RURAL PLANNING JOURNAL
Website: https://journals.irdp.ac.tz/index.php/rpj

DOI: https://doi.org/10.59557/rpj.26.2.2024.106

Determinants of Market Outlet Choices for Irish Potato Production among Smallholder Farmers in Mbeya District, Tanzania

George Z. Kihamba*, Flora Mlage and Luhuvilo Lupondo[1]
[1]Institute of Rural Development Planning, P. O Box 138, Dodoma, Tanzania
*Corresponding author: Email: gkihamba@irdp.ac.tz

Abstract

The study examined the determinants of market outlet choices among smallholder Irish potato growers in Mbeya District. A two-stage random sampling method was used to select 288 smallholder farmers for primary data collection. The data were analysed using Stata version 15, and the multivariate probit model was applied to assess the factors influencing market outlet selection. The findings showed that the probability of Irish potato farmers choosing blocker, wholesaler, local, and retailer outlets was 32.1%, 31.6%, 28.5%, and 22.3%, respectively. This indicates that blockers were the most commonly chosen outlets, while retailers were the least preferred. The joint probability of farmers opting for all four market outlets was 0.6%, lower than the likelihood of not selecting all four outlets (16.7%). The multivariate probit model results revealed that several factors, including the age of the household head, education level, farm size, distance to the nearest market, availability of market information, access to extension services, and access to credit, had significant effects on farmers' market outlet choice behaviour. Based on these findings, the study recommended improving the current production systems, encouraging farmers to adopt intensive cultivation methods, and ensuring better prices for farmers as important strategies for making informed market outlet decisions. Furthermore, the study emphasised the need for policy measures that strengthen infrastructure development, such as creating market centres closer to farmers' locations and promoting farmers' groups to facilitate better market access.

Keywords*:* Determinants, Irish potato, choice, Multivariate Probit model, smallholder farmers

1. Introduction

Irish potato (Solanum tuberosum) is a well-known root and tuber crop grown worldwide and is one of the most significant contributors to food energy in developing regions (FAO, 2020; Guluk & Obi-egbedi, 2021). FAOSTAT (2019) estimates the global production of Irish potatoes to be 388 million metric tonnes, yielding 20,110.8 kg per hectare. Additionally, developing nations produce over half of the world's total output, with China being the largest producer, accounting for 99,205,600 metric tonnes in 2017. Nearly one-third of global production is harvested in China and India (FAOSTAT, 2019).

Africa is also a key player in Irish potato production, contributing approximately 25 million metric tonnes and yielding 13,215.4 kg per hectare (FAOSTAT, 2019a). Nigeria, Egypt, Algeria, South Africa, and Morocco are among the leading producers on the continent. Other significant African producers include Tanzania, Kenya, Rwanda, and Uganda (AfDB, 2021; FAOSTAT, 2021). Globally, the per capita consumption of fresh and processed Irish potatoes is recorded at 34.64 kg (FAOSTAT, 2016).

In sub-Saharan Africa (SSA), demand for Irish potatoes has grown at an average rate of 3.1%, making it a leading staple food, particularly in East Africa (Wassihun *et al.*, 2019; Guluk & Obi-egbedi, 2021). In Tanzania, Irish potato production has been steadily increasing in recent years at an annual average rate of 11% and is expected to increase by 245% by 2025 (AfDB, 2021; FAOSTAT, 2021; Kilimo Trust, 2023). This growth in potato farming is partly due to the crop's relatively short growing season and its potential for multiple harvests within a year (FAOSTAT, 2017). According to Mpogole (2014) and TOSCI (2022), 80%-90% of the Irish potatoes produced by smallholders in Tanzania are sold, significantly contributing to employment creation and income generation for smallholder farmers and other stakeholders along the value chain. Data from the Ministry of Agriculture (2019) show that 337,803 metric tonnes of potatoes were produced in the 2018/19 season, with 282,404 metric tonnes (83%) coming from Southern Tanzania. The leading potato-producing regions are Njombe, Mbeya, Iringa, and Songwe, with Njombe region contributing the most (49.8%), followed by Mbeya (19%), Iringa (10.8%), and Songwe (3.9%) (MoA, 2019, TOSCI, 2022).

Irish potatoes are a vital crop for commercial purposes and food security in the southern highlands (Kabungo, 2008; Mende *et al.,* 2014; Mpogole, 2014; Mwatawala *et al.,* 2020). However, Irish potato production and marketing in Southern Tanzania remain informal, with small-scale farmers not benefiting from the production chain (TAHA, 2018). The crop faces various challenges that cause low productivity despite being an important food and cash crop (Mpogole, 2014; Mwatawala *et al.,* 2020). According to the SAGCOT (2018), there is a low Irish potato productivity per acre in the southern highlands. Smallholder Irish potato farmers encounter difficulties in achieving profitability due to factors such as failure to make decisions on choosing better marketing channels (Mgale & Yunxian, 2020). However, there are inadequate marketing structures, unspecified weights and measures, limited value addition, and a lack of crop promotion (Mende *et al.,* 2014; SAGCOT, 2018; Mwatawala *et al.,* 2020).

The term marketing channel refers to the various stages involved in taking a product from the producer to the consumer. This includes transportation, handling, storage, processing, and distribution. Agricultural marketing is crucial for the economic success of small-scale farmers. Small-scale farmers decide where to sell their produce based on factors such as transportation costs, potential profits, trustworthiness of different markets, and familiarity with the marketplace. Smallholder farmers' livelihoods are closely tied to agricultural incomes, directly impacted by access to output markets (Liu, 2018). These considerations help them make informed decisions about the best market outlets for their products (Kotler, 2002; Adu, 2018; Jebesa, 2019).

Choosing a marketing channel for smallholder farmers is very important in marketing, as it provides various price levels and demands searching for farmers (Mgale & Yunxian, 2020). When deciding which market outlets to choose, households must consider several factors. It is important to understand the characteristics of different marketing

channels and have the knowledge to make informed decisions. Knowing the factors influencing outlet selection is crucial because effective strategies can lead to increased crop production, investment, and farm income (Soe *et al.,* 2015). The information could help develop strategies to improve smallholder farmers' market access and increase their profitability. According to Muricho *et al.* (2015), it is crucial to comprehend the connections between marketing channels and the factors that influence the use of each channel. This understanding is vital for profiling markets and creating well-designed policy interventions that benefit farmers. Smallholder producers benefit from understanding each market channel's profitability, risk, cost structure, and requirements (Soe *et al.,* 2015).

Farmers typically prioritise options that offer higher benefits and will positively impact their household income when deciding which market outlet to choose. These decisions are specific to small-scale farmers and require consideration of multiple factors, as outlined by Jebesa (2019). Various factors can influence smallholder farmers' choice of markets, including their resources, access to outlets, prices, and transportation costs. According to the study by Nwafor (2021), smallholder farmers may sell their produce through low prices outlets due to a lack of market knowledge or challenges in accessing more profitable markets. Before selling their products, producers carefully consider their marketing options and evaluate the alternatives available, as noted by Mugenzi *et al*. (2021). The income earned from selling farm products depends on the farmer's expertise in production and sales, their bargaining and marketing skills, and the accessibility of outlets in the region (Olofsson, 2020).

Previous studies on Irish potatoes in Tanzania focused on agronomic practices, marketing efficiency, growth, and crop productivity (Msese & Mashenene, 2020; Mgema, 2021; Kassian *et al.,* 2023). Output growth is not determined by introducing new technology alone but by the increased choice of market outlets among agricultural producers in which technologies and inputs are used (Jwanya *et al*., 2014). Similarly, most marketing interventions are not geared to enhance producers' market choice of their produce (Panwall, 2018).

The government of Tanzania implemented several efforts to improve market access, such as the establishment of the programme for the Development of Agriculture in the Southern Region of Tanzania (SAGCOT), which is a partnership programme between the government and the private sector that was launched during the World Economic Forum - Africa (World Economic Forum - Africa) held in Dar-es-Salaam in 2010. The primary task of SAGCOT was to sensitize farmers to form cooperatives for market access (URT, 2015). Another effort made by the Government of Tanzania is to use the extension officers to assist farmers in forming farmers' groups for collective markets. Also, a study conducted by Mwatawala et *al*. (2020) revealed that for better market access, one of the common strategies to employ includes sensitizing programmes for smallholders to form or join farmer groups or associations for collective marketing. Other efforts include training farmers on using improved technologies to get better quality and quantity of Irish potatoes, which will help improve market access

(URT, 2020; HRDC, 2021; Ngozi *et al.,* 2024; MoA, 2022).

The decision to use a marketing channel for smallholder farmers is critical because it provides various price levels; the better the price, the better the market channel (Mgale & Yunxian, 2020). Households must consider several factors when deciding which market outlets to use. It is important to understand the characteristics of different marketing channels and have the knowledge to make informed decisions. Knowing the factors influencing outlet selection is crucial because effective strategies can lead to increased crop production, investment, and farm income (Soe *et al.,* 2015).

Hence, the a need to study the determinants of market outlet choices among Irish potato farmers to guide market developments for enhanced Irish potato production. This study aims to examine the determinants of market outlet choices among Irish potato farmers in Mbeya District, Southern Tanzania.

2. Materials and Methods

2.1. Description of Study Area

The study was conducted in the Mbeya district, located between 8°38"-9°20" South of the Equator and 33°01"-33⁰49" East of Greenwich. The district receives an annual rainfall that ranges from 650mm to 2700mm, and the average temperature fluctuates between 16°C and 25°C (Kimbi *et al.,* 2015; URT, 2018). Mbeya district and three specific wards (Bonde la Songwe, Isoto, and Ilembo) were selected purposefully because it is one of the leading producers of Irish potatoes in Tanzania (TAHA, 2019; TOSCI, 2022). For example, in the 2018/19 season, 48.9% of the total Irish potato production in the Southern Highlands came from this area (MoA, 2019). The district has good climatic conditions that favour the production of different varieties of potatoes. Concurrently, the Mbeya district was the major contributor to that share (Mwatawala *et al.,* 2020).

2.2.Study Design and Data Collection

Specifically, a cross-sectional survey design was used whereby the research team used a multi-stage sampling technique as outlined by Kothari (2004); there were two stages to this process. In stage one, the Mbeya district and three specific wards (Bonde la Songwe, Isoto, and Ilembo) were selected purposefully. In stage two, 96 small-scale farmers (households) were systematically randomly selected from 20,074 registered households in the selected wards, making a total sample of 288 small-scale farmers (URT, 2021). Data from households were collected using the semi-structured questionnaire and interview guide. Heads of households dealing with Irish potato production were purposively involved in the study because they are at the hub of decision-making at the household level (Mwatawala *et al.,* 2020). The questionnaire was designed to gather information on the socio-demographic characteristics of a household head and the determinant of market outlet choices of Irish potato producers. In-depth interviews with extension officers at district and ward levels were also carried out to gather more relevant data related to the study. Additionally, documentary reviews were conducted to gather important information related to potato production in the study areas.

2.3. Data Analysis

Data collected from the semi-structured questionnaire were coded, validated, sorted, and entered into the SPSS

software version 25 and exported to STATA version 15 for descriptive and econometric analyses. Before analysis, preliminary data exploration was done to check for missing values, duplicates and unusual observations. Some variables were combined to enhance the power of the groups. Variables like age, marital status, and education level were re-categorized based on previous literature for better interpretation and comparability between studies. The main dependent variable was market outlet choices.

Different econometric approaches were considered to analyse the determinants of market outlet choices among smallholder Irish potato farmers. Classical logistic regression was considered to determine the association between exposures and outcomes of interest. However, the model failed to converge because it requires the dependent variable to be binary (Wooldridge, 2010). Multinomial models (Multinomial logit/probit) were then considered to determine the association between market outlet choices and outcomes of interest among Irish potato farmers; the models failed, too, because they were obliged to choose only one outcome from a set of mutually exclusive and collectively exhaustive alternative lists of market outlets (Ermias, 2021). However, it is important to note that in this study, Irish potato farmers' market outlet selections are not mutually exclusive and collectively exhaustive. Therefore, the use of such models could lead to the possibility of simultaneous use of market outlets and a potential correlation among these selection decisions (Lekhisa & Muroyiwa, 2024). Since smallholder farmers' market outlets choice decisions were expected to be affected by the same set of explanatory variables, multinomial models did not consider the possibility of interdependence and simultaneous use of market outlets because they have an assumption of independence among the outcome variables (Abate *et al*., 2019). Since the market outlet decisions by Irish potato farmers are interdependent, there is also a problem of simultaneous use of market outlets (Ermias, 2021). Univariate probit estimation of choice of each type of market outlet would be misleading for the expected problem of simultaneity. The selection of one type of market outlet would depend on the selection of the other since smallholder farmers' decisions are interdependent, suggesting the need to estimate them simultaneously. To account for this problem, a Multivariate Probit Model (MVP) was employed (Dessie *et al.,* 2018; Abate *et al*., 2019; Lekhisa & Muroyiwa, 2024). MVP model examines the association between market outlet choices and outcomes of interest among Irish potato farmers; the model simultaneously models the impact of a set of independent variables on each of the different market outlet choices while allowing for the potential correlation between unobserved disturbances, as well as the relationship that exists between the different marketing outlets (Cappellari & Jenkins, 2003; Dessie *et al.,* 2018; Abate *et al*., 2019). The prior table of the variables used in the MVP is shown in Table 1.

Following Abate *et al*., 2019, the selection of appropriate market outlets i by fa, er j is Y_{ij}^{A} defined as the choice of the farmer j

to transact market channel i (Y_{ij}^{A}= 1) or not (Y_{ij}^{A} = 0) is expressed as follows:

$$Y_{ij}^{A} = \begin{cases} 1 \text{ if } Y_{ij}^{A} = X_{ij}^{A} \propto_{ij}^{A} + \mathcal{E}^{A} \geq 0 \Leftrightarrow X_{ij}^{A} \geq -\mathcal{E}^{A} \\ 0 \text{ if } Y_{ij}^{A} = X_{ij}^{A} \propto_{ij}^{A} + \mathcal{E}^{A} < 0 \Leftrightarrow X_{ij}^{A} < -\mathcal{E}^{A} \end{cases}$$

Where;

$\propto_{ij}^{A}$ is a vector of estimators, $\mathcal{E}^{A}$ a vector of error terms under the assumption of normal distribution, Y_{ij}^{A} the dependent variable for market outlet choices simultaneously and X_{ij}^{A} the combined effect of the explanatory variables. Since the market outlet choice decisions by smallholder Irish potato farmers in the study are affected by a similar set of independent variables, the econometric specification of the Multivariate Probit Model is stated as follows:

$$\begin{aligned} Retailer_{j} &= X_{1}\beta_{1} + \varepsilon^{A} \\ Wholesaler_{j} &= X_{2}\beta_{2} + \varepsilon^{B} \\ Broker_{j} &= X_{3}\beta_{3} + \varepsilon^{C} \\ \{Local\ market_{j} &= X_{4}\beta_{4} + \varepsilon^{D} \end{aligned}$$

Where Retailer j, Wholesaler j, Brokers j and Local market j are binary variables taking values of 1 when farmer j selects retailers, wholesalers, Brokers and local market respectively, and 0 otherwise; X_1 to X_4 are the vector of variables; $\beta 1$ to $\beta 4$ are vectors of parameters to be estimated and ε^{A} disturbance term.

In the multivariate model, the use of several market outlets simultaneously is possible, and the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity and ρij represents the correlation between endogenous variables, given by:

$$\begin{pmatrix} \varepsilon^{A} \\ \varepsilon^{B} \\ \varepsilon^{C} \\ \varepsilon^{D} \end{pmatrix} \ldots N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \begin{pmatrix} 1 & \rho 12 & \rho 13 & \rho 14 \\ \rho 21 & 1 & \rho 23 & \rho 24 \\ \rho 31 & \rho 32 & 1 & \rho 34 \\ \rho 41 & \rho 42 & \rho 43 & 1 \end{pmatrix}\right]$$

$$\begin{aligned} \mathrm{E}(\varepsilon/X) &= 0 \\ \mathrm{Var}(\varepsilon/X) &= 1 \\ \mathrm{Cov}(\varepsilon/X) &= \rho \end{aligned}$$

Table 1: Description of the model variables for the MVP

Variable	Category description
X_1 = Age of household head	Continuous (years)
X_2 = Sex of Household head	1 if male and 2 if female
X_3 = Education status	Continuous (no of years schooling)
X_4 = Farmers experience	Continuous (Number of years)
X_5 = Farm size	Continuous (acres)
$X_{6=}$ access to storage	1 if access, 0 if otherwise
X_7 = Access to off/non-farm Income (TZS)	1 if access, 0 if otherwise
X_8 = Distance to the nearest market	Continuous (Km)
$X_{9=}$ Market information	1 if accessed 0 if otherwise
X_{10} = Traditions and cultural	1 if there is, and determine the choice 0 if otherwise
X_{11} =Access to extension services	1 if access, 0 if otherwise
$X_{12=}$ Access to training	1 if access 0 if otherwise
$X_{13=}$ Market Policies& Regulations	1 if available and implemented 0 if otherwise
$X_{14=}$ Credit Access	1 if accessed 0 if otherwise

3. Results

3.1. Socio-Demographic Characteristics of the Study Farmers

Socio-demographic characteristics of 288 Irish potato smallholder farmers were analysed. The finding in Table 2 indicates that the majority (58.3%) of respondents were male, and the minority (41.7%) were female. This indicated that males were more involved in Irish potato production than females. This signifies that male farmers are more market-oriented and actively engaged in cash crop production to generate household income. Furthermore, Men may be more willing to take on the financial risks associated with cash crop farming, which can involve higher upfront investments and market uncertainties. The finding complies with the study by Mwatawala *et al.* (2020), who found that more men were involved in Irish potato production than females in Mbeya District. Also, the findings revealed that the majority (56.5%) of respondents were aged 36-45, which implies that most of the respondents were middle-aged youth who formed the working group. They are energetic and can offer their power to enhance high productivity; at this age group, they may have more experience, skills, and knowledge in Irish potato production than younger respondents. The finding complies with that of Abate *et al.* (2019), which suggests that middle age implies that respondents have good experience in crop production. Furthermore, the study found that 70.8% were married. Married couples are likely to be more productive than single people due to lack of mobility, hence offering labour supply. This implies that married couples engaged more in Irish potato production as the cash crop as a source of household income. Moreover, the study revealed that most respondents (54.5%) attended primary school. According to URT (2019), education equips people to face the existing challenges of the world, which is most likely to affect the production of Irish potatoes. This complies with the study of Mohammed *et al.* (2019), who concluded that education boosts the producers' knowledge and can be used to collect information, interpret the information received, and make knowledgeable and marketing decisions. Moreover, the findings revealed that the majority of households in the study area had family sizes exceeding five (58%) members, indicating that they have reasonable labour for Irish potato production (Wakaba *et al*., 2022).

Table 2: Socio-demographic characteristics of the study farmers (n=288)

Variables	Frequency (n)	Percent
Sex		
Male	168	58.3
Female	120	41.7
Age		
< 25	22	7.6
26-35	65	22.7
36-45	163	56.5
46-55	27	9.4
Above 55	11	3.8
Marital status		
Single/separated/widow	84	29.2
Married	204	70.8
Education status		
No formal education	16	5.6
Primary education	157	54.5
Secondary School and above	115	39.9
Family size		
0-5	121	42.0
Above 5	167	58.0

3.2. The Proportion of Market Outlets Chosen by Irish Potato Producers

The proportional analysis of market outlet choice shows that about (12.5%) of the farmers had a retail market outlet choice, (14.6%) of the farmers had a local market outlet choice, (19.4%) of the farmers had a wholesaler market outlet choice, and the majority (53.5%) of the farmers had brokers market outlet choice as shown in Figure 1. This implies that a significant portion of Irish potato producers in the study area prefer to sell their potatoes directly to brokers at the farm gate. Brokers at farm gate sales can offer farmers convenience and quick transactions. This finding complies with the study by Nwafor (2021), which showed that brokers at farm gates ranked as the first market outlets in South Africa where small-scale farmers used to sell cocoyam.

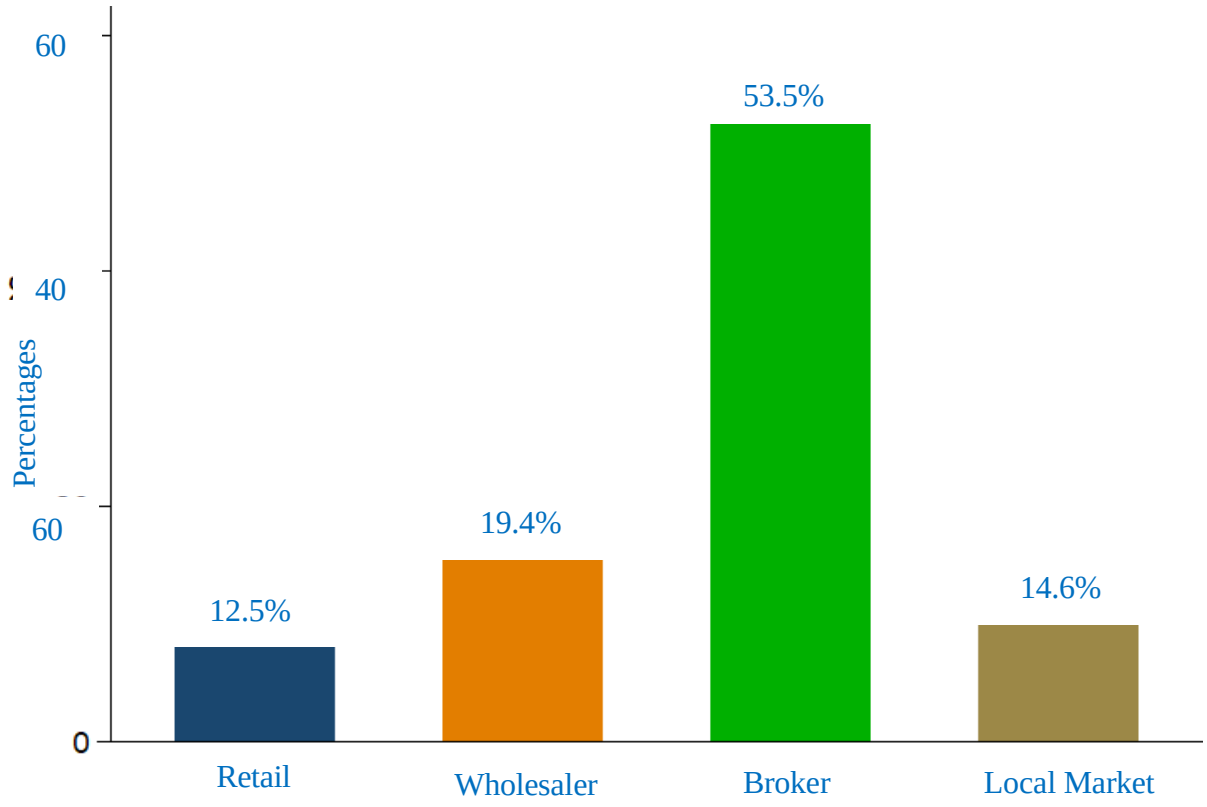

Figure 1: Bar graph showing market outlet choices

3.3. Model Fitness, Probability and Correlation Matrix of Market Outlets Choices

The multivariate probit model was used to jointly estimate several correlated categorical outcomes, as shown in Table 3. In this study, the decisions of Irish potato producers choosing brokers, wholesalers, local markets, and retailers' outlets are correlated. Given the binary nature of the decisions, the multivariate probit model was found to be appropriate for jointly predicting these four outlet choices on an individual-specific basis, and the parameter estimates are simulated maximum likelihood (SML) estimators. The Ward test=116.53 is statistically significant at the 5% significance level. This means that the subset of the model's coefficients is jointly significant and the explanatory power of the variables included in the model is acceptable. The likelihood ratio test in the model indicates that X^2 test =13.89 and prob>x^2=0.000* is statistically significant at the 1% significant level. This rejects the null hypothesis that the choices of the four market outlets are independent. That means the likelihood ratio test of the null hypothesis of independence between the market outlets decision ($\mu_{21}= \mu_{31}= \mu_{41}= \mu_{32}= \mu_{42}= \mu_{43}=0$) is statistically significant at a 0.1% significance level of precision, which shows the goodness of fit of the multivariate probit model. Therefore, the likelihood ratio test of independence indicates that there are different market outlet choice behaviours among smallholder Irish potato producer farmers. In this study, samples are drawn 3 times to increase accuracy, which indicates the precision level of the sample (Table 3).

The (μ) indicates the correlation of each dependent variable (Market outlet

choices). The μ_{21} correlation between retailer and wholesaler, the μ_{32} correlation between retailer and broker, the μ_{41} correlation between retailer and local market, the μ_{42} correlation between wholesaler and retailer, The μ_{42} correlation between local market and wholesaler, the μ_{43} correlation between local market and broker are negatively and statistically significant at 5%, 1%, 10%, 1%, and 1% significance level, respectively. The result indicates that farmers selling their Irish potato produce to the retailer's outlets are less likely to deliver to local markets, wholesalers, retailers, and broker outlets (Table 3).

The result in Table 3 also indicated the marginal success probability of each market outlet choice. The simulated maximum likelihood (SML) estimation result showed that the likelihood of choosing a broker is relatively higher (32.1%) than the probability of choosing a wholesaler (31.6%), local market (28.5%), and retailer (22.3%). This result revealed that retailer outlets are less likely to be chosen by Irish potato producer farmers than other outlets.

As indicated in Table 3, the joint probabilities of success or failure of choosing four outlets suggest that the likelihood of sample farmers jointly choosing the four outlets is low. The likelihood of sample Irish potato producer farmers jointly choosing the four outlets was 0.6%, which is lower than their failure to choose them (16.7%) jointly. This indicates that the possibility of choosing the joint market outlets is very low. This evidence suggests that choosing the right mix of market channels will be determined by different factors for each market channel

Table 3: Overall model fitness, probability, and correlation matrix of market outlet choices

Variables	Retailer	Wholesaler	Brokers	Local market
Predicted probability	0.223	0.316	0.321	0.285****
Joint probability of success	0.006			
Joint probability of failure	0.167			
Estimated correlation of market outlets				
μ_{21}		-0.185**		
μ_{31}		-0.405***		
μ_{41}		-0.156*		
μ_{32}		0.527		
μ_{42}		-0.203***		
μ_{43}		-0.443***		
Likelihood ratio test of $\mu_{21}= \mu_{31}= \mu_{41}= \mu_{32}= \mu_{42}= \mu_{43}=0$				
$X^2_{(6)}$ test =13.89 and prob>x^2=0.000***				
Number of observations=288				
Log likelihood=156.908				
Ward test=116.53		Prob> Chi^2=0.001**		

(*) Indicates significance at the 10% level, (**) indicates significance at the 5%, and (***) indicates significance at the 1% level.

3.4. Determinants of Market Outlet Choices of Irish Potato Producers

The results in Table 4 indicate that out of the 14 explanatory variables used in the model, the age of the respondent, education status, farm size, distance to market, market information, access to extension services, and access to credit statistically significantly affected farmers' choice of market outlets.

3.4.1. Age of the respondent

The age of the household head was found to have negatively significant effects on choosing retailer outlets at a 10% significance level and negatively significant effects on choosing local market outlets at a 10% significance level. This implies that for every one-year increase in age, the probability of farmers selling their produce to retailer outlets decreases by 3.4% unit on average, and an increase of one year of age decreases the probability of farmers selling their produce to local market outlets by 21% unit on average. The possible reason could be that the older household head appears not to trust the price given by retailers' market outlets and local traders' market outlets and instead prefers brokers' market outlets and wholesalers' market outlets that offer a reasonable buying price for Irish potatoes. This result is in line with the study of Dissie et al. (2018), who affirmed that older household heads appear not to trust the price given by local traders and instead prefer urban traders like wholesalers to form a long-term relationship and to get a reasonable selling price of wheat.

3.4.2 Education status

The education status of the farmers was found to have positively significant effects on choosing broker outlets at the 10% significance level. This means that for every increase in the level of education, the probability of farmers selling their product to broker outlets increases by 42.5% units on average. The result shows that as a farmer's education increases, the level of education, they can learn what type of production inputs are used, how to produce more and sell more, and they become informed to decide to select a preferable market outlet channel over the existing channels. The result is in line with the research results of Sori & Adugna (2022), who identified that education level positively affects producers' probability of selecting brokers' market channels, which enables them to get a high price from other existing market outlets.

3.4.3. Farm size

The average farm size was found to have negative significant effects on the choice of retailer outlets at the 5% significance level. This means that, for every one-acre increase in average farm size, the probability of farmers selling their product to retailer outlets decreases by 7.8% units on average. This indicates that those households that allotted a large size of land for Irish potato production would produce more output, and farmers would be more likely to sell their produce to wholesalers, blockers or local market outlets and less likely to sell their produce to retailers' market outlets. This means farmers receive higher prices from wholesalers, blockers, or local market outlets than retailer market outlets when selling their Irish potato produce. This may be due to the fact that producers with large land sizes are likely to participate more in wholesalers,

blockers, or local markets as they have a scale advantage in reducing the costs of taking products to distant markets. This result is consistent with Abate et al. (2019), who found that households with larger land sizes increase the probability of choosing distance market outlets.

3.4.4 Distance to the nearest market

Distance to the nearest market was found to have negatively significant effects on choosing broker market outlets at the 1% significant level. This means that for every kilometre increase in the nearest market, farmers' average probability of selling their product to broker market outlets decreases by 81.9% unit. This result revealed that for those households whose residence from the nearest market increases by a kilometre, the likelihood of households choosing broker market outlets decreases by 81.9%. This implies that households far from the nearest market are less likely to deliver Irish potato produce to broker market outlets. This is because farmers located far from the market have limited access to the broker market outlets. This result is consistent with Getahun (2018), who found that distance to the market reduces producers' likelihood of selling to wholesaler market outlets.

3.4.5. Market information

Market information was found to have negatively significant effects on choosing retailer outlets at the 10% significance level and positively significant to wholesaler outlets at the 5% significance level. This means that for every increase in market information, the probability of farmers selling their product to retailer outlets decreases by 6.9% unit on average, while the probability of farmers selling their product to wholesaler outlets increases by 16.5% unit on average. The MVP model results revealed that the coefficients for market information for farmers are negatively significant to retailer market outlets and positive to wholesaler market outlets in the study area. This indicates that information received by farmers on retailer market outlets did not significantly influence farmers' choices compared to wholesaler market outlets utilised by farmers in the study area. According to Abate *et al.* (2019), knowledge of market information such as prices, quality and quantity, and other market requirements helps farmers to make informed decisions while marketing their agricultural output. Knowledge of reliable market information helps to reduce transaction costs associated with searching for the market, contracting, and enforcing the contract (Mgale & Yunxian, 2020). The result aligns with (Mmbando *et al.*, 2016), who identified that access to market price information is directly related to households' choice of wholesaler market channel.

3.4.6. Access to extension services

Access to extension services was found to positively affect choosing wholesaler market outlets at a 5% significance level. This means that for every increase in excess of extension services, the probability of farmers selling their Irish potato produce to retailer market outlets increases by 90.1% units on average. This positive correlation implies that increased access to extension services by Irish potato farmers increases their chances of choosing them as their market outlets for Irish potato produce. This could be due to the reason that access to

extension services gives farmers timely and reliable market information, such as market demand, price, and quantities required, and by equipping them with this information, farmers are better prepared to engage the retailer market outlets. Frequent access to agricultural extension services for farmers improves their knowledge, skills, and marketing capacity, which helps them improve their production and select both appropriate and profitable market outlets (Ahmed et al., 2017). This result agrees with Lekhisa & Muroyiwa (2024), who found that access to extension services has a positive and significant influence on retailer market outlet choice by broiler farmers in Lesotho.

3.4.7. Access to Credit

Access to credit was found to positively affect choosing wholesaler outlets at a 1% significant level. This means that, for every increase in access to credit, the probability of farmers selling their product to wholesaler outlets increases by 41.6% units on average. In the study area, Irish potato producers usually borrow money from lenders to buy inputs such as quality seeds, fertilisers, and pesticides. In contrast, those who utilise inputs tend to have more significant production to sell to wholesaler market outlets. Credit availability increases farmers' confidence in producing more Irish potatoes. It significantly increases the likelihood of Irish producers selling to large-scale traders (wholesaler market outlets) compared to other market outlets (Mgale & Yunxian, 2020).

Table 4: Multivariate probit estimations for determinants of market outlet choices

Variables	Coefficients (Choices of market outlets)			
	Retail	Wholesaler	Brokers	Local market
Age of household head	-0.034*	-0.61	0.17	-0.207*
Sex of household head	-0.23	-0.32	-0.21	-1.125
Education status	0.76	0.37	0.425*	-0.589
Farmers experience	0.067	0.22	0.34	0.439
Farm size	-0.078**	0.04	0.64	0.629
Access to storage	0.3	0.14	0.18	0.245
Access to off/non-farm Income (TZS)	0.46	0.011	0.24	0.67
Distance to the nearest market	-0.13	-0.94	-0.819***	-3.301
Market information	-0.069*	0.165**	0.11	0.21
Access to market	0.2	0.003	0.26	0.159
Traditions and cultural	-0.71	0.108	-2.07	0.629
Access to extension services	0.901**	0.667	0.19	0.062
Access to training	0.018	0.35	0.67	0.245
Policy & regulation	0.084	0.23	0.019	0.301
Credit access	0.98	0. 416***	0.71	0.21
Constant	0.0041	0.013	-1.99*	0.231

(*) Indicates significance at the 10% level, (**) indicates significance at the 5%, and (***) indicates significance at the 1% level.

4. Conclusion

This study examined the determinants of market outlet choices among Irish potato farmers. The results of the study affirm that the age of the household head, education status, farm size, distance to the nearest market, market information, access to extension service, and access to credit were found to be significantly influencing the choice of the household's potato market outlets. The study also shows that brokers are the most likely to choose market outlets, while retailers are the less likely to choose market outlets. The joint probability of farmers choosing the four market outlets is lower than the likelihood of not choosing four market outlets. The probability of choosing retailer market outlets was affected by the age of the household head, farm size, market information and access to extension services. Market information and access to credit affected the probability of choosing wholesaler market outlets.

Moreover, the likelihood of households choosing broker market outlets was affected by education status and distance to the nearest market. Likewise, the probability of households choosing local market outlets was affected by the age of the household head. Hence, based on the findings of this study, the concerned bodies should give information to farmers on the importance of education and extension services because farmers know how to use inputs for improved production at a convenient time for Irish potatoes production and get better prices in the marketing activities of their Irish potato products and facilitate the time to search the appropriate market channel. Appropriate policies should be strengthened to facilitate all necessary infrastructures for improving Irish potato production and marketing systems. This means that the concerned body should establish an Irish potato market centre near the farmer's residence or production area. Farmers should rely on intensive cultivation to increase the production and productivity of Irish potatoes. The study also suggested that improving the existing production system, farmers relying on intensive cultivation, giving better prices for farmers, and being members of any cooperative are important strategies for selecting the appropriate market outlets. Generally, the government could take decisive intervention to upgrade producers through improving trade regulation of Irish potatoes.

References

Abate, T. M., Mekie, T. M., & Dessie, A. B. (2019). Determinants of market outlets choices by smallholder teff farmers in Dera district, South Gondar Zone, Amhara National Regional State, Ethiopia: a multivariate probit approach. *Journal of Economic Structures*, *8*, 1-14.

Adu, E. (2018). *Factors affecting smallholder paddy rice farmer's choice of marketing channel in the northern region of Ghana: a thesis submitted in partial fulfilment of the requirements for the degree of Master of AgriCommerce at Massey University, Palmerston North, New Zealand* (Doctoral dissertation, Massey University).

Ahmed, J., Umare, A., Mahamed, N., Galane, O., & Desse, K. (2017). Factors affecting groundnut market outlets choice in moisture stress area

of Babile District, Eastern Ethiopia: Multivariate Probit Approach. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EESs)*, *7*(2), 91-101.

Cappellari, L., & Jenkins, S. P. (2003). Multivariate probit regression using simulated maximum likelihood. *The STATA journal*, *3*(3), 278-294.

Dessie, A. B., Abate, T. M., & Mekie, T. M. (2018). Factors affecting market outlets choice of wheat producers in North Gondar Zone, Ethiopia. *Agriculture & Food Security*, *7*, 1-8.

Ermias, D. (2021). Econometric analysis of factors affecting market outlets choice of mango fruit producers in Hadero Tunto Zuriya District, Southern Ethiopia. *Cogent Food & Agriculture*, *7*(1), 1891660.

FAO. (2020). *World Agricultural Statistics*. Statistics Division, Food and Agricultural Organization: Rome, Italy.

FAOSTAT. (2016). *Food and Agricultural Organization Statistical Database*. Retrieved from http://faostat3.fao.org/download/FB/CC/E on 30 August 2024.

FAOSTAT. (2017). *Food and Agriculture Organization of the United Nations Statistics*. Retrieved from http://www.fao.org/faostat on 22 September 2024.

FAOSTAT. (2019a). *Food and Agricultural Organization Statistical Database*. Retrieved from http://www.potatopro.com/world/potato-statistics on 22 September 2024.

FAOSTAT. (2021). *Food and Agriculture Organization Corporate Statistical Database*. Retrieved from http://www.fao.org/faostat/en/#data/QC on 19 September 2024.

Getahun Tefera, A. (2018). *Determinants of commercialization and market outlets choices of Tef: the case of smallholder farmers in Dendi district of Oromia, Central Ethiopia* (Doctoral dissertation, Haramaya university).

Gulak, D. M., & Obi-Egbedi, O. (2021). Technical Efficiency of Irish Potato Production: A Case Study from Nigeria. *Review of Agricultural and Applied Economics (RAAE)*, *24*(2), 112-120.

Horticultural Research and Development Centre (HRDC). (2021). *Extension Services Report*.

https://www.statista.com/statistics/1169641/production- volume-of-potatoes-in-tanzania/ (accessed on September 17, 2023).

Jebesa, S. R. (2019). Determinants of smallholder farmers market participation and outlets choice decision of agricultural output in Ethiopia: A review. *American journal of agriculture and forestry*, *7*(4), 139-145.

Kabungo, C. V. (2008). *Evaluation of Irish potato production and marketing performance: A case study of Mbeya Rural District, Mbeya Region, Tanzania* (Doctoral dissertation, Sokoine University of Agriculture).

Kassian, L. M., Majule, A. E., & Lyimo, J. G. (2023). Soil fertility improvement practices and round potato production among smallholder farmers in two gradients in Southern Highlands, Tanzania. *Tanzania Journal of Agricultural Sciences*, *22*(2), 316-326.

Kimbi, E., Lekule, F., Mlangwa, J., Mejer, H., & Thamsborg, S. (2015). Smallholder pigs production systems in

Tanzania. *Journal of Agricultural Science and Technology A*, *5*(2015), 47-60.

Kothari, C. R. (2004). Research methodology: Methods and techniques. *New Age International*.

Lekhisa, K., & Muroyiwa, B. (2024). Determinants of Market Outlets Choice for Smallholder Broiler Farmers in Leribe District of Lesotho. *Journal of Social and Development Sciences*, *14*(2 (S)), 13-26.

Liu, Y. (2018). Determinants and impacts of marketing channel choice among cooperatives members: Evidence from agricultural cooperative in China.

Mende, D. H., Kayunze, K. A., & Mwatawala, M. W. (2014). Contribution of round potato production to household income in Mbeya and Makete districts, Tanzania.

Mgema, J. M. (2021). The role of socio-economic groups on rural Irish potato seed obtainability in Lushoto district, Tanzania.

Msese, L. R., & Mashenene, R. G. (2020). Rural-Urban Dynamics: Irish Potato Production Investment Opportunities And Emerging Markets In Njombe, Tanzania. *East African Journal of Social and Applied Sciences [EAJ-SAS]* 2(1), 59.

Mgale, Y. J., & Yunxian, Y. (2020). Marketing efficiency and determinants of marketing channel choice by rice farmers in rural Tanzania: Evidence from Mbeya region, Tanzania. *Australian Journal of Agricultural and Resource Economics*, *64*(4), 1239-1259.

Ministry of Agriculture, Tanzania (2022). *Irrigation and Water Management Report*.

Mmbando, F. E., Wale, E., Baiyegunhi, L. J. S., & Darroch, M. A. G. (2016). The choice of marketing channel by maize and pigeonpea smallholder farmers: evidence from the northern and eastern zones of Tanzania. *Agrekon*, *55*(3), 254-277.

Mohammed Kassaw, H., Birhane, Z., & Alemayehu, G. (2019). Determinants of market outlets choice decision of tomato producers in Fogera woreda, South Gonder zone, Ethiopia. *Cogent Food & Agriculture*, *5*(1), 1709394.

Mpogole, H., & Kadigi, R. M. (2012). Round potato (Solanum tuberosum) profitability and implications for variety selections in the Southern Highlands of Tanzania.

Mugenzi, P., Owour, G., & Bett, H. K. (2021). Factors Influencing Smallholder Potato Farmers' Choice Decisions of Market Outlets in Musanze and Nyabihu Districts, Rwanda: A Multivariate Probit Model.

Muricho, G., Kassie, M., & Obare, G. (2015). Determinants of market participation regimes among smallholder maize producers in Kenya.

Mwatawala, H., Mwakijele, E., & Mpogole, H. (2020). Strategies for Enhancing Productivity and Profitability of Irish Potato in Mbeya District, Tanzania.

Ngozi, S., & Feleke, S. (2024). Enhancing youth's retention in potato farming enterprise through consortium agribusiness models in Tanzania. Crop Science, 64(3), 1421-1431.Mwangi,

Nwafor, C. U. (2021). Marketing channel preference among smallholder cocoyam farmers in South Africa. Journal of Agribusiness and Rural Development, 62(4), 407-414.

Olofsson, M. (2020). Socio-economic differentiation from a class-analytic perspective: The case of smallholder tree-crop farmers in Limpopo, South Africa. Journal of Agrarian Change, 20(1), 37-59.

SAGCOT (2018) Empowering smallholder farmers Southern Agricultural Growth Corridor of Tanzania.

Soe W.P.P., Moritaka M., Fukuda S. (2015): An analysis of the factors influencing marketing channel choice by paddy rice farmers in Myanmar. Journal of the Faculty of Agriculture, Kyushu University, 60: 535–54

Sori, O., & Adugna, M. (2022). Determinants of groundnut producers' market channel choice in Western Oromia region, Ethiopia. *Journal of Agriculture and Food Research*, *7*, 100277.

TAHA (2018). Report of Irish potatoes in southern Highland. USAID Report

The United Republic of Tanzania, (2021). Agriculture basic data. National Bureau of Statistics, Ministry of Agriculture, food security and Cooperatives. http://www.fao.org/docrep/V8260B/V8260B1m.htm. Accessed 28/8/2024

.

TOSCI Tanzania Official Seed Certification Institute (2022). Potato Variety Catalogue of Tanzania 2022.

The United Republic of Tanzania. (2015). Agricultural Sector Development Strategy-II 2015/2016–2024/2025. *Ministry of Agriculture.*

The United Republic of Tanzania. (2018). Mbeya Region Socio-Economic Profile. National Bureau of Statistics, Ministry of Finance and Planning, and Mbeya Regional Secretariat.

United Republic of Tanzania (2019). Education sector performance report 2018/2019: Tanzania Mainland. Dodoma, Tanzania: Ministry of education, science and technology.

The United Republic of Tanzania (2020) Tanzania Agricultural Research Institute, Tanzania Mainland, Dodoma,

Wakaba, D., Ateka, J., Mbeche, R., & Oyugi, L. (2022). Determinants of Irish potato (Solanum tuberosum) commercialization and market participation by farmers in Nyandarua County, Kenya. Journal of Agriculture and Food Research, 10, 100382.

Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data. MIT press