Factors affecting market outlet choice of agroforestry based mango producers in Kwale and Kilifi counties, Kenya: The application of the Multivariate Probit model

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Abstract: Access to profitable market outlets for agroforestry mango producers is a major concern in Kwale and Kilifi counties. This paper is set to determine the factors affecting the choice of market outlets among agroforestry mango producers. The study analyzed the market outlets chosen by producers to find out which were the most prevalent chosen. The multivariate probit model was used to determine the factors that affect the choice of market outlets among the agroforestry mango producers. Data were collected using exploratory research through the systematic sampling approach. This resulted in an ultimate selection of 208 respondents, half of which participated in commercial farming and the other half practiced subsistence agroforestry. The results show that of the sampled respondents, 15% sold at farm gate, 63% sold to middlemen, 11% sold to local retailers and 11% sold to town markets. The Multivariate Probit model results indicate that education level (5%), price (1%), access to credit (5%) and age (10%) had a negative significant influence on the producers’ choice of farm gate market outlet as only gender had a positive influence at 10% significance level. Negotiation costs and

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PUBLIC INTEREST STATEMENT
Agroforestry in Kenya, like in most developing countries, is seen as a solution in promoting sustainable agriculture. The deterioration of staple food yields due to climatic changes makes it essential to come up with alternative farming systems to enhance farm diversification. Diverse farm production will result in more yields, which triggers market participation. However, marketing involves certain technicalities which majority of the producers are not conversant with. The study analyzes the various market outlets used by mango producers and the determinants of selection since farm households are assumed to be rational, thus making selling decisions based on the utility and profit achieved. Unless we take care of the determinants affecting market participation, encouraging mango producers engage into commercial marketing will not be effective. The findings reveal that the majority of the producers have not tapped into the lucrative market outlets due to the bottlenecks that arise in accessing profitable markets.
mango quantity sold had a positive influence in selection of middlemen at 1% and 5% significant level, respectively, while price and cost of transport had a negative influence at 1% and 5% significance level. For the local retail market outlet, price and cost of transport had a positive and negative significance at 1% and 5%, respectively. Lastly, at the town market outlet distance to market outlet, education level (5%), price (1%) and age (5%) positively influenced the selection of the outlet, while both off-farm income and negotiation cost had a negative influence at 5% significance level. The prevalence of mango producers’ selling to middlemen was as a result of the immediate cash offered by the outlet capitalizing on the desperate need for cash by mango producers. However, the town markets offered better returns though the several barriers to enter limited mango producers from accessing them. The results revealed that subsistence agroforestry mango producers dominated the farm gate and middlemen outlets, while producers with commercial systems mostly sold their produce to the local retail and town markets. The high transaction costs involved in accessing potential profitable markets need to be addressed by the relevant stakeholders so as to encourage more agroforestry mango-based producers into market participation.

Subjects: Agriculture & Environmental Sciences; Plant & Animal Ecology; Environment & Business; Environment & Economics; Conservation -Environment Studies; Biodiversity & Conservation; Ecology -Environment Studies

Keywords: Agroforestry; market participation and marketing factors

1. Introduction
Agroforestry is one of the most important measures for mitigation of food shortages in the world (Adebanjo et al., 2017). It has the potential to enhance diversification of farm production and increase income generation at the household level. Improved food productivity and crop diversification represent a buffer mechanism against harvest failure due to climate changes and other environmental hazards (FAO, 2010). The trees provide an additional source of subsistence, cash, as well as contributing to crop and livestock production (Gebrewahid & Selemawi, 2019). Such a diversification reduces the risk of total economic disaster should the food crop fail, as would be the case if farmers specialized in growing a single food crop. Therefore, understanding local usage of agroforestry products is essential to come up with easily acceptable commercial farm enterprises in the study area.

Coastal and Eastern Kenya account for 70% of the mangoes produced in Kenya (Kenya Investment Authority, 2012). The main agroforestry commodities produced in the two counties include mangoes, coconuts and cashew nuts fruit trees commodities (KCIDP, 2018). Kwale and Kilifi counties are predominant mango tree producers due to their favourable climatic conditions for tropical fruit growing. Mango tree products have the highest value chain returns compared to other horticultural crops in Kenya. They contribute to 56% of the gross income obtained from horticultural commodities at an estimated value of KES 1.7 billion annually (HCDA, 2011).

Tree fruits products trade has been going on for centuries (Shomkegh et al., 2016). In the developing countries, most agroforestry producers have been introduced into agroforestry without consideration of their target markets. This is in contrast with industrialized countries where agroforestry extension is focused on the markets of tree products (Andre et al., 2017). Linking farmers to potential markets is thus of paramount importance to unlock the benefits of agroforestry.
Agroforestry markets in Africa are characterized by asymmetric information, producer limited market power and high transaction costs (IFPRI, 2017). The technical and institutional factors of marketing have not been fully taken into consideration (IFPRI, 2017). Due to the small-scale nature of farmers in Kwale and Kilifi counties, the cost of meeting standardization for global markets is high. Striving to achieve the unfulfilled local and international markets should, thus, be of focus to agroforestry-related stakeholders.

Export of tropical fruits from Sub-Saharan developing countries created a revenue of 12.8 billion dollars (FAO, 2015). However, the majority of small-scale farmers are excluded from the value chain due to low economies of scale, insufficient market information and poor market linkages (Adebanjo et al., 2017). Even with the emergence of supermarkets as key buyers of horticultural products, small-scale farmers still find themselves unable to meet the minimum requirements for produce supply. The market outlets in Kenya consist of many players thus making them inefficient to producer needs GoK (2010). The inefficiency of the market outlets hits hard on agroforestry mango producers during the glut production seasons where the commodity is produced in plenty, thus forcing to sell at even lower prices.

In Kenya, 98% of the mangoes produced are domestically consumed, while the remaining 2% finding its way to the export markets (Msabeni et al., 2010). An approximate revenue of KES 150 million is obtained from the exported produce annually (Msabeni et al., 2010). The average price of mangoes per kilogram in Kwale and Kilifi counties is KES 30 (KCIDP, 2018). Most of the farmers in Kwale and Kilifi counties rely on informal networks to obtain market information, thus at a risk of getting incorrect information. Better market information enables producers target the most profitable markets thus boosting their profits (Adijah et al., 2012). Enabling mango farmers meet the required quality standards in the international market is of paramount importance to increase agroforestry producers’ revenue.

The objective of this study was to identify the market outlets used by agroforestry mango-based producers and the determining factors affecting choice of the chosen outlets in Kwale and Kilifi Counties, Kenya.

1.1. Scope and limitations of the study
This study focuses on the commercial aspect of mango fruits in Kwale and Kilifi counties. The target population were the agroforestry mango-based producers. Despite the fact that agroforestry research has been conducted in Kenya, there is little current research information about commercial agroforestry in Kwale and Kilifi counties. Lack of formal education was a challenge in accurate data capturing from the respondents which had be solved by using enumerators who understood the local languages.

1.2. Operational definition of terms
Commercial producer refers to a mango producer who sold more than 25% of the quantity produced.

Subsistence producer refers to a mango producer who sold less than 25% of the quantity produced.

2. Theoretical framework
The study used the random utility theory based on the assumption that producers’ decision to select an outlet is based on utility achieved. The choice of the outlet is subject to internal and external factors which affect the farmer’s decision (Hess et al., 2018). Rational individuals are assumed to be profit driven (Keith, 2018). However, the producer has incomplete information on the various market outlets available which implies that uncertainty on outlet selection has to be taken into consideration (Hess et al., 2018). The utility achieved from various outlets is thus
modelled as a random variable in order to show the uncertainty involved. The utility that the producer obtains from the outlet selected is expressed as:

\[ U_n = X_n + \epsilon_n \]

where \( U_n \) is the utility achieved from the outlets selection.

\( X_n \) are the various outlet alternatives and 

\( \epsilon_n \) is the error term, which represents the uncertainty involved in the producer’s outlets choice decisions.

Letting \( X_i, i = 0, 1, 2, 3, \ldots, n \) alternatives, then the utility function of the producer is satisfied by 1 to \( n \) alternatives.

\[ U = f(X_1, X_2, X_3, \ldots, X_n), \text{ where } X \text{ represents the alternatives chosen by a particular producer.} \]

The producer selects a combination of various alternatives, \( X_1 \) to \( X_n \) based on the utility achieved and maximum profit obtained.

The market outlets chosen are influenced by the price offered and proximity to the farmer. Therefore, the decision on selling to various market outlets has to meet the profit and utility satisfaction motive. Utility is derived from the household’s profitability of produce sale.

The utility maximization model of the producer is based on the expected value of the non-observable underlying utility function that ranks the preference of the producer according to the selected market outlets. The non-observable underlying utility function can be represented by:

\[ E[U_{in}(P_n, M_n, T_n)] \]

where \( E \) is the expectations operator,

\( n \) represents the market outlet,

\( i \) represent the farm producer.

Utility \( (U_i) \) is derived from the observable market outlet characteristics, where:

\( P \) represents price offered,

\( M \) stands for market distance and

\( T \) stands for the transport mode.

The producer opts among,

\[ E[U_1], E[U_2], E[U_3] \text{ and } E[U_4] \]

where \( E [U_1] \) stands for farm gate,

\( E [U_2] \) represents middlemen,

\( E [U_3] \) stands for local retail and

\( E [U_4] \) represents town markets.
The study was, thus, underpinned under this theory based on the assumption that mango-based agroforestry producers would select a combination of various market outlets based on the utility achieved. The producers being rational decision makers are expected to choose the market outlets with the minimal cost and the highest profit margins.

3. Materials and methods

3.1. Study area
The study was conducted in Kwale and Kilifi counties in Kenya. They border the Indian Ocean sea line in the south and the Lamu, Tana River and Taita Taveta counties, respectively, in the north. Kwale County lies between a longitude of $39^\circ 27^\prime$ and $6^\circ 74^\prime$, and a latitude of $4^\circ 10^\prime$ and $27^\circ 98^\prime$ South. Kilifi County lies between a longitude of $39^\circ 05^\prime$ and $40^\circ 14^\prime$ East, and a latitude of $2^\circ 20^\prime$ and $4^\circ 0^\prime$ South. The two counties have a total area of 20,880 Km². Total population of people in the study area according to the Population and Housing Census (2019) is 866,820 and 1,443,787 in Kwale and Kilifi counties, respectively. The South Coastal belt receives an annual rainfall of between 800 mm and 1600 mm, while the northern drier parts of the two counties receive between 300 mm and 800 mm per year. The annual temperature in the region is between 21°C and 30°C in the South Coast belt and between 30°C and 34°C in the northern parts. The main vegetation in the area is the savannah woodlands where drought resistant shrubs survive. The majority of the households practice agriculture for subsistence consumption with a few producers who venture into cash crop farming. The main perennial crop grown both in the South Coast and the northern hinterland is mango tree, which justifies selection of the study area.

3.2. Sampling procedure
The study used the systematic sampling approach in selection of the respondents. Kwale and Kilifi counties were chosen because of the favourable tropical climatic conditions for mango trees growing. Samples were purposely drawn from three sub counties, namely, Kilifi North, Kilifi South and Matuga to capture the uptake of mango produce commercialization in Kwale and Kilifi counties. The wards were randomly selected from the chosen Sub-Counties. Systematic sampling was used to select farmers from the list given by the Ward Agricultural Officers. The $y^{th}$ farmer is chosen where $y$ is the sampling interval.

It is calculated as $n = \frac{N}{y}$.

where $n$ is the sample size and $N$ is the population size. Each farmer in the population thus had an equal probability to be selected.

The targeted sample size was determined using a formula by Cochran (1963).

$$n = \frac{pq(Z^2)}{e^2}$$

where $n$ = Sample size $p = 0.5$ is the maximum possible proportion of mango producers in the study area,

$q = 1 - 0.5 = 0.5$; therefore, $pq$ produces the maximum sample size,

$Z = 1.96$ (value for the selected alpha level at 95% confidence level and $e = 6.8\%$ (acceptable margin of error).

The sample size for the targeted mango producers was as follows:

$$n = 0.5 \times 0.5 \times \frac{(1.96)}{0.068} = 208$$
3.3. Data collection

Data were collected using semi-structured questionnaires administered on a face-to-face method to the selected respondents. A questionnaire pretest was conducted to test the validity of the tool before commencing with the collection exercise. This thus ensured respondents were made aware of the objective of the research which paved the way for a voluntary participation. Both open- and closed-ended questions were administered to aid in getting the relevant information required. Questions asked in the questionnaires were based on the objective of the study where respondents were asked on the main market outlets chosen and the determinants towards the selection.

3.4. Data analysis

The primary data collected from respondents were first examined to ensure that it is was completely filled. It was then cleaned, organized and analyzed using SPSS, STATA and Ms EXCEL.

Descriptive statistics, like measures of central tendencies such as means and percentages, were used to analyze the main market outlets used and the socio-economic attributes of agroforestry mango-based producers in the study area.

The multivariate probit regression model was used to analyze the determinants of market outlet choice by agroforestry mango-based producers. The model simultaneously estimates the influence of explanatory variables on one or more than one dependent variables while allowing for free correlation of the error terms (Belderbos et al., 2004).

Characteristics of the hypothesized dependent and independent variables used in the multivariate probit model are stipulated in Table 1.

4. Results and discussion

4.1. Agroforestry products market information sources

Table 2 shows the main market information sources between commercialized and subsistence mango producers. It indicates that more than a quarter (33.07%) of the respondents did not have access to formal market information. This implies that most of the mango fruit producers in Kwale and Kilifi counties did not invest much in market information search. The majority of the respondents obtained information from nearby neighbours (28.65%), while the other information sources were from extension officers (13.02%) and radios (10.42%). The findings suggest that producers depended mainly on close neighbours for market information. The mango fruit producers also acknowledged that extension officers and radios were important in relaying market information. When the results are classified into commercial and subsistence producers, they indicate that, of those respondents without formal information access, 83.46% were subsistence, while only 16.54% were commercial producers. Among the information sources from which respondents utilized, commercial producers had more than half participation in each source. This implies that the commercial oriented producers had more access to market information compared to the subsistence producers. The results are in line with Innocent (2016), who found that information access positively affects mango fruit producers’ participation in the market.

4.2. Means of transport used by mango fruit producers

Figure 1 shows the main means of transport used by agroforestry mango-based producers. In order to access the main market destinations, the results reveal that motorcycles were widely used (81%), followed by pick-ups (11%), human transport (7%) and trucks (1%). The producers’ preference to use of motorcycles can be explained by their flexibility and affordability to the respective users. Thus, this made it the most effective mode of transport used in Kwale and Kilifi counties. The producers who sold their produce at farm gate found it more convenient to use human labour
Table 1. Description of variables for the determinants of market outlet choice

| Variable          | Variable description        | Units of measurement       | Expected sign |
|-------------------|-----------------------------|----------------------------|---------------|
| Dependent Variable| MktOutl                     | 1 = Farm gate, 2 = Middlemen, 3 = Local retail, 4 = Town market, |               |
| Gender            | Sex                         | 1 = Male 0 = Female        | ±             |
| QtyS              | Quantity sold               | Currency KES               | ±-            |
| Trans C           | Transport cost              | Currency KES               | ±             |
| Mktdis            | Market distance             | In Kilometers              |               |
| Cred              | Credit access               | Dummy 1 = Yes, 0 = No     | ±             |
| Exp               | Farmer experience           | Na. of yrs in farming     | +             |
| Edu               | Education                   | Na. of yrs in school      | ±             |
| Off-frm           | Non-farm income             | Currency in KES            | ±             |
| Prc               | Market Price of produce     | Currency in KES            | ±             |
| NgC               | Negotiation costs           | Currency in KES            | ±             |
| SrC               | Search costs                | Currency in KES            | ±             |
| Age               | Age                         | Na. of yrs                 |               |

Table 2. Main market information sources

| Source of information | Commercial | Subsistence | Expected sign |
|-----------------------|------------|-------------|---------------|
| No formal information | 16.54      | 83.46       | 33.07         |
| access                |            |             |               |
| Neighbouring farmers  | 54.55      | 45.45       | 28.65         |
| Producer groups       | 73.1       | 26.9        | 6.77          |
| Extension officers    | 78         | 22          | 13.02         |
| Private organizations | 66.66      | 33.34       | 7.81          |
| Radio                 | 77.5       | 22.5        | 10.42         |
| Internet              | 100        | 0           | 0.26          |
| Total                 |            |             | 100           |

due to its cheaper cost which is similar to Chemuku et al. (2017) findings. The pick-ups and trucks were used by the producers who sold their fruits in bulk to town markets.

4.3. Main market outlets used by agroforestry-based mango producers

The main market outlets used by small-scale agroforestry farmers in Kwale and Kilifi counties are indicated in Figure 2. The majority of the mango producers sold their produce to middlemen (62.5%). This indicates that mango business in the study area is dominated by middlemen who act as intermediaries between the producers and the market. The preference of selling to middlemen can be attributed to the need of immediate cash by farmers so as to cater for their daily basic needs. The middlemen also relieve the producers from the transaction costs involved in the produce marketing. However, the middlemen usually obtain higher profits compared to the producers due to their knowledge and experience of produce marketing. Similar findings are supported by Mesay (2017) whose results indicate that middlemen enjoy larger profits in the mango business compared to producers in Eastern Africa. When the results are classified into commercial and subsistence producers, the key findings indicate that mango producers with commercial enterprises had a 100% participation in selling to the town market. The subsistence mango producers on the hand had a higher percentage (93.8%) of selling at the farm gate outlet. This implies that mango commercial producers targeted high returns market outlets (town markets) as compared to the producers with subsistence systems. The result is consistent with
Innocent (2016) findings, which depict that producers who engage into commercialization mostly participate in high value markets regardless of the costs involved.

4.4. Preliminary tests for model appropriateness
In order to authenticate the validity of the econometric model used, multicollinearity and heteroskedasticity tests were conducted.

4.4.1. Multicollinearity test
Multicollinearity occurs when more than one independent variables are related to each other. This means that one variable can be linearly estimated from the other variables. The presence of multicollinearity often leads to the occurrence of inflated standard errors, thus making some
predictor variables to be statistical insignificant (Tonidandel and James, 2011). The Variable Inflation Factor (VIF) was conducted on the explanatory variables used in the model to detect the presence of multicollinearity. A VIF of less than 10 indicates the absence of multicollinearity among the explanatory variables of the estimated model (Jim, 2017). According to the results presented in Table 3 below, the VIF mean is less than 5 and the VIF results for all the variables are less than 10, thus showing the absence of multicollinearity. The test, thus, approved the use of the data for analysis.

4.4.2. Test for heteroskedasticity

4.4.2.1. Breusch-pagan/cook-weisberg test for heteroskedasticity. Ho: Constant variance

Variables: fitted values of Local retail market

\[
\text{Chi2 (1) } = 0.99
\]

\[
\text{Prob } > \text{Chi2 } = 0.3632
\]

The Breusch-Pagan test was conducted to check for heteroskedasticity using the command estat hettest. The results show a p value of 0.3632, thus indicating the absence of heteroskedasticity. A p value of more than 0.1 indicates that the test is insignificant, thus implying that the errors are homoscedastic which means that they are randomly dispersed throughout the range of the independent variable, hence the absence of heteroskedasticity (Henning and Christof, 2014).

4.5. Factors affecting the choice of market outlets used by agroforestry mango-based producers

The multivariate probit model was employed in determining the factors that affected the choice of market outlets among mango producers. The MVP is an extension of the probit model as it is used to simultaneously estimate several correlated binary outcomes (Belderbos et al., 2004). The model takes into account the correlation in the error terms by jointly modelling the effect of the independent variables on each of the market outlets. The study found four outlets for the mango produce, which are farm gate customers, middlemen, local retail and town markets. The producers thus sold their fruits among these outlets in various proportions. If the inter-relationships involved in selling among the various outlets are not taken into consideration, it may result in biased estimates of the factors that influence the choice of the produce market

| Variable                   | VIF | 1/VIF |
|----------------------------|-----|-------|
| Cost of transport          | 2.71| 0.368 |
| Distance to market outlet  | 2.21| 0.452 |
| Negotiation cost           | 2.07| 0.483 |
| Age                       | 1.97| 0.507 |
| Agroforestry experience    | 1.87| 0.533 |
| Mango price               | 1.75| 0.570 |
| Access to credit           | 1.61| 0.620 |
| Off-farm income            | 1.51| 0.662 |
| Search cost                | 1.48| 0.674 |
| Mango quantity sold        | 1.45| 0.688 |
| Gender                    | 1.44| 0.695 |
| Education level            | 2.04| 0.490 |
| Mean VIF                  |     | 1.84  |
Table 4. The determinants of mango market outlets chosen by producers from the multivariate probit model

| Explanatory variable                  | Farm gate |                      | Middlemen |                      | Local retail |                      | Town market |                      |
|--------------------------------------|-----------|----------------------|-----------|----------------------|-------------|----------------------|-------------|----------------------|
|                                      | Coef      | SE                   | Coef      | SE                   | Coef        | SE                   | Coef        | SE                   |
| Gender                               | 0.38      | 0.24                 | −0.17     | 0.28                 | −0.05       | 0.24                 | −0.69       | 0.46                 |
| Distance to market outlet             | 0.005     | 0.01                 | 0.005     | 0.02                 | −0.02       | 0.01                 | 0.06**      | 0.02                 |
| Agroforestry experience              | −0.003    | 0.02                 | 0.002     | 0.02                 | 0.01        | 0.02                 | 0.004       | 0.02                 |
| Education level                      | −0.33**   | 0.16                 | −0.08     | 0.16                 | −0.1       | 0.14                 | 0.76***     | 0.28                 |
| Off-farm income                      | 0.004     | 0.003                | −0.03     | 0.003                | 0.001      | 0.003                | −0.02**     | 0.008                |
| Negotiation cost                     | −0.04     | 0.02                 | 0.1***    | 0.04                 | 0.01       | 0.02                 | −0.08**     | 0.02                 |
| Search cost                          | 0.09      | 0.1                  | 0.1       | 0.1                  | 0.007      | 0.1                  | 0.1         | 0.1                  |
| Mango price                          | −0.3***   | 0.07                 | −0.4***   | 0.08                 | 0.4***     | 0.008                | 0.5***      | 0.09                 |
| Cost of transport                    | 0.04      | 0.03                 | −0.2***   | 0.05                 | −0.08**    | 0.03                 | 0.04        | 0.03                 |
| Mango quantity produced              | 0.007     | 0.02                 | 0.06**    | 0.02                 | 0.003      | 0.02                 | 0.002       | 0.03                 |
| Access to credit                     | −0.67**   | 0.24                 | 0.21      | 0.28                 | 0.12       | 0.22                 | 0.40        | 0.43                 |
| Age                                  | −0.02*    | 0.01                 | −0.002    | 0.01                 | 0.002      | 0.01                 | 0.04**      | 0.02                 |
| Constant                             | 2.72      | 0.52                 | 1.56      | 0.60                 | −2.32      | 0.55                 | −5.9        | 1.1                  |
| No. of observations                  |           |                      |           |                      |            |                      |             |                     |
| Log likelihood                       |           |                      |           |                      |            |                      | −315.92     |                     |
| Wold chi2                            |           |                      |           |                      |            |                      | 222.30      |                     |
| Prob> chi2                           |           |                      |           |                      |            |                      | 0.0008***   |                     |

Variable marked with* are significant at 10%, ** at 5%, *** at 1%

outlets (Amos et al., 2017). The multivariate probit model was thus used to account for the interdependent relationships of the market outlets.

The results of the MVP model are presented in Table 4, showing the likelihood test ratio (Rho-values), of \( \rho_{21} = \rho_{31} = \rho_{41} = \rho_{42} = \rho_{43} = 0 \) are statistically significant at 1%. The error terms of the multivariate probit model thus jointly follow a normal distribution with a zero conditional mean. The model is thus fit for use as it shows that the producer’s decision to sell to various market outlets is interdependent.

Increase in distance to the market is hypothesized to reduce product commercialization. However, increase in distance to the market outlet had a significant \((p < 0.05)\) positive effect on selling to town markets. The finding implies that the further away the distance from the farm, the higher the returns from produce sale. This can be supported by the high demand of fruits in Coastal towns which consequently necessitates the increase in mangoes supplied. The fact that Coastal towns are populated with customers having a higher purchasing power than the rural markets, mango producers are willing to incur the costs involved in accessing the outlet. This is in line with Njuguna et al.
(2012) whose study indicates that due to the warm and hot climate in the Coastal Kenya towns, demand for mango produce by locals and visiting tourists is always high throughout the year.

The education level of respondents had a negative and positive effect on the choice of farm gate and town markets at 5% and 1% levels of significance, respectively. This implies that an increase in the level of education of the respondent reduced the probability of selling at farm gate by 33% but increased the likelihood of the producer selling to town markets by 76%. The findings indicate that educated mango producers were much more aware of the profitability of selling at higher returns market outlets (town markets). The finding is in line with Erick et al. (2015) who found that higher education level increases the probability of farm products producers integrate into high value chain markets. Education increases the basic knowledge of handling commercial transactions. Thus, this gives the educated producers an advantage in gaining more returns from their farm enterprises by venturing into more profitable market outlets.

Increase in off-farm income is expected to increase the level of produce commercialization. However, increase in off-farm income had a negative significant ($p < 0.05$) impact on selling to town markets by 2%. The results indicate that an increase in off-farm income reduced the probability of producers selling their produce to the market. The rationale behind this can be that mango producers who had other sources of income did not see the need of selling their produce at the expense of their own consumption. The transaction costs involved in selling produce to the town markets may also have inhibited their access to town markets. The finding is in line with Palapala and Samuel (2016) who found that farm producers who have other sources of income do not depend much on agricultural returns. The other reason could be that the mango producers involved in other income-generating activities do not have enough time to solely focus on farming. The fact that they are engaged in off-farm activities implies that farming is not their primary source of income; thus, less emphasis is placed on it. This is in line with ASDSP (2017) findings that due to the small-scale nature of farming in Kwale and Kilifi counties, most households look for other means of living in the form of formal and informal employment. The seasonal nature of mango production also necessitates the need to search for other alternative income sources during the production in off seasons.

Negotiation cost had a positive and negative impact on selling to middlemen and town markets at 1% and 5% level of significance, respectively. Increase in negotiation costs increased the probability of selling to middlemen by 10%. The possible explanation could be that the producers were willing to sell to middlemen even at higher negotiation costs because they offered immediate cash for buying farm produce. This leaves mango producers who are in desperate need of cash in hand with no option but rather sell their produce to middlemen. This finding is in line with Mesay (2017) whose findings indicate that middlemen usually exploit producers as they offer low prices but reap higher prices by linking producers to the market. On the other hand as expected, at the town market outlet negotiation cost had a negative impact on choosing the outlet implying that a one shilling increase in negotiation costs reduced the probability of selling to town markets by 8%. Due to the taxes involved in selling fruits to town markets, producers try to avoid those costs by transferring them to middlemen. The results are in line with IFPRI, (2017) findings that high transaction costs limit mango producers into selling at high value market outlets.

Mango price had a negative significant ($p < 0.01$) influence on selection of the farm gate and middlemen market outlets at 30% and 40%, respectively. This implies that a one shilling increase in mango prices reduced the probability of selling to farm gate customers and middlemen by 30% and 40%, respectively. The possible rationale behind this finding could be that these two outlets offer lower prices to mango producers thus an increase in market price of mangoes means that producers opted for higher price offering outlets. The findings are in line with Korir et al. (2013) whose results show that price is one of the primary factors influencing producers’ decision to sell their fruits. The mango price however, had a positive significant ($p < 0.01$) effect on the choice of local retail and town markets at 40% and 50%, respectively. A one shilling unit increase in mango
price increased the probability of producers selling their produce at local retail and town markets by 40% and 50%, respectively. The rationale behind this finding is that the local retail and town markets offer better produce prices compared to the farm gate and middlemen. The finding supports Korir et al. (2013) results which indicate that the higher the produce price offered by a market outlet the higher the likelihood of producers targeting the respective market.

Transport cost had a significant ($p < 0.05$) negative effect on choosing the middlemen and local retail market outlets selection by 20% and 8%, respectively. This implies that a shilling increase in transport cost reduced the probability of selling produce to middlemen and local retail markets by 20% and 8%, respectively. The rationale behind this finding is that the middlemen will always factor in the cost of transport incurred to ferry produce to the market at the expense of producers. The finding is in line with Mesay (2017) who found that middlemen always strive to maximize their returns by deducting all the transaction costs from the producers selling price. This means that the producers have to carry the burden of transport cost increase by receiving even lower prices from the middlemen. Thus, an increase in the cost of transport consequently reduced the probability of producers selling to middlemen. Furthermore, an increase in transport cost reduced the likelihood of mango producers selling to local retail markets. This implies that the mango price offered at the local retail markets could not cover the increase in cost of transport. Thus, this necessitated the producers' reduction in using the outlet. The findings are in line with Chemuku et al. (2017) results which shows that inability to afford transport costs limits mango producers from accessing potential markets in Kwale and Kilifi counties.

The mango quantity produced had a positive and significant ($p < 0.05$) effect on choosing the middlemen market outlet. The results show that an increase in quantity of mangoes produced increased the likelihood of producers selling their fruits to middlemen by 6%. The possible reason behind this is that middlemen prefer to buy in bulk so as to distribute the produce to different market destinations. In most cases middlemen have a mastery of the agricultural value chain and it is no different with the mango value chain at Kwale and Kilifi counties. This finding is similar to HCDA (2011) which indicates that middlemen understand the market mechanisms better than the producers thus able to maximize their returns.

Credit access is hypothesized to increase the level of mango produce commercialization. However, credit access to producers shows that it had a significant ($p < 0.05$) but negative effect on choosing the farm gate market outlet. This implies that a one shilling increase in credit received reduced the probability of mango producers selling at farm gate by 67%. The fact that credit access enables producers to purchase the necessary inputs, thus being able to produce better yields. With better yields, producers eventually opted for high value market outlets rather than selling at farm gate prices. The credit further enhanced their capacity to cater for harvesting, packing and transport costs required in selling to other market outlets apart from farm gate. The finding is similar to Kirimi et al. (2013) who found that access to credit enables mango producers in attaining better yields thus being able to sell to high value markets for better returns.

Age had a negative and positive impact on selling to farm gate and town markets at 1% and 5% level of significance respectively. The results show that an increase in age by one year reduced the probability of the producer to choose the farm gate market outlet by 2% but increased the likelihood of choosing town market outlet by 4%. The implication of the finding is that as the age of the producer increases his/her experience consequently increases. With more experience, the producers have a clear understanding of the most profitable market outlets. Therefore, as the age of the producer increased, the probability of selling their produce to high-end markets consequently increased. The findings are in line with Hailua et al. (2015) who found out that the more experienced the producer is, the higher the chances of integrating into more profitable market outlets.
5. Conclusion
The study was conducted in Kwale and Kilifi counties, Kenya, to determine the main market outlets used by agroforestry mango-based producers and the factors affecting choice of products outlets used. Respondents were selected using the systematic sampling method for an ultimate selection of 208 mango producers. Descriptive statistics was used in determining the main market outlets used. The results indicate that the majority of the producers (63%) of all the respondents sold their products to middlemen due to the less transaction costs involved and immediate cash offered by the outlet. The multivariate probit model was employed in determining the factors influencing outlet choice by producers. The model’s results indicate that education level, price, access to credit and age had a negative significant influence on the producers’ choice of farm gate market outlet. Negotiation costs and mango quantity sold positively influenced producers selection of middlemen, while price and cost of transport had a negative significant influence. The local retail market was positively and significantly influenced by mango price and negatively affected by an increase in transport cost. The town market was positively and significantly affected by an increase distance to market outlet, education level, price and age, while off-farm income and negotiation cost had a negative significant influence in selection of the outlet by mango producers.

6. Policy recommendations
According to the results, the study recommends that agroforestry mango-based producers in Kwale and Kilifi counties should engage into high-value market outlets, mainly the town markets as they offered better prices despite the long distance and transaction costs involved. The transaction costs involved in produce marketing have to be addressed for effective market participation by mango producers. High transaction costs is one of the reasons why producers sold their produce to middlemen. The agroforestry mango-based producers thus need to be protected from exploitative middlemen who take advantage of their desperate need for cash, hence buying the produce at low prices. The National and County governments within the study area have to set a law which indicates the minimum commodity buying prices for mangoes so as to cushion the producers from exploitation. The results also reveal that education level had a positive influence in accessing high value markets. Efforts should thus be put in place to ensure that mango producers are equipped with basic farming knowledge to boost their understanding of marketing mechanisms. Furthermore access to credit had a positive influence in producers targeting profitable markets. Creating a suitable financial environment is of paramount importance to aid mango producers handle the entry costs required in high returns market outlets. Therefore, it is thus necessary to come up with policies which will enhance mango producers’ market participation as a way of improving their respective households’ incomes.

Acknowledgements
This paper is part of MSc research work for the author. Special thanks goes to the respondents who created time to take part in the survey and the field enumerators involved in data collection.

Funding
This research was conducted with support from the Center of Excellence in Sustainable Agriculture and Agribusiness Management (CESAAM) at Egerton University, Center of Excellence in Sustainable Agriculture and Agribusiness Management, Egerton University [KM19/12083/17];

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Disclosure of potential conflicts of interest
The authors declare no conflict of interest.

Citation information
Cite this article as: Factors affecting market outlet choice of agroforestry based mango producers in Kwale and Kilifi counties, Kenya: The application of the Multivariate Probit model, Abel Mбега Mвембе, George Овуор, Jackson Langat & Patience Mщенга, Cogent Food & Agriculture (2021), 7: 1936367.

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### APPENDIX 1: PAIRWISE CORRELATION OF THE MARKET OUTLETS USED BY AGROFORESTRY MANGO BASED PRODUCERS

```
pwcorr Farm_gate Middle_men Local_retailers Town_mrkt,star(5)
```

|                  | Farm_gate | Middle_men | Local_retailers | Town_mrkt |
|------------------|-----------|------------|-----------------|-----------|
| Farm_gate        | 1.0000    |            |                 |           |
| Middle_men       |           | -0.0684    | 1.0000          |           |
| Local_retailers  |           | -0.2946*   | -0.1285         | 1.0000    |
| Town_mrkt        |           |            | -0.4060*        | -0.4301*  | 0.1033    |

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