FACTORS AFFECTING CHOICE OF OUTLETS FOR IMPROVED PIGEON PEAS AMONG FARMERS IN TAITA TAVETA COUNTY

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ABSTRACT

Improved pigeon pea (*Cajanus cajan*) is a high-yielding climate-smart crop produced by smallholder farmers in arid and semi-arid lands (ASALs) for cash income. However, productivity of improved pigeon pea varieties in Taita Taveta County declined over the years. Decline in productivity of the improved pigeon peas could be attributed to the type quality of varieties produced and market accessibility. Thus, this study determined the varieties produced, the accessed markets and the factors influencing the choice of the outlets by farmers. A four-stage sampling procedure was used to select 297 farmers who were interviewed using structured questionnaires. The results of Multivariate probit model showed that inproved pigeaon pea varieties; KAT 60/8 (*P=0.046*), ICEAP00557 (*P<0.001*), ICEAP0077 (*P=0.008*) and ICEAP0055 (*P<0.001*), ICEA P0077 *(P=0.008)* and ICEA P00850 (*P=0.035)* had an influence on the choice of market outlet. It was also revealed in the number of assets owned (*P≤0.005*), household size (*P≤0.005*), quantity harvested (*P<0.001*), group membership (*P<0.05*), farm-size under pigeon pea (*P=0.046)* influenced pigeon pea marketing. The adopted varieties were KAT60/8, ICEAP 00850, ICEAP00777, ICEAP 0557, and ICPL89091 while the chosen outlets were consumers, brokers, and retailers. Retailer outlet comprised 36% of the farmers, consumers (33%) and brokers (31%). This study recommends that the Government should integrate high-end markets to increase prices and farmers' incomes.

INTRODUCTION

Pigeon pea (*Cajanus cajan*) is a legume produced mainly by smallholder farmers in developing countries (Sharma *et al*., 2011; FAO, 2012). Previou studies documented that India produced 70% of the total world production of pigeon pea, followed by Myanmar, Malawi, Kenya and Tanzania in 2018 (Indexbox, 2018). India hasbeen reported as the top producer of pigeon pea, followed by Mozambique, Myanmar, Tanzania and lastly Kenya (FAO, 2021). Despite the fact that India is the largest producer of pigeon pea, it is reported to be the largest importer of the same, accounting for 90% of the total imports in 2020 (FAO, 2021). Other major importers of pigeon pea include Zimbabwe, United States, Peru, United Kingdom, Malaysia, Australia, Sri Lanka, Nepal and Canada (FAO, 2021). Myanmar was reported to be the largest exporter of pigeon pea, accounting for approximately 90% of the export volumes in 2018 while Tridge 2021 reported that Mozambique exported more pigeon pea in 2020. Kenya is ranked fourth in exportation of pigeon pea, after Tanzania and Sudan (FAO, 2021).

In Kenya, pigeon pea is the third most important legume after green grams and beans, cultivated on about 0.24 million hectares in the arid and semi-arid lands (ASALs), especially for cash (FAOSTAT, 2021). According to Food and Agriculture Organisation Corporate Statistical Database (FAOSTAT, 2021) Kenya increased its annual production of pigeon pea from 85,684 tons in 2018 to 123,627 tons in 2020. The most producing Counties of pigeon pea in Kenya are Machakos, Makueni and Kitui (KIA, 2020; Esilaba *et al*., 2021). According to Kenya Agricultural and Livestock Research Organisation (KALRO, 2019), pigeon pea has been up scaled in Machakos, Makueni, Kitui, Tharaka Nithi and Nyeri counties, neglecting Taita Taveta and Elgeyo Marakwet which are also pigeon pea producing counties in Kenya (Otieno, 2010; FAOSTAT, 2015; MoALF, 2017; CGoM, 2019;). Nevertheless, according to Indexbox (2018) statistics, Kenya had the average consumption of 6.72 kg of pigeon pea per person yearly, which left farmers with surplus for sale. The surplus gives Kenya a likelihood of increasing exports to international markets especially in the Sub-Saharan Africa where the crop is prioritized for the attainment of food security goal due to its nutritional and environmental benefits when productivity is increased (Lindgren *et al*., 2018).

As such the government of Kenya, developed several strategies such as *Poverty Reduction Strategy Paper* of 2001-2004 (RoK, 2001) and *Kenya Vision 2030* of 2008-2030 (RoK, 2007) that are vital in exploiting the available opportunities for economic development. In particular, the agricultural strategies including Strategy for Revitalizing Agriculture of 2004- 2014 (RoK, 2004), Agricultural Sector Development Strategy of 2010-2020 (GoK, 2010) and the Agricultural Sector Transformation and Growth Strategy of 2019-2029 (RoK, 2016) have also been developed by the ministry of Agriculture, Livestock and

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Fisheries mainly to improve productivity for agricultural products. This gives pigeon pea farmers an opportunity to increase their incomes through increased sales channelled to different market outlets.

The decision by pigeon pea farmers to choose market outlets for their produce is depended on the need to maximize farm income (Shewaye, 2016). However, the decision to choose an outlet is household-specific, and under the influence of various factors such as the resource endowment of the farmer, accessibility of the market outlet, prices of the output in different outlets, farm size of the farmer; contract arrangements between the farmer and the buyer; and the transportation cost to the accessible markets (Shewaye, 2016; Honja *et al*., 2017; Tarekegn *et al*., 2017). Jagwe and Machethe (2011) indicated that transaction costs like time spent looking for a trading partner, price negotiations and packaging costs significantly influence the decision of a smallholder farmer to choose a particular market outlet. However, for pigeon pea farmers, it is not clear whether the improved variety of pigeon pea produced influences the decision of a farmer to choose an outlet. Thus, determining the adopted varieties of improved pigeon pea among farmers is key in fostering further innovations of the existing varieties for increased productivity targeting consumers.

Improved varieties of pigeon pea including KAT60/8, ICPL87091, ICEAP00557, peacock, ICEAP00554, KARI Mbaazi 1 and 2, KAT777, Egerton Mbaazi M1, KAT/ Mbaazi 3 and ICEAP00777 were developed and distributed to smallholder farmers. These improved varieties have different characteristics in terms of size, protein content, colour, aroma, maturity period, productivity, and taste which may affect the choice of marketing channels among smallholder farmers. This study therefore intended to determine the improved varieties of pigeon pea adopted by smallholder farmers in Taita Taveta County and how the adopted varieties affected the choice of a market outlet among farmers.

Theoretical Framework

This study was based on a random utility theory (McFadden, 1973). The model assumed that different farm households assessed their expected utilities for the accessible marketing outlet. Expected utility was determined by a set of explanatory variables influencing farmers' choice of market outlet. A market outlet with the highest utility was chosen by the farmer for the sale of his or her pigeon pea output. The farmer examined his or her net distribution by considering the certainty equivalent for each market outlet by calculating its associated costs. Since smallholder pigeon pea farmer's decision to deliver pigeon pea to a particular outlet and leave the other was seen as a multi-choice problem, the decision to deliver to that particular outlet depended on maximum utility or net return derived from the outlet.

A farmer *I* faced with a decision to choose from among the different market outlet alternatives was perceived to attain a certain level of utility from each alternative based on their characterization as shown below:

$$U_{ij} = \beta X_j + \varepsilon_j \quad \text{..... (1)}$$

Where;
U_{ij} was the maximum utility that an ith individual derived from choosing *a jth* market outlet.

X_{ij} Vector of explanatory variables
β Estimated parameter
ε_{ij} the error term

Since we could only observe some of the attributes of market outlet chosen by farmers but not farmers' utility, we, therefore, decomposed farmers' utility into deterministic V_{ij} and random error terms ε_{ij} as given in the following equation:

$$U_{ij} = V_j + \varepsilon_j \quad \text{..... (2)}$$

Where;
U_{ij} is the channel choice, V_{ij} is the indirect utility and ε_{ij} is the random error term.

The choice strategy was given by the probability of choosing one outlet and leaving the others or the probability of choosing to deliver to more than one market outlets.

MATERIAL AND METHODS

The study adopted a multi-stage sampling technique. In the first stage, Taita Taveta County was purposively selected as it is among the potential pigeon pea producing counties with limited research on the crop. The County is also among the targeted areas for the Kenya Climate Smart Agricultural Project. Secondly, Voi Sub-County was purposively selected from the four sub-Counties (Mwatate, Wundanyi, Voi and Taveta) as it is the driest Sub-County suffering from food insecurity, thus pigeon pea production can improve food security and increase household income as Voi is the largest town in the County, which avails market for pigeon pea farmers (MoALF, 2016). In the third stage, Kasighau, Mbololo and Maungu

wards were selected purposively as they have the highest number of smallholder farmers producing improved pigeon pea varieties, for both commercial and home consumption according to the reports of Voi Sub-County, ministry of agriculture.

In the fourth stage, proportional random sampling was used to select smallholder pigeon pea farmers from the Wards since they were not of the same size (Mbololo=385, Marungu= 367 and Kasigau=400). Finally, simple random sampling was used to select individual smallholder pigeon pea farmers in each Ward. A total of 297 smallholder farmers producing improved varieties of pigeon pea were reached using Yamane (1967) formula:.

$$n = \frac{N}{1 + N(\ell^2)}$$

Such that

$$n = \frac{1152}{1+1152(0.05^2)} = 296.91 = 297$$

The sample was randomly selected and proportionately distributed among the three wards; Maungu (89), Mbololo (89) and Kasighau (119) (Table I).

TABLE I-TARGET POPULATION AND DISTRIBUTION OF SAMPLES IN WARDS

Sub-County	Wards	Target Population	Proportionate	Sample size
Voi	Mbololo	385	0.3	89
	Marungu	367	0.3	89
	Kasigau	400	0.4	119
Total		1152	1	297

Single-farm interviews were employed in collecting data using structured questionnaires. Choices of market outlets, the dependent variables, were in binary form for all the three outlets. One indicated a choice for a particular market outlet and zero otherwise. According to Deb and Trivedi, (1997) and Greene, (2002), a binary selection model fits this analysis as the dependent variable is dichotomous. The four market outlets chosen were consumers (direct consumers, hotels/restaurants and institutions such as learning institutions), brokers and retailers The primary data that was collected included the socio-economic characteristics of the farmers, membership to farmers group, market outlets chosen by farmers in channelling their pigeon pea produce, quantity of pigeon pea harvested in the main growing season 2020-2021 and the improved variety produced. Primary data collected was then coded, recorded, cleaned and analysed using SPSS version 25 and STATA version 16.

Multivariate Probit (MVP) modelling was used in simultaneously determining the influence of a set of independent factors on the choice of the outlets by smallholder farmers producing improved pigeon pea varieties. Smallholder pigeon pea farmers are more likely to choose more than one market outlet so as to maximize their income and minimize risks associated with choosing one market outlet (Arinloye *et al*., 2015). This multivariate decision of selection ruled out univariate modelling as such modelling could omit important economic information that is in the interdependent and simultaneous decisions of choice (Dorfman, 1996). Independent estimation of binary equations leads to biased and inefficient estimates as the analysis does not allow for correlation of error terms. Thus, MVP model was used in modelling the selection decisions so as to overcome the univariate modelling shortcomings.

Multivariate Probit model is useful in regressing a combination of numerous correlated binary equations against single vector of independent variables (Cappellari and Jenkins, 2003; Kassie *et al*., 2013; Teklewold *et al.,* 2013). The error terms between binary correlated coefficients of the equations for the three outlets were estimated in order to determine the appropriateness of the relationship between the outlets and the MVP model for analysis. According to Green, (2000), a decision of a farmer to choose an outlet in an expected utility framework is grounded on the random utility theory. The utility is determined by a set of explanatory variables which have an effect on the choice of market outlet by a farmer. However, the utility gained by the farmer is not observable, thus his/her action is observed via the choice he/she makes. Therefore, for a farmer to choose a particular outlet over the other, that particular outlet should be able to give a farmer the highest benefit compared to the other outlets.

Consider a pigeon pea farmer *I* (*I* =1…. *N),* who needs to

decide whether or not to choose a particular outlet *j* (*j=1, 2 and* 3) over a one time period, to get the highest net benefit *y*. The farmer can choose j^{th} market outlet if;

$$y_j = u_j - u_0 \geq 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The net benefit y_j that farmer *I* derives from choosing a market outlet as a latent variable determined by observed independent variable x_i and disturbance term ε_i is expressed as;

$$y_{ij} = x_j \beta_j + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

With j =1, 2, …, n., $y_i = 1$ If $y_i \geq 0$ and 0 otherwise
Where;

explained variable for channel choice of broker, retailer and consumers

x_j = the combined effect of the explanatory variable
β_j = vector estimator
ε_i = error term

In this multivariate modelling, the error term jointly follows a multivariate normal distribution (MVN) with zero conditional means and a variance normalized to unity (for identification of parameters)

$$(u_{x1}, u_{x2}, u_{x3}, u_{x4}, u_{x5}) \text{ MVN} \approx (0, \Omega).$$

In the analysis, several variables affecting choice of market outlets by farmers were modelled. The factors included improved variety produced; and household socio-economic characteristics, market factors, transaction factors, and institutional factors derived from the previous studies (Jagwe and Machethe, 2011; Mabuza *et al*., 2014; Arinloye *et al*., 2015; Geoffrey *et al.,*2015; Mutura *et al*, 2015; Abera*.,* 2016; Honja *et al*., (2017); Tarekegn *et al.,* 2017; Mulbah *et al.,* 2021).

RESULTS AND DISCUSSION

The results of the descriptive statistics for continuous variables of households are in Table II. The results showed that household size ranged from a minimum of two to a maximum of thirteen. Households that chose consumer and retailer market outlets had approximately 6 people, while those who chose broker market outlet had approximately 5 people. There was a statistical [t (295) = -2.326, P=0.021] difference of mean harvest for farmers who sold their produce to retailer market outlet. The number of people in a household determines the rate of consumption, hence influencing marketable quantity of farm produce (Kiran and Dhawan, 2015).

The farmers' selling experience for pigeon pea ranged from a minimum of one to a maximum of 40 years. This implies that there were farmers with little experience and others with more experience in pigeon pea production. The mean years of marketing experience of farmers who sold pigeon pea to consumers, brokers and retailers was 1.4, 1.7 and 1.6 years, respectively. There was a statistical [t (295) = 3.542 P=0.001] difference in the mean years of experience for farmers who participated in consumer market outlet. Less experienced farmers chose to sell the improved pigeon pea direct to consumers. Experience is likely to create a strong long-lasting bond and trust between a farmer and the buyer, making it difficult for farmers to use alternative market outlets.

The amount of pigeon pea harvested ranged from 2 kg to a maximum of 600 kg. The large difference between the quantities harvested can be attributed to the effect of wildlife attack and poor management practices of the crop (Autio *et al*., 2021). The average quantity of improved pigeon pea harvested by farmers who sold via consumer outlet, brokers and retailers were 72.38 kg, 75.85 kg, and 53.13 kg, respectively. However, there was a statistical [t (295) = -2.680, P= 0.0078] difference in the mean of the quantity of pigeon pea harvested by farmers who channelled the improved pigeon pea to consumer market outlet. There was also a statistical [t (295) = -3.16, P= 0.0017] difference in the quantity of pigeon pea harvested by farmers who channelled it through the broker outlet. The quantity of harvest is likely to determine the quantity to be sold thus influencing the type of marketing outlet to be used.

There were five improved pigeon pea varieties adopted by smallholder farmers. They included KAT60/8, ICEAP 00850, ICEAP00777, ICEAP 00557, and ICPL89091. Results showed that more farmers grew variety ICEAP 00557 followed by ICPL89091. Comparison categorical variables for participants and non-participants in each market outlet was done using a chi-square (Table II).

TABLE II - CONTINUOUS VARIABLES DESCRIBING THE SOCIOECONOMIC CHARACTERISTICS OF FARMERS PARTICIPATING IN CONSUMER, BROKER OR RETAILER MARKET OUTLET

Continuous variables	Consumer outlet (n=129)			Broker outlet (n=122)			Retailer outlet (n=142)		
	Yes Mean (SD)	No Mean (SD)	t-score	Yes Mean (SD)	No Mean (SD)	t-score	Yes Mean (SD)	No Mean (SD)	t-score
Age	52.91(14.33)	49.98(13.71)	-1.79	51.02	51.42(13.31)	0.24	50.34(14.08)	52.09(14.00)	1.07
H/H size	5.47(2.24)	5.66(2.56)	0.69	5.39(2.61)	5.71(2.29)	1.13	5.92(2.50)	5.26(2.32)	-2.33***
Years of schooling	7.11(3.76)	7.17(3.73)	0.13	7.38(3.76)	6.98(3.72)	-0.91	6.98(3.85)	7.29(3.63)	0.72
Selling experience	1.42(0.93)	1.74(0.60)	3.54***	1.66(0.70)	1.55(0.83)	-1.24	1.62(0.70)	1.57(0.85)	-0.60
Price	79.87(24.57)	79.05(11.80)	-0.38	79.86(15.00)	79.08(20.53)	-0.36	78.52(16.02)	80.21(20.41)	0.79
Land size in hectares	0.57(0.36)	0.58(0.46)	0.23	0.61(0.45)	0.55(0.39)	-1,20	0.60(0.45)	0.56(0.39)	-0.89
Quantity harvested	72.38(99.47)	46.99(70.13)	-2.68***	75.85(104.05)	44.63(66.03)	-3.16***	53.13(82.93)	61.41(86.94)	0.84
Distance (KM)	2.29(2.05)	2.04(1.52)	-1.20	2.25(1.95)	2.07(1.64)	-0.87	2.23(1.84)	2.07(1.71)	-0.80

NOTE: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.
SD = standard deviation

The lowest percentage (26.36%) of farmers of the sample belonged to farmers group. Majority of farmers who belonged to a farmers group participated in broker market outlet (40.98%). Most of farmers who were not members of farmers group participated in consumer market outlet. Group membership had a significant (χ^2=7.517, P = 0.006) relationship with the choice of consumer marketing channel. Farmers group is likely to facilitate trainings, and free flow of information on matters concerning availability of the buyer and price.

23.77% of farmers of the sample sold their produce to broker market outlet, 14.73% used consumer outlet while 10.56% used retailer outlet. Production of ICEAP00777 had a significant (χ^2=3.785, P=0.05; χ^2=11.412, P=0.001) relationship with the choice of broker and retailer market outlets respectively.

Finally, a bigger proportion (28.69) of farmers producing peacock (ICEAP00850) variety channeled their produce to retailer market outlet while a smaller proportion (11.63) sold the produce to consumer market outlet. Production of broker ICEAP00850 variety had a statistical (χ^2=5.473, P=0.019) relationship with the choice of retailer market outlet. The biggest proportion (33.33%) of farmers of the sample who produced ICEAP89091 variety sold their produce to consumer market outlet while the smallest proportion (27.46) of farmers sold their produce to retailer market outlet. Production of ICEAP89091 variety had a statistical (χ^2=5.888, P=0.015) relationship with the choice of consumer outlet.

TABLE III - CATEGORICAL CHARACTERISTICS OF FARMERS PARTICIPATING IN EITHER CONSUMER, CONSUMER AND BROKER MARKET OUTLETS.

Variables	Consumer outlet		Broker outlet		Retailer outlet	
	Percent	Chi	Percent	Chi	Percent	Chi
Gender		0.175		0.001		0.003
Male	35.66		34.43		34.51	
Female	64.34		65.57		65.49	
Non-farm income		1.178		0.005		2.624
Yes	62.79		59.02		64.08	
No	37.21		40.98		35.92	
Group membership		7.517***		3.240		0.822
Yes	26.36		40.98		32.39	
No	73.64		59.02		67.61	
KAT60/8		1.825		0.002		10.948***
Yes	13.18		16.39		23.94	
No	86.82		83.61		76.06	
ICEAP00557		3.723**		0.4910		0.843
Yes	38.76		47.54		47.89	
No	61.24		52.46		52.11	
ICEAP00777		2.171		3.785**		11.412***
Yes	14.73		23.77		10.56	
No	85.27		76.23		89.44	
Peacock/ ICEAP00850		0.663		0.0222		
Yes	11.63		13.11		28.69	5.473***
No	88.37		86.89		71.31	
ICPL89091		5.888***		0.6292		0.2031
Yes	33.33		28.69		27.46	
No	66.67		71.31		72.54	

NOTE: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

Improved varieties of pigeon pea are likely to differ in terms of tenderness, ease to cock, maturity time, nutritional content and physical appearance. A larger proportion of farmers (23.94%, 47.89%) who produced KAT60/8 and ICEAP00557 varieties respectively sold their produce to retailer market outlet while the smallest proportion (13.18%, 38.76%) of farmers who produced KAT60/8 and ICEAP00557 varieties respectively sold their pigeon pea produce to consumer outlet. Production of KAT60/8 variety had a significant (χ^2=10.948, P=0.001) relationship with the choice of retailer market outlet. There was also a significant (χ^2=3.723, P=0.05) relationship between production of ICEAP00557 and the choice of consumer market outlet. In terms of ICEAP00777 production,

Empirical results

The result shows that Wald test (Wald (c^2 (33) = 173.42, P=0.0000) is significance at 1% probability

level, implying that the subset of coefficient of the model is jointly significant. The findings shows that the explanatory power of the variables included in the model is satisfactory, hence, the multivariate probit model fits the data reasonably well. The simulated maximum likelihood estimation result (LR (c^2 (3) = 63.9669 Prob > chi2 = 0.0000 of the null hypotheses of independence between the market outlets choices (ρ21 = ρ31 = ρ32 = 0) is significant at 1% significance level. Therefore, the null hypothesis that all the ρ (Rho) values are jointly equal to 0 is rejected at 99% confidence interval, indicating that the MVP model has goodness-of fit, supporting the use of the model over individual probit model. This provides a proof that separate estimation of choice decisions of the market outlets was unbiased, and the decisions of choosing the three pigeon pea market channels are interdependent. As the simulated maximum likelihood (SML) estimation result indicates in Table IV, the marginal success probability of each market outlet was presented. The probability of choosing consumer market outlet which is 56% was relatively high compared the probability of choosing retailers market outlet (30%) and brokers market outlet (26%). The joint probability of success and failure of choosing the three market outlets was 0.0163% and 14.5% respectively.

TABLE IV - PROBABILITY AND OVERALL FITNESS OF MVP MODEL

Variable	Consumer outlet	Broker outlet	Retailer outlet
Probability of selecting	0.558	0.262	0.303
Joint probability (success)			0.0001628
Joint probability (failure)			0.1450551
Simulation draws			5
Observation			297
Log likelihood			-468.26909
Wald (c2 (33))			173.42
Prob>c2			0.0000***

Note: *** is statistically significant at 1% significant level.

Note: ρ^1, ρ^2, ρ^3 represents retailer, broker and consumer market ou
***, and ** are statistically significant at 1% and 5% signific

The ρ value in Table V depicts the degree of correlation between the explained variables or each market outlet. The findings indicate that the three market outlets were negatively correlated and statistically significant at 1% significant level. Generally, this implies that the pigeon pea farmers involved in one market outlet were less likely to supply or get involved in the other market outlets.

Household size had a significant effect on the choice of broker and retailer market outlet at a 5% significant level. However, the effect was negative for the choice of broker market outlet and positive for the choice of retailer market outlet. The implication of the result is that a large family size tends to consume more of the produce limiting the available market supply of pigeon pea, thus choice of retailer market outlet. In addition, selling pigeon pea produce to retailer market outlet generates immediate income to facilitate acquisition of basic family needs especially for poor households with no other sources of income. These findings concur with the findings of Gani and Adeoti (2011) who showed that large family has a higher demand for basic needs hence the need for increased production and choice of easily accessible markets for income generation.

Number of assets (communication assets, transportation assets and farm tools) had a negative and positive effect on the choice of consumer and broker market outlets at 1% and 5% significant levels respectively. The findings might be attributed to the fact that communication assets are necessary in facilitating information flow concerning time and collection centers among small-scale farmers who channel their produce to broker market outlet. Farm tools such as processing and storage equipment are important for farmers who harvest earlier than other farmers and channels their produce to broker outlet. Farmers who harvest their produce early and channel their produce to consumer market outlet require lesser farm tools (packaging and value-addition equipment) than farmers who channel their produce to broker market outlet.

TABLE V - ESTIMATED CORRELATION MATRIX OF MARKET OUTLETS

Market outlets	ρ^1	ρ^2	ρ^3
ρ^1	1.0000		
ρ^2	-0.552*** (-0.340)	1.0000	
ρ^3	-0. 276** (-0.269)	-0. 355*** (-0.340)	1.000

The likelihood ratio test $\rho^1 = \rho^2 = \rho^3 = 0$: c^2 (3) = 63.9669: Prob>c^2=0.0000***

tlets. However, both farmers might require transportation assets
cant levels in facilitating delivery of the produce to the respective market channels. The results of this study corroborate with the findings of Melese *et al*., (2018) who found out that ownership of communication devices facilitates the process of acquiring information on the availability of buyers.

In relation to land allocated for pigeon pea production in Hectares, there was a negative and significant effect on the choice of consumer market outlet at 5% significant level. The findings might be attributed to the fact that as smallholder farmers increase the size of the farm, productivity decreases since large farm size requires more input and technical choices which might be unaffordable. The findings adhere to the Muyanga and Jayne (2019) study, who found that there was an inverse relationship between farm size and the output per hectare.

Membership to a producers' group negatively and significantly influenced the choice of consumer market outlet at 1% significant level while positively influencing the choice of broker market outlet at 10% significant level. The implication of the results is that farmers group collects the produce from group members and channel to the market to reduce transaction costs. However, selling pigeon pea produce to consumer outlet is based on the social-networking ability of individual farmer.

Quantity harvested significantly and positively influenced the choice of consumer market outlet at 1% significant level. The findings can be attributed to the fact that end-markets fetch high prices than intermediaries, hence attracting higher quantity of produce to increase income. However, quantity of pigeon pea harvested negatively and significantly influenced the choice of broker and retailer market outlets at 10% and 1% significant levels. Farmers producing relatively lower quantity of pigeon pea than farmers who channeled to consumer outlet sold their produce to broker market outlet while farmers who produced the least quantity of pigeon pea and were not in group membership channeled their produce to retailer outlet, as the outlet collects the smallest quantity. This result agrees with that of Bessy *et al*. (2014) and Endris *et al*. (2020), who showed that increased interest in the volume of sales encourages a farmer to choose a market outlet with the capability of buying large volumes.

This study revealed that four out of five improved pigeon pea varieties had significant influence on the choice of market outlet. KAT 60/8 had a positive and significant influence on the choice of retailer market outlet at a 99% confidence interval. This might be attributed to the fact that KAT60/8 is an early maturing variety making it suitable in improving food security among poor households especially during the critical months of the food insecurity. The findings concur with the report of ILRI 2021 which indicated that early maturing pigeon pea, sorghum and green grams are remedy for food insecurity among households in Eastern Kenya.

ICEAP00777 pigeon pea variety had a negative significant effect on the choice of retailer and consumer market outlets at 99% and 90% confidence intervals respectively. A farmer who produces ICEAP00777 has a reduced chance of selling to consumer and retailer market outlets. The implication is that ICEAP00777 takes 8-9 months to mature and is highly productive under a low-input production system, which tends to meet the timing of brokers and the quantity collected by broker market outlet at a given price. After maturing, farmers prefer selling their produce to brokers to cut on transportation costs incurred while delivering to distant and high-end markets (consumer outlet).

There was a significant effect of ICEAP00557 variety on the choice of consumer and broker market outlets at 1% and 10% significant levels. ICEAP00557 negatively influenced the choice of consumer market outlet while positively influencing the choice of broker market outlet. Despite the fact that ICEAP00557 variety has sweet taste and is tender, the characteristics that suits the choice of consumer outlet, farmers producing ICEAP00557 sold their produce to broker market outlet. The findings can be attributed to the fact that the grains have rough texture when cooked which is undesirable feature for consumer outlet, especially restaurants and schools. Besides, the variety takes 8-9 months to mature, coinciding with the time at which brokers collect the produce from farmers. Thus, farmers tend to avoid transportation cost by delivering the produce to broker market outlet rather than consumer outlet.

ICEAP00850 variety had a positive significant influence on the choice of retailer market outlet at a 95% confidence interval. The implication of the findings is that peacock variety is high yielding in high rainfall or under irrigation. During low rains, the variety yields low output, the quantity which suits the choice of retailer market outlet.

TABLE VI: MULTIVARIATE PROBIT RESULT FOR DETERMINANTS OF MARKET OUTLET CHOICE

Variables	Consumer outlet			Broker outlet			Retailer outlet		
	Coeff	Std. Err	P>z	Coeff	Std. Err	P>z	Coeff	Std. Err	P>z
Age of farmer	0.01	0.01	0.396	-0.01	0.01	0.142	-0.01	0.01	0.457
Gender of farmer	-0.11	0.19	0.557	0.07	0.17	0.676	0.05	0.18	0.772
Household size	-0.03	0.04	0.444	-0.07	0.03	0.014**	0.07	0.03	0.020**
Education level	0.01	0.06	0.887	-0.08	0.06	0.184	-0.02	0.06	0.711
Non-farm income	0.09	0.18	0.621	-0.08	0.18	0.600	0.21	0.17	0.206
No. of assets owned	-0.93	0.20	0.000***	0.51	0.02	0.005**	0.04	0.18	0.842
Sell experience	-0.02	0.02	0.279	-0.02	0.18	0.256	-0.01	0.02	0.910
Land (hectares)	-0.45	0.23	0.046**	0.23	0.05	0.207	0.19	0.19	0.324
Quantity harvested	0.64	0.07	0.000***	-0.09	0.04	0.093*	-0.21	0.06	0.000***
Total distance (Km)	-0.03	0.04	0.567	0.04	0.16	0.404	0.05	0.04	0.280
Group membership	-0.55	0.19	0.003***	0.28	0.21	0.092*	-0.19	0.17	0.277
KAT60/8	-0.18	0.23	0.438	0.02	0.16	0.908	0.65	0.22	0.003***
ICEAP00557	-0.75	0.19	0.000***	0.30	0.22	0.070*	0.01	0.17	0.980
ICEAP00777	-0.44	0.24	0.066*	0.28	0.23	0.195	-0.59	0.22	0.008***
Peacock	-0.05	0.27	0.797	-0.10	0.18	0.684	0.52	0.25	0.035**
ICPL89091	0.14	0.19	0.465	0.16	0.18	0.370	0.20	0.18	0.268

NOTE: *** significant at 1%, ** significant at 5% and * significant at 10%

CONCLUSION AND RECOMMENDATIONS

Smallholder farmers in Voi Sub-County adopted KAT60/8, ICEAP 00850, ICEAP00777, ICEAP 0557, and ICPL89091 varieties while the chosen outlets were consumers, brokers, and retailers. Results showed that retailer outlet comprised the majority of the farmers (36%) followed by consumers (33%) and lastly brokers (31%).

MVP results indicated that number of assets owned, farm-size under pigeon pea production, group membership, and ICEAP00557 and ICEAP00777) negatively influenced the choice of market outlet. On the other hand, number of assets, quantity harvested, group membership, KAT60/8 variety, ICEAP 00850 and ICEAP00557 varieties negatively influenced the choice of consumer market outlet while quantity harvested positively influenced the choice of consumer outlet. The choice of broker market outlet was negatively influenced by household size and quantity harvested as its choice was positively influenced by number of assets owned, group membership and ICEAP00557 variety. ICEAP00850 and KAT60/8 varieties, and household size positively influenced the choice of retailer market outlet while quantity harvested and ICEAP00777 variety negatively affected the choice of retailer market outlet.

This study recommends that the Government should integrate high-end markets to improve farmers' participation in those markets, for increased cash incomes. Secondly, farmers should be encouraged to avoid production of ICEAP00557 and ICEAP 00777 varieties as they negatively influence the choice of high-end market (consumer outlet).

ACKNOWLEDGEMENT

The Almighty God, for giving me wisdom and strength to carry out my studies to the end.

Egerton University for the opportunity to enrol for my studies and for the academic support through the Department of Agricultural Economics and Agribusiness Management.

Kenya Climate Smart Agriculture Project (KCSAP) for awarding me a scholarship to carry out the research work effectively.

Ministry of agriculture; Voi Sub-County for their support in carrying out the field work.

The producers of improved pigeon peas and enumerators who participated in this survey.

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