to the local market by 0.06, *ceteris paribus*. The findings imply that smallholder Irish potato farmers living far away

from the markets, could hardly sell their produce to market alternatives other than brokers as a result of increased market distance. The findings imply that smallholder farmers avoid transporting their produce to the market outlets by themselves to avoid high transaction costs associated with selling to the markets. The farmers might be having limited market information as the market distance increases, therefore, preferring selling to brokers as it might be convenient, available and accessible compared to the other market outlets. The findings differed from those of Ermias (2021) reported distance to the market has a significant positive influence on mango farmers in Ethiopia.

Gender of the household head had a negative and significant ( $p < 0.05$ ) impact on smallholder Irish potato farmers selling their produce to the local market (Table 20). These findings imply that females are more likely to sell their produce to the local markets compared to their male counterparts. These results indicate that households headed by males decreased the probability of selling to the local markets by 1.05, *ceteris paribus*. The findings disagree with that of Anthony *et al.* (2021) who reported household gender had a positive impact on rice farmers selling at the wholesaler and the collectors market outlets. The findings can be due to male headed households being perceived to have access to diverse opportunities, market information and market contacts that might result from social networks (Isaboke and Ndirangu, 2021). Therefore, male headed households might prefer higher-valued market outlets than female head households who might prefer selling to local markets.

Market information access significantly influenced the likelihood of choosing all the market outlets. Access to market information negatively and significantly ( $p < 0.05$ ) influences the likelihood of selecting brokers and contract market outlets. On the other hand, market information access positively and significantly ( $p < 0.05$ ) influenced the likelihood of selling to local and urban markets (Table 20). The findings imply that farmers who access market information, are likely to sell their produce to either local or urban markets. These findings showed that access to market information decreased the likelihood of selling to brokers by 1.0103 and contract by 1.4015, *ceteris paribus*. However, access to market information increased the likelihood of selling to the local and urban market by 2.0104 and 1.32816 respectively, while other factors held constant.

Amfo *et al.* (2022) reported information access through different sources significantly influenced the sale of rice to retailers negatively among farmers in Ghana.

Access to market information can influence selling to the local and urban market as information facilitate informed decision-making. The price information accessed by farmers in different markets can help farmers weigh which among the market outlets can maximize their returns. Access to market information can result in farmers choosing local and urban market outlets as they can be perceived to be more profitable compared to brokers and contracts. Through access to market information, smallholder farmers can be aware of higher prices offered in the urban markets compared to those offered by brokers therefore, farmers will forego selling to brokers. In contrast, smallholder farmers might be informed of the extra costs associated with trading at the contract markets and therefore, choosing local and urban markets. The probability of selling to the local market is higher (2.0104) compared to the urban markets (1.3282) as a result of access to market information. The high transaction costs involved with the sale of Irish potatoes to the urban markets and poor roads in the study area could have limited farmer's participation in urban markets.

Phone access significantly ( $p < 0.05$ ) and positively influenced the probability of selling to brokers, and significantly ( $p < 0.05$ ) negatively influenced farmers' probability of selling to urban and contract market outlets (Table 20). These findings showed access to phones increased the likeliness of farmers selling their produce to brokers by 0.9318, *ceteris paribus*. However, phone access decreased the likelihood of selling to the urban and contract market outlets by 0.7376 and 0.7881 respectively holding other factors constant. The study findings concurred with that of Ozkan *et al.* (2022), who stated that phone ownership negatively influenced the selling of vegetables and fruits to the main and local markets. Phone access could have facilitated the selling of Irish potatoes by farmers to brokers since the farmers can communicate with the buyers who can purchase their produce at the farmgate eliminating marketing costs that could have otherwise been incurred when selling at the urban markets. The results could also be a result of smallholder farmers lacking trust in the contractors therefore, smallholder farmers prefer the convenient and more readily available market outlet.

Table 20: Multivariate probit results on the effects of transactor's characteristics on market outlet choice

Variables	Brokers			Local market			Urban market			Contracts		
	Coef.	Std. Err	p>z	Coef.	Std. Err	p>z	Coef.	Std. Err	p>z	Coef.	Std. Err	p>z
Household Age	0.0220	0.0156	0.158	-0.0060	0.0235	0.798	0.0650	0.0182	0.00	-0.2004	0.0674	0.003
Education years	-0.0363	0.0411	0.377	-0.0715	0.0533	0.180	-0.0190	0.0487	0.696	-0.0557	0.0807	0.490
Household size	-0.0090	0.0721	0.901	-0.1485	0.0945	0.116	0.1243	0.1124	0.269	0.0959	0.1349	0.477
Experience	-0.0258	0.0206	0.211	0.0396	0.0300	0.187	-0.0063	0.0201	0.753	-0.0286	0.0531	0.590
Land under Irish potato	0.7316	0.2771	0.008	-1.7854	0.7978	0.025	-0.0154	0.1849	0.934	0.0099	0.0177	0.554
Market distance	0.0293	0.0088	0.001	-0.0556	0.0142	0.000	-0.0058	0.0110	0.595	-1.0407	0.5604	0.063
Gender	0.4408	0.2831	0.12	-1.0531	0.4911	0.032	-0.0188	0.3026	0.950	0.0525	0.2400	0.827
Information access	-1.0103	0.2630	0.00	2.0104	0.4592	0.000	1.3282	0.2892	0.000	-1.4015	0.5938	0.018
Extension access	0.0381	0.4144	0.927	-0.8348	0.0425	0.084	0.0891	0.5462	0.870	-1.1545	1.0846	0.287
Phone access	0.9318	0.3783	0.014	-1.2248	0.6328	0.053	-0.7376	0.3294	0.025	-1.7602	0.7881	0.026
Group membership	-0.4291	0.4029	0.287	0.5168	0.4790	0.281	0.2563	0.4935	0.604	-0.0577	0.6501	0.929
Credit access	-0.4281	0.4171	0.305	0.0908	0.5122	0.859	0.5073	0.5781	0.380	2.4794	0.7957	0.002
Main occupation	-0.2021	0.3709	0.586	-1.0551	0.6409	0.100	0.0789	0.4612	0.864	1.2256	0.5281	0.020

Coef. – Coefficient, Std. Err. - Standard Errors.

Confidence level – 95%

Extension service significantly ( $p < 0.05$ ) and negatively influenced the probability of selling Irish potato to local market (Table 20). These findings showed extension service access decreased the likelihood of farmers selling to local markets by 0.4825 *ceteris paribus*. Jebesa (2019) found that extension services influenced market participation positively. However, Anthony *et al.* (2021) reported extension service access significantly and negatively influenced smallholder rice farmers in Nigeria to sell at the local markets. These findings can result from farmers working closely with extension providers and being provided with information about the alternative market outlets, skills and resources to enable farmers in selecting the most profitable market outlets. Hence, farmers might select higher market outlets to maximize their profits or choose brokers to minimize transaction costs associated with the market outlets.

Credit access had a positive and significant ( $p < 0.05$ ) impact on Irish potato farmers choosing contract market outlets (Table 20). The findings imply that smallholder farmers who accessed credit are more likely to sell their Irish potato to the contract markets. Access to credit increased the likelihood of selling through the contract market outlet by 2.4794. In most cases, contract farming requires huge amounts of investments from the farmers to facilitate the purchase of inputs and other requirements as per the contract terms, to attain the required quantity and quality. Therefore, credit will help smallholder farmers in planning for the contracts and implement the specified planning practices. Therefore, smallholder farmers accessing credit might be influenced to choose contracts as the market outlets as contracts assure stable better prices. These findings concur with that of Oppong-Kyeremeh *et al.* (2022) who reported credit access influenced Ghana poultry farmers to select contracts as the market outlet positively.

The main occupation had a significant ( $p < 0.05$ ) positive effect on smallholder farmers' decision to choose a contract market outlet (Table 20). The results showed that smallholder farmers having agriculture as their main occupation increased their likelihood of selling through the contact market outlets by 1.2256%, *ceteris paribus*. The findings imply that smallholder farmers whose main occupation is agriculture, are more likely to choose contract farming as their market outlet. The findings can be attributed to the benefits that result from contract farming including guaranteed stable prices. Therefore, households who depend on agriculture as their main source of income

are likely to choose contracts as the market outlets to stabilize their income and reduce marketing risks. Smallholder farmers having other sources of income as their main occupation are less likely to choose contracts as they have less dependence on agriculture. Nazifi and Hussain (2021) who found farm occupation significantly and positively influenced maize farmers in Nigeria participating in contracts.

#### **4.6 Effects of Transaction Cost on the Choice of Market Outlet**

In the study, indirect input transportation cost, indirect market information, indirect market transport cost, direct input transport, and market bargaining costs significantly ( $p < 0.05$ ) influenced smallholder farmers' likelihood of selling through brokers. The findings showed direct input transport and direct market bargaining costs significantly ( $p < 0.05$ ) influenced the likelihood of selling through the local markets (Table 21).

The study findings showed indirect input transportation costs significantly ( $p < 0.05$ ) and negatively influenced the likelihood of selling through brokers (Table 21). The results indicated that the more time spent by farmers in transporting inputs to the farm for production, the more they are likely to sell through other market outlets and not brokers. Therefore, an increase in the input transportation cost by smallholder farmers by one shilling decreases the likelihood of selling through the brokers by 0.0012, *ceteris paribus*. Farmers increased time while transporting inputs to farms leads to extra costs, which rises their production costs that could have ultimately reduced farmers' returns.

These could have made farmers get persuaded to sell to the local markets directly instead of brokers in search of better prices. Abokyi *et al.* (2020) report that, an increase in transportation costs encourages farmers to search for alternative markets to sell their produce, thereby increasing the likelihood of choosing local markets. Local markets were relatively close to the farming communities. The results revealed that farmers could easily access the local markets, hence reducing transportation costs and time involved in the transportation of output to the local market. Thus, farmers preferred selling to local markets that could yield higher prices while minimizing marketing costs.

Direct input transportation cost significantly ( $p < 0.05$ ) and negatively influenced the likelihood of selling to brokers and significantly ( $p < 0.05$ ) positively influenced the

likelihood of selling to the local market (Table 21). These findings showed that farmers were discouraged from selling their Irish potato through brokers when the cost of transporting inputs to the farm was high. These implied that, when other factors are held constant, an additional shilling spent to transport inputs for Irish potato production to the farm, decreased by 0.00059 the likelihood of selling Irish potatoes through brokers. On the other hand, an increase in the input transport cost by one shilling increased by 0.000495 the probability of selling Irish potatoes through the local market, *ceteris paribus*. The high transport cost for the inputs could have resulted in smallholder farmers searching for better markets than brokers that yielded higher returns. Studies by Adams *et al.* (2021) documented transportation costs to significantly and positively influence the choice of market outlet among smallholder potato producers in Ghana.

In the study, indirect market information search cost significantly ( $p < 0.05$ ) and negatively influenced the likelihood of choosing the brokers (Table 21). The findings implied that the more smallholder farmers spent while searching for market information, the less likely they were to sell Irish potato to brokers. The results showed that an increase in indirect information search cost by one shilling, decreased the likelihood of selling to brokers by 0.0002. Studies by Mulbah *et al.* (2021) reported that the time taken to find buyers significantly influenced smallholder rubber farmer's sales through alternative markets than to brokers. These can result from the time spent by smallholder farmers to search for market information exposing the smallholder farmers to a more profitable market like the urban or contract market outlet than the brokers as a result of obtaining market information. Farmers not incurring the information search costs could have sold to brokers as the market knowledge is not known to them.

Table 21: Analysis of the effects of transaction costs on market outlet choice using multivariate probit

Variable	Brokers			Local market			Urban market			Contract		
	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Indirect input information	0.00003	0.00023	0.891	-6.6000	0.00021	0.975	-0.00072	0.00983	0.467	-0.00014	0.00004	0.747
Indirect input bargaining cost	-0.00069	0.00136	0.614	0.00128	0.00143	0.371	-0.00049	0.00465	0.916	-0.00081	0.00187	0.666
Indirect input transport cost	-0.0012	0.00062	0.050	0.00049	0.00062	0.43	0.00416	0.00266	0.117	0.0008	0.00077	0.299
Indirect contract search cost	-0.00039	0.00040	0.327	-0.00023	0.00044	0.600	-0.00095	0.00122	0.94	0.00074	0.00042	0.076
Indirect market information cost	-0.0002	0.00083	0.015	0.00010	0.00026	0.697	0.00144	0.00095	0.131	-0.00019	0.00054	0.721
Indirect market bargaining	0.00114	0.00065	0.081	-0.00072	0.0006	0.228	-0.00536	0.00431	0.214	-0.00018	0.00064	0.776
Indirect market transport cost	0.01108	0.0040	0.006	-0.00634	0.00333	0.057	-0.01240	0.00945	0.192	0.017358	0.01892	0.359
Indirect market contract cost	0.00142	0.00891	0.874	-0.00658	0.01633	0.687	0.01306	0.05124	0.799	0.002939	0.00958	0.759
Direct input information cost	-0.00049	0.00030	0.868	-0.00057	0.00031	0.852	0.00083	0.00062	0.177	-0.00151	0.0016	0.346
Direct input bargaining cost	0.00258	0.00259	0.318	-0.00167	0.00250	0.504	-0.0052	0.00570	0.362	0.000935	0.01881	0.960
Direct input Transport cost	-0.00059	0.00017	0.001	0.00049	0.00016	0.002	0.00027	0.00042	0.949	0.000426	0.00028	0.130
Direct market information	-0.00083	0.00063	0.19	0.00080	0.00062	0.194	0.00144	0.00179	0.423	-0.00484	0.00371	0.191
Market bargaining cost	-0.00844	0.00211	0.000	0.00440	0.00132	0.001	0.00551	0.00384	0.152	0.0015	0.00326	0.645
Contact marketing cost	0.00232	0.00520	0.655	-0.0034	0.00949	0.72	0.00341	0.02667	0.898	-0.00086	0.00596	0.885

Coef. – Coefficient, Std. Err. - Standard Errors

Confidence level – 95%

Indirect market transportation costs significantly ( $p < 0.05$ ) and positively affected the likelihood of selling Irish potatoes through the brokers (Table 21). These results meant that one additional shilling spent by farmers to transport their Irish potatoes to the market indirectly resulted in an increase of 0.011083 in the likelihood of selling their Irish potatoes through the brokers, *ceteris paribus*. Studies by Dlamini-Mazibuko *et al.* (2019), reported that transportation costs to the markets influenced the decisions of the output selection among smallholder farmers in Switzerland. Farmers aim at maximizing their profits through cost minimization. Hence, if the cost of transportation to the markets is higher than selling to brokers, farmers may choose markets that give higher returns. Transportation costs were found to be a barrier to marketing Irish potatoes due to increased transaction costs and poor roads in the study area. These could have resulted in many farmers preferring to sell their Irish potatoes to brokers. The probability of selling to brokers could have also increased as majority of smallholder farmers lacked possession of transportation means, and the available means were expensive due to poor roads.

Direct market bargaining costs significantly ( $p < 0.05$ ) and negatively influenced the likelihood of selling Irish potatoes through brokers, and significantly ( $p < 0.05$ ) positively through the local market (Table 21). These results indicated that when market bargaining costs increase, smallholder farmers would choose to sell their Irish potatoes through the local markets compared to brokers. These implied that an increase of 0.00844 in market bargaining costs by one shilling would decrease the likelihood of selling Irish potatoes through the brokers. On the other hand, the likelihood of selling through the local market would increase by 0.004404 as a result of an increase in market bargaining cost by one shilling; when all other factors were held constant.

Studies by Hung and Khai (2020), found bargaining and negotiation costs to significantly influence small-scale chili farmers in Vietnam. Similarly, studies by Kiprop *et al.* (2020) reported bargaining costs to positively influence choosing brokers as a market outlet among indigenous chicken farmers in Baringo County, Kenya. Smallholder farmers may have little resources and could have lacked the knowledge and capacity to participate in proficient discussions with brokers as brokers have higher bargaining power. Farmers may have been discouraged from selecting brokers due to

higher negotiation expenses, which include the effort necessary to engage with brokers. Instead, they may have chosen to sell directly to local markets, where discussions are frequent, and simpler and more familiar.

#### **4.7 Effects of Transaction cost on gross margins among smallholder Irish Potato Farmers**

Quantile regression was done at three quantile points, including 25%, 50%, and 75%. The reason for choosing the three quantiles was due to the high difference in gross margins between the farmers with lower gross margins and those with higher gross margins. In the study indirect input transport cost, indirect market bargaining cost, indirect contract marketing costs, direct contract search cost, direct market bargaining costs, direct market transport cost and direct contract marketing cost significantly ( $p < 0.05$ ) influenced smallholder Irish potato farmers' gross margins at the 25% quantile. In the 50% quantile, indirect input transport, indirect market bargaining, indirect contract marketing, direct contract search, direct market bargaining and direct contract search costs significantly influenced ( $p < 0.05$ ) smallholder Irish potato farmers' gross margins. In the 75% quantile, indirect input transport, indirect market information, indirect market bargaining, direct input information, and direct market bargaining significantly ( $p < 0.05$ ) influenced smallholder Irish potato farmers' gross margins (Table 22).

Indirect input transportation cost significantly ( $p < 0.05$ ) and positively influenced smallholder farmers' gross margins at quantiles 25%, 50%, and 75% (Table 22). These imply that the more time spent in transporting inputs to the farm, the more smallholder farmers' gross margin increases. Therefore, an increase in indirect input transportation cost by one shilling increases smallholder farmers' gross margin by Ksh. 65.0502, Ksh. 55.5933 and Ksh. 66.8219 at the point of 25%, 50% and 75% quantiles respectively *ceteris paribus*. Additionally, the indirect input transportation cost has a much stronger effect on farmers' gross margin for the farmers having a higher gross margin. This is as a result of an increase in Ksh. 66.82 in smallholder farmers having high gross margins per acre, compared to the farmers having low gross margin (Ksh. 65.05).

Table 22: Analysis on the effects of transaction cost on gross margins using quantile regression

Variable	0.25 quantile regression			0.5 quantile (median)			0.75 quantile regression		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
Indirect input information cost	0.1888	1.1101	0.865	-0.0594	0.9719	0.951	1.2228	0.8804	0.166
Indirect input bargaining cost	-61.6343	31.6228	0.053	0.5490	27.6837	0.984	-4.1458	25.0778	0.869
Indirect input transport cost	65.0502	13.9782	0.000	55.5933	12.2370	0.000	66.8219	11.0851	0.000
Indirect contract search cost	-1.1846	13.0323	0.928	3.3738	11.4089	0.768	7.8699	10.3350	0.447
Indirect market information cost	1.8824	2.9251	0.521	1.8672	2.5607	0.467	8.5750	2.3197	0.000
Indirect market bargaining cost	16.0862	6.8704	0.020	21.4818	6.0146	0.000	19.1235	5.4485	0.001
Indirect market transport cost	43.2810	150.0771	0.773	-57.296	131.3828	0.663	-133.254	119.0156	0.264
Indirect contract marketing cost	2060.646	605.5185	0.001	1346.188	530.0921	0.012	638.1719	480.1939	0.185
Direct input information cost	-2.3905	7.8474	0.761	-6.5056	6.8699	0.345	-11.2078	6.2232	0.073
Direct input bargaining cost	-51.2266	81.4430	0.530	-92.0645	71.2981	0.198	-70.0339	64.5867	0.279
Direct input transport cost	-4.6540	5.8110	0.424	-6.9009	5.0872	0.176	0.9994	4.6083	0.829
Direct contract search cost	1131.101	440.7572	0.011	780.7671	385.8543	0.044	520.6471	349.5334	0.138
Direct market information cost	12.9427	19.7863	0.514	17.2262	17.3216	0.321	4.5313	15.6911	0.773
Direct market bargaining cost	101.664	48.6601	0.038	121.7102	42.5988	0.005	164.8609	38.5889	0.000
Direct market transport cost	-2.4405	1.3727	0.077	-1.6770	1.2017	0.164	-1.0658	1.0886	0.329
Direct contact marketing cost	934.2371	301.3309	0.002	577.5227	263.7957	0.030	199.2672	238.9643	0.405
Total transaction cost per acre	0.7212	1.0655	0.499	0.6849	0.9328	0.464	-0.9225	0.8450	0.276

0.25 Quantile regression, Pseudo R2 = 0.2850; 0.5 regression (0.5), Pseudo R2 = 0.2681; 0.75 Quantile, Pseudo R2= 0.2342

Coef. – Coefficient, Std. Err. - Standard Errors.

Confidence level – 95%.

These findings can be attributed to the role played by inputs in production. Inputs like fertilizers, seeds, and land aid in improving the productivity of Irish potato. Therefore, the costs spent to transport and utilize the farm inputs will positively contribute to profits. The study findings concur with that of Mishra *et al.* (2019), who stated that transportation costs influence smallholder farmers' yields and profits. On the contrary, Aku *et al.* (2018), found transportation costs to negatively influence smallholder vegetable farmers' income in Tanzania. The results can result from cheaper inputs provided by suppliers who can be at a distance from the farmers in the study area. For instance, farmers who travelled from the study area to Naivasha town could receive a cheap subsidized fertilizer provided by the government at Ksh. 3500 whereas the farmers who bought the fertilizer at the local agrovets could be bought at Ksh. 6000 per 50 kg bag. Although the farmers incurred a higher input transportation cost to get the subsidized fertilizer that was not available in the local agrovets, it could have been worth it to reduce the production cost by Ksh. 2500 per 50kg of fertilizer purchased. These could have increased the farmer's gross margins.

Indirect market information search cost significantly ( $p < 0.05$ ) and positively influenced smallholder farmers' gross margin at the point of 75% quantile (Table 22). These imply that an increase in information search cost on Irish potato markets by smallholder farmers increases the smallholder farmers' gross margin. These imply that an increase in smallholder farmers' indirect information cost by one shilling for additional Irish potato market information would increase smallholder farmers' gross margin by Ksh. 8.5750 *ceteris paribus*. Market information is vital for farmers to participate and sell their Irish potato in the markets as it helps farmers to make accurate and informed decisions. When market information becomes costly, farmers will prefer to sell their produce to nearby markets even if unsatisfied. Majority of smallholder Irish potato farmers in the study area (71.37%) could not access market information therefore, selling their produce to brokers who controlled the prices. These could be attributed to most farmers not being members of farmer groups and they did not receive extension services that could have been a source of market information. Therefore, the farmers were left with the option of searching for market information by themselves by travelling to the marketplaces or even incurring credit costs. The extra costs incurred could have facilitated the farmers selling to the preferred markets to increase their gross

margins. Kyomugisha *et al.* (2018), found that transaction costs such as information search, bargaining, and building trust with buyer's costs significantly influenced smallholder potato farmers' profits in Uganda positively. As a result, farmers tried to reduce their costs by forming farmer groups to facilitate collective marketing.

Indirect market bargaining costs significantly ( $p < 0.05$ ) and positively influenced the smallholder Irish potato farmer's gross margins at 25%, 50% and 75% quantile (Table 22). These imply that the more farmers bargained for their Irish potato, the more likely their gross margins will increase. Therefore, an increase in indirect market bargaining cost by one shilling increases the farmer's gross margins by 16.0862, 21.4818, and 19.1235 at the point of 25%, 50%, and 75% quantiles, respectively (Table 22). Additional shilling spent on indirect market bargaining cost resulted in a greater effect at the point of 50% quantile (21.4818) and the least effect at the point of 25% quantile (16.0862). The findings disagreed with that of KC and Jamir (2018), who found bargaining costs influenced smallholder farmers' profits negatively. However, due to reduced information asymmetry, bargaining power is much more effective when farmers have access to market information (Pingali *et al.*, 2019). Majority of farmers in the study area bargained with more than one buyer who offered different prices for comparison. Therefore, the farmers who could have bargained with many buyers had the probability of having a buyer who offered the highest price hence maximizing the gross margins.

Indirect contractual marketing cost significantly ( $p < 0.05$ ) and positively influenced smallholder Irish potato farmers' gross margin in the 25% and 50% quantiles (Table 22). These imply that an increase in indirect contractual costs increased the likelihood of smallholder farmers receiving more returns. Therefore, at 25% quantile, an increase in indirect contractual cost by one shilling would result in an increase in gross margins by Sh. 2060, and at 50% quantile, by Ksh. 1346, *ceteris paribus*. Furthermore, the findings indicated a stronger influence of an increase in indirect contractual marketing cost at the point of 25% quantile compared to 50% quantile (Table 22).

Majority (98.34%) of the farmers in the study area did not have contracts. The prices offered by the contractors were stable unlike those offered in the alternative markets

which were fluctuating. Therefore, smallholder farmers who were under contract could have received higher and reduced prices offered by the contractors. Additionally, some contractors in the study area offered production inputs such as seeds and fertilizers so that farmers can produce the required qualities therefore, smallholder farmers under contracts could have reduced production costs that could have maximized their profits. As such, the costs incurred by smallholder farmers to sell their produce to the contractors could yield the farmers more profits compared to the non-contracted farmers.

In the study direct contract search cost had a positive and significant ( $p < 0.05$ ) influence on smallholder farmer's gross margins in both 25% and 50% quantiles (Table 22). These findings imply that an increase in direct contract search cost by one-shilling increases farmers' gross margin increases by Ksh. 1131.101 and Ksh. 780.7671 in 25% and 75% quantiles respectively. Additionally, the findings revealed a stronger influence on farmers' gross margin at the point of the 25% quantile than the 75% quantile (Table 22). Contracts reduce farming difficulties by providing the necessary inputs in production such as fertilizers, seeds, information, and technology for the required quantities and qualities (Khan *et al.*, 2021). The findings of these studies disagreed with those of Pramana and Rondhi (2020), who found contractual costs influenced profitability negatively among potato farmers in East Java, Indonesia. The findings could have resulted from smallholder farmers in the study area searching for contractors by themselves who were difficult to find. The contracts could have provided inputs to the farmers and assured markets for the produce, thereby shielding farmers from price and market uncertainties. Therefore, the contracted farmers could have attained higher gross margins compared to farmers selling in other market outlets. However, Rondhi (2020) reported the contracted farmers experienced lesser profits compared to the non-contracted potato farmers in Indonesia. Direct market bargaining cost significantly ( $p < 0.05$ ) and positively influenced smallholder farmers' gross margin significantly and positively at 25%, 50% and 75% (Table 22). These findings suggest that an increase in direct market bargaining cost by one shilling will increase farmers' gross margin by Ksh. 101.664, Ksh. 121.7102 and Ksh. 164.8609 at the point of 25%, 50% and 75% quantiles respectively. The findings concurred with that of Baraka *et al.* (2021) who found smallholder vegetable farmers in Kenya gained a higher gross margin as a result

of bargaining costs they incurred when negotiating in the urban markets. On the contrary, the study findings by Ba *et al.* (2019), found that bargaining costs reduced profits among smallholder rice farmers in Vietnam. Majority of the farmers who incurred higher direct bargaining costs were farmers who had market information and sold Irish potato at the urban markets. The farmers could have received better prices for their produce as a result of the increased efforts they put in while bargaining with buyers due to increase bargaining power. Hence, increasing their gross margins compared to the farmers who did not put more effort into bargaining. The findings further showed an increase in direct bargaining costs by one shilling, resulting in a greater increase in the 75% quantile compared to the 50% and 25%. These could have resulted in smallholder farmers having a higher gross margin per acre and having a higher bargaining power than those having a low gross margin which could have resulted in the quantities of output sold.

Direct contract marketing cost significantly ( $p < 0.05$ ) and positively influenced smallholder farmers' gross margin at 25% and 50% quantiles (Table 22). Therefore, an additional shilling spent by farmers to market their Irish potatoes through contracts would result in an increase in farmers' gross margins by Ksh. 934.2371 at 25% quantile and Ksh. 577.5227 at the 50% quantile, *ceteris paribus*. These findings align with those of Vishnu and Rai (2022), who found that contractual costs influenced smallholder farmers' profits positively as contracts reduced transaction costs that smallholder farmers incurred. The findings further showed that the magnitude at the 25% quantile was greater compared to 50% quantile. Farmers at the higher quantile could have achieved various economies of scale in Irish potato production such as low production costs, increased Irish potato production, and high bargaining power. Hence, the increased influence of added contract marketing costs on their gross margin could have a smaller margin than those of the farmers at the lower quantile. Contracts link farmers to the markets and they reduce the marketing risks, uncertainties, and unpredictability of production and marketing (Ochieng *et al.*, 2018). Therefore, Irish potato farmers who were under a contract could have been assured of the market and the price of their Irish potatoes. As a result, these could have reduced the transaction costs for searching for markets to sell their Irish potato. The contract marketing costs facilitated delivering the Irish potato to the contractors, and as a result, the farmer's gross margins could be influenced positively.

## CHAPTER FIVE

### SUMMARY, CONCLUSION, AND RECOMMENDATIONS

#### 5.1 Summary of the Findings

The study analyzed transaction cost and transactor's characteristics effects on market outlet choices and gross margins among smallholder Irish potato farmers in Kinangop sub-county. A cross-sectional design was employed in the research as it facilitated the description of smallholder farmers' characteristics and the transaction costs they incur when selling their Irish potato in various market outlets. The study data was collected from 241 smallholder Irish potato farmers using a cluster random sampling technique. Descriptive statistics were employed to quantify the transaction cost incurred by smallholder Irish potato farmers when selling their produce in different market outlets. Smallholder Irish potato farmers' gross margin was calculated using the gross margin analysis. The multivariate probit model was used to determine the transactor characteristics and transaction costs effects on the choice of market outlets, while quantile regression was utilized in determining the effect of transaction costs on smallholder farmers' gross margins at 95% confidence level.

The study findings indicated that the majority (92.95%) of smallholder Irish potato farmers in the study area sell their produce through brokers. Most farmers stated that brokers are available and it is convenient to sell through brokers. The findings show that smallholder Irish potato farmers spend a total of Ksh. 8265.14 per acre as transaction costs to sell their produce, implying smallholder farmers' profits can be reduced due to these high transaction costs. The study sort to determine the effects of transactors' characteristics on the choice of market outlets among smallholder Irish potato farmers in Kinangop sub-county. Thirteen variables, including; Age, education, household size, experience, occupation, land size, market distance, market information access, gender, phone access, extension services, access to credit and group membership, were involved in the study. Age, land size, market distance, and phone access significantly ( $p < 0.05$ ) and positively influenced smallholder farmers selling to the brokers. However, Information access significantly ( $p < 0.05$ ) and negatively influenced smallholder Irish potato farmers selling to brokers. Land size, market distance, gender and extension service access significantly and negatively influence the probability of smallholder farmers selling to the local markets and information access

significantly and positively influenced smallholder farmers selling to the local markets. Selling Irish potato to the urban market was significantly and positively influenced by age, information access and phone access. The likelihood of selling Irish potato to contract market outlet was significantly ( $p<0.05$ ) positively influenced by land size, credit access and main occupation and significantly ( $p<0.05$ ) negatively by age, information access and phone access.

The study sort to determine the transaction cost effects on the market outlet choice among smallholder farmers in Kinangop sub-county. The results of the MVP model revealed that indirect input transportation cost, indirect market information cost, direct input transport cost, and direct market bargaining costs significantly ( $p<0.05$ ) and negatively influenced the likelihood of selling through the brokers negatively. On the other hand, indirect market transport costs significantly ( $p<0.05$ ) and positively influenced the likelihood of selling through the brokers. The likelihood of choosing the local market as a market outlet was significantly ( $p<0.05$ ) and positively influenced by indirect market transportation costs, and direct market bargaining costs.

The study sort to determine the transaction cost effects on smallholder Irish potato farmers' gross margins where quantile regression was employed. Quantile regression was done at three quantile points, including 25%, 50%, and 75%. The reason for choosing the three quantiles was due to the high difference in gross margins between the farmers with lower gross margins and those with higher gross margins. Seventeen variables, including direct and indirect information search, bargaining, transport, and contractual costs in the input market and direct and indirect information search, bargaining, transport, and contractual costs in the output markets, were used in the quantile regression model. At the first (25%) and median (50%) quantiles, indirect input transportation cost, indirect market bargaining cost, indirect contractual marketing costs, direct ( $p<0.05$ ) and positively influenced smallholder Irish potato farmers' gross margins. At the point of 75% regression, indirect input transport, indirect market information search, and indirect market bargaining and direct market bargaining costs significantly ( $p<0.05$ ) and positively influenced smallholder farmers' gross margin.

## **5.2 Conclusion**

Majority of smallholder Irish potato farmers in Kinangop sub-County sold their produce to brokers since it was the available and convenient market outlet. Transaction costs among smallholder Irish potato farmers in Kinangop sub-county were high; approximately Ksh. 8,265 per acre, which limit smallholder farmer's market outlet decisions. Further, the presence of brokers along the market chain prevents smallholder farmers from accessing market information and limit their market outlet decisions. Hence, to enhance market outlet choice decisions among smallholder farmers in the study area, the farmers should be provided with marketing knowledge and skills through extension services that will enrich farmers with information and ways of reducing transaction costs.

From the second objective, the study concluded that smallholder farmers' characteristics are critical in market outlet choice decision-making. Farmers who accessed credits, market information and extension services, were more likely to sell their Irish potato to a high value market such as urban and contract markets. On the other hand, an increase in land and market distance increased the likeliness of smallholder farmers selling their produce to brokers. Hence, smallholder farmers should be informed of the importance of collective actions such as selling Irish potato in groups to reduce the transportation costs resulting from an increased market distance.

Transaction costs were important factors in market outlet choice decisions. The study found that, although transaction costs can be perceived to influence smallholder farmers' market outlet choice negatively, transaction costs such as market bargaining costs and information search costs significantly discouraged smallholder farmers to choose brokers as farmers can sell to a higher value market. Transaction costs such as contract search and marketing costs facilitated smallholder farmers selling their produce to contract markets that offered better stable prices and therefore smallholder farmers increased their profits. Despite transaction costs being viewed as a barrier to accessing market outlets, transaction costs can contribute to smallholder farmers' increased returns.

### **5.3 Recommendations**

From the colclusions derived, the following recommendations were made by the study;

- i. The agriculture extension agents and relevant non-governmental organizations should disseminate relevant trainings and information to smallholder Irish potato farmers to help them make informed decisions on the market outlets to reduce transaction costs and maximize profits.
- ii. Smallholder Irish potato farmers in Kinangop sub-county should be encouraged to form active farmer groups to foster collective action and increase farmers' bargaining power when purchasing the inputs and selling Irish potato to the preferred market outlets.
- iii. The relevant agriculture policy-makers should develop appropriate policies, programs, and measures to shield smallholder farmers from brokers who always exploit the farmers.
- iv. Smallholder Irish potato farmers should also collaborate with agricultural finance cooperations to facilitate credit access that will enhance farmers investment in a higher value market.
- v. Smallholder Irish potato farmers shold be encouraged to establish collection centres in designated points to collect produce from different farmers and transport them to the market jointly thus cost sharing and reducing the transaction costs involved in marketing.

### **5.4 Suggestions for Further Research**

- i. The study suggests further research on the role of collective action in reducing transaction costs among smallholder Irish potato farmers in Kinangop sub-county.

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## APPENDICES

### Appendix I: Introductory Letter

Dear Sir/Madam,

I am Patrick Kamau Mwaniki, a Chuka University student pursuing a Master of Science in Agricultural Economics. Currently, I'm conducting scholarly research on '**Analysis of Transaction Cost and Transactor Characteristic Effect on Market Outlet Choice and Gross Margins among Irish Potato Farmers In Kinangop Sub-county, Nyandarua County.**' This study aims to partially fulfill the requirements for the Master's degree in Agricultural Economics at Chuka University award. I respectfully urge that you answer the questionnaire questions with honesty as possible. Your participation is entirely voluntary, and you can be certain that any information you contribute will be confidential and used solely for research purposes. Your participation in this interview is highly appreciated.

Yours faithfully,

Patrick Mwaniki Kamau

Thank you for participating.

## Appendix II: Survey Questionnaire

This questionnaire collects data on transaction cost elements, profit, and market participation among smallholder Irish potato farmers in Nyandarua county, Kenya.

### Section 1: Household Identification

Serial number	
Date of interview	
Sub-county	
ward	
Name of Household Head	
Name of respondent	

### Section 2: Transactor's (farmers) characteristics

		Responses
i. Gender of the respondent	1= Male 0= Female	
ii. Gender of the household head	1= Male 0= Female	
iii. Maximum number of years in formal education	[In Years]	
iv. How many people have lived in the household continuously for the last two production seasons?	1,2,3, 4 ..., n	
v. How long have you been practicing Irish potato farming?	[In Years]	
vi. Household head income from Irish potato farming per season	[KES]	
vii. What other crops provide income for the household?	CODE A	
viii. Household head income from other crops (income from sources above)	[KES]	
ix. Land size owned by the household head	[Ha]	
x. Land size under Irish potato farming	[Ha]	
xi. Quantity of Irish potato produced in the last production season	[50 kg bags]	

**Code A:** 1. Irish potatoes 2. Carrots 4. Cabbage 5. Beans 6. Others (specify)

### B. Market distance and transaction frequency

a.	b.	c.	d.	e.
What is the distance to the market where you sell your Irish Potatoes?	What are the means of transport you use when transporting Irish potatoes to the market?	Ownership of the mode of transport	What is the transport ation cost per trip?	How many times did you take Irish potatoes to the market the past two production seasons?
(Kms)	Code B	1= own, 2=Rented, 3= borrowed	(KES)	Season before the last season Latest season

**Code B:** 1. Bicycle 2. Motorbike 3. Pickup 4. Lorry 5. Human porters 6. Animals 7. Others

### Section 3: Market Outlet Choices

a) Did you sell your Irish potatoes last season? 1=Yes, 0=No; If yes, answer the questions in the following table

i.	Which places did you sell your Irish potatoes (Waru) in the 2022 production season?	1=Brokers, 2=Local, 3=Urban, 4=Contract	
ii.	How did you know there is market for your Irish potatoes?	Code B	
iii.	Did you search for better markets/ prices for your Irish potato?	1=Yes, 0=No	
iv.	How much time did you spend when looking for a place to sell your Irish potatoes?	Hrs.	
v.	Did you engage in any form of agreements (written or unwritten) [contracts]	1=Yes, 0=No	
vi.	If yes, what form of agreement/ contracts do you engage in?	Code C	
vii.	Are there agreement fees you paid?	1= Yes, 0=No	
viii.	If yes, what was the amount paid?	KES	
ix.	How much time did you spend negotiating for the agreements?	Hrs.	
x.	What enforcement mechanisms did you use to ensure Agreement compliance?	<i>Specify</i>	
xi.	Do you trust your partner with whom you are in the agreement with?	1=Yes, 0=No	
xii.	How long do you wait for the buyer to collect the produce after the agreement?	DAYS	
xiii.	what quantities were you not able to sell last season?	50kg bags	
xiv.	What are the reasons of not selling them?	Code D	
xv.	What limit your access to market?	Code E	
xvi.	Do you pay any market fees in a respective marketing outlet?	1=Yes; 0=No	
xvii.	If you pay, how much do you pay?	KES	

**Code B:** 1. Radio/Tv 2. Internet 3. Public baraza 4. Newspapers 5. Friends/ neighbors

6. Brokers 7. Others [*specify*] **Code C:** 1. Marketing 2. Input supplies 3. Information source 4. Production 5. Others [*specify*] **Code D:** 1. lack of market 2. Damaged by pest and diseases 3. Spoiled during storage 4. Others [*specify*] **Code E:** 1. Transport costs 2. Market information 3. Market regulations 4. Intermediaries' presence 5. Other reasons[*specify*]

b). Do you sell Irish potatoes through brokers?

	i. Used broker?	ii. What quantities did you sell last season through brokers?	iii. The price offered by the brokers	iv. Number of brokers used last season?	v. What are the reasons for selling through brokers?
	1= Yes; 0=No	Kgs	KES/ 50kg bag		Code G
<b>Response</b>					

**Code G:** 1. It is convenient and available method 2. To avoid marketing risks 3. I am not aware of any other 4. Markets are far and I don't have capability to take my produce 5. Any other reasons [*specify*]

#### Section 4: Transaction costs incurred by Irish potato farmers

##### A. Market information search cost

i.	Do you access market information?	1=yes, 0=No	For inputs	For outputs
ii.	What are your means of obtaining information?  [indicate with a tick]	Extension officers		
		Neighbors		
		Buyers		
		phone		
iii.	Time taken to obtain market price information	Hrs.		
iv.	Was the price in alternative markets known before selling your potatoes?	1=Yes, 0=No		
v.	The price was _____ compared to the expected price	KES		
vi.	Did you know the buyer personally before?	1=Yes; 0=No		
vii.	Did you fix the prices before sale?	1=yes; 0=No		
viii.	Did you travel to search for market price information?			
ix.	If yes, how much time did you use to travel per day?	Hrs.		
x.	What is the amount you incurred per trip when you were searching for information?	KES		
xi.	Do you, or any member of your household own a mobile phone?	1=Yes, 0=No		
xii.	If yes, is the mobile phone internet enabled?	1=yes. 0=No		
xiii.	Do you use the phone for searching market information?	1=Yes; 0=No		
xiv.	How much did you spend in terms of airtime to search for market information?	KES		

##### B. Bargaining and Negotiation costs

			Input	output
i.	Do you bargain for better prices for your inputs or produce when selling?	1=Yes, 0= No		
ii.	How many times did you negotiate before agreeing on price for your latest sale or inputs purchase?			
iii.	Who negotiated with the for your produce sold or inputs bought last season?	<b>Code H</b>		

iv.	On average, what time does it take to agree on the price to sale?	Hrs.		
v.	In your opinion, who sets the exchange price?	<b>CODE I</b>		
vi.	Did you incur any extra fees/ charges during negotiations?	Estimate the costs		
vii.	Did you negotiate with the buyers or sellers through phone?	1=yes, 0= No		
viii.	If yes, how long did negotiation last?	Hrs.		
ix.	How much charges, in terms of airtime did the negotiation cost?			
x.	How many potential buyers did you talk to, before making the decision to purchase or sale your produce?			
xi.	Did you travel to meet the buyers to negotiate the buying prices?	1=Yes, 0=No		
xii.	If yes, how much did you incur in terms of transportation costs?	KSH		

**Code H:** 1=Broker; 2= Myself; 3=Farmer groups; 4=others **CODE I:** 1= broker; 2=buyer; farmer; 4; market; 5; other [specify]

### C. Contractual costs

Did you sell on contract/ agreement to the buyers? 1=Yes; 0=No		
i.	Did you pay any charges or fees before sales?	1=yes; 0=No
ii.	If yes, how much did you pay for the agreement as fees?	KES
iii.	How much time did you use before coming to an agreement of the contract?	Hrs.
iv.	If you paid any transport costs, how much did you pay during the contract process?	
v.	Any other cost you incurred for contract agreements	[Please specify the costs and amount paid]

### D. Monitoring and enforcement cost

i.	Did you sell irish potatoes on credit last season?	1=Yes; 0=No	
ii.	If you sold on credit, how long did it take for you to be paid?	Days	
iii.	On average, how many times did you ask the debtor (buyer) for payments?		
iv.	Time spent when asking for payment per one time?	Hrs.	

v.	How much did you spend when asking for payments the last time you sold on credit?		
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### E. Infrastructure information

i.	Do you store irish potatoes in warehouse?	1=Yes, 0=No	
ii.	If yes, how much does it cost per kg of Irish potato stored?	KES	
iii.	Do you weigh Irish potatoes before and after storage?	1=Yes, 0=No	
iv.	If yes, what is the shrinkage loss in kgs		
v.	Did you incur losses when transporting irish potatoes to the market in the last season?	1=Yes, 0=No	
vi.	If yes, estimate the loss you incurred		

## Section 5: Gross margin information

### A. Irish potato production

i.	What is the proportion of land you used under Irish potato?	[Ha]	
ii.	What is the form of land ownership?	1= Owed, 2= Rented, 3= Gifted for production of last season	
iii.	If rented, how much do you pay as rent charges?	[KES]	
iv.	What is the type of seeds used?	1= Certified, 2= self- supplied seeds	
v.	What quantity of seeds did you use for planting last season?	[Kgs]	
vi.	How much did you incur in Land preparation and planting?	[KES]	

### B. Input costs per Ha per season

Input	Types	Quantity	Cost per kg/Ltr
i. seeds			
ii. fertilizer			
iii. Pesticides/ Herbicides			

### B. Cost of labor used in production

Activity	Labor (Man-days)	Machinery used	Costs [KES]
i. Ploughing			
ii. Harrowing			
iii. Planting			
iv. Weeding			
v. Harvesting			

- C. What Quantities of 50 Kg bag of Irish potatoes did you harvest last season?  
\_\_\_\_\_kgs
- D. What quantities of 50 kg bag of Irish potatoes did you sell last season?  
\_\_\_\_\_kgs
- E. What was the Price of Irish potato sold per 50kg bag? \_\_\_\_\_ KES
- F. Estimate the total revenue received in the last season \_\_\_\_\_ Per Ha.

**Thank you for participating in my study**

**BE BLESSED**

## Appendix III: Chuka University Ethics Letter



### CHUKA UNIVERSITY INSTITUTIONAL ETHICS REVIEW COMMITTEE

Telephones: 020-2310512/18

Direct Line: 0772894438

Email: [info@chuka.ac.ke](mailto:info@chuka.ac.ke),

P. O. Box 109-60400, Chuka

Website: [www.chuka.ac.ke](http://www.chuka.ac.ke)

19<sup>th</sup> April, 2023

REF: CUIERC/ NACOSTI/365

TO: Patrick Mwaniki Kamau

**RE: Analysis of transaction cost and Transactor Characteristic effect on Market Outlet Choice and Gross Margin among Irish Potato Farmers in Kinangop Sub-County, Nyandarua County.**

This is to inform you that *Chuka University IERC* has reviewed and approved your above research proposal. Your application approval number is *NACOSTI/NBC/AC-0812*. The approval period is 19<sup>th</sup> April, 2023 – 19<sup>th</sup> April, 2024.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by *Chuka University IERC*.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to *Chuka University IERC* within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to *Chuka University IERC* within 72 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to *Chuka University IERC*.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.






Yours sincerely

**Dr. Benjamin Kanga**  
SECRETARY

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*Chuka University is..... Inspiring Environmental Sustainability for Better Life*

## Appendix IV: NACOSTI Research License

 <b>REPUBLIC OF KENYA</b>	 <b>NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY &amp; INNOVATION</b>
Ref No: <b>807441</b>	Date of Issue: <b>25/May/2023</b>
<b>RESEARCH LICENSE</b>	
	
<b>This is to Certify that Mr. Patrick Mwaniki Kamau of Chuka University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nyandarua on the topic: Analysis Of Transaction Cost and Transactor Characteristic Effect on Market Outlet Choice and Gross Margin Among Irish Potato Farmers in Kinangop Sub-County, Nyandarua County for the period ending : 25/May/2024.</b>	
License No: <b>NACOSTI/P/23/26000</b>	
<b>807441</b>	
Applicant Identification Number	Director General <b>NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY &amp; INNOVATION</b>
	Verification QR Code
	
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