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*Full Length Research Paper*

# Factors influencing the choice of supermarket channel by smallholder vegetable farmer suppliers in Nairobi and Kiambu Counties, Kenya

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**The increasing demand for high-value food products in developing countries is creating incentives for expansion of supermarket chains as an alternative marketing system to the traditional marketing channels. However, smallholder farmers especially those in the vicinity of the urban cities and county capital townships in Kenya do not use supermarket channels effectively due to a number of factors. The purpose of this study is to determine the factors influencing the choice of participation in the supermarket supply channel as compared to that of traditional market channel. Data for the study were collected from a sample of 120 farmers - 60 supplying to supermarket supply chains and 60 supplying to traditional marketing channels. Multistage random sampling procedure was used to construct the sample. Descriptive statistics and the logit regression model were used as the methods of analysis. The results reveal that farmers participating in supermarket supply chain have significantly higher value of revenues, farm sizes, number of labourers, labour costs and input costs as compared to those supplying to traditional markets. Ultimately they had a higher gross margin of Kshs 35,346.00 compared to a loss of Kshs 1847.00 realized by the farmers supplying to traditional markets. Empirical results of the logit model indicated that the marginal probabilities for farm size, labour cost, education level, extension assistance, method of supply, group participation and formation of a supply relationship significantly influenced the choice of supermarket supply chain. Hence public and private policy needs to support the development of smallholder technical, social and institutional environments that can help them to get over the scale problem. Supermarkets can help in a number of ways such as providing technical and financial support, reviewing buying practices and treating smallholder farmers as equal partners.**

**Key words:** Supermarket channel, traditional market channel, smallholder farmers, logit model.

## INTRODUCTION

The demand for food, both of crop and animal origin, is increasing globally and especially in developing countries due to increases in population, incomes and urbanization (Mengesha, 2012). At the same time, there is a change in consumer preferences as people put healthy, nutritional, astronomical and environmental issues into consideration. Consumers in developing countries have also been exposed to these global trends due to ease of communication and travel (Mendelsohn and Olmstead, 2009). The delivery of food from producers to consumers is extended from rural markets and regional wholesale markets to supermarkets in urban areas where consumers can get all goods under one roof. Stakeholders in

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agriculture: policy makers, large and small-scale farmers, input suppliers, traders and value addition industries have to respond to these demands and changes. It is no surprise then that policy makers are turning to the value chain paradigm from the traditional farming system approach. The increasing dominance of multi-national retailers and processors have brought to the fore issues concerning market power in the food industry and concern of how the activities of these firms influence suppliers and consumers (Dobson et al., 2003).

As supermarkets consolidate and increase their market share, they may be large enough to exert market power and may have both negative and positive impacts on the suppliers and consumers of agricultural and manufactured/processed products. The increasing demand for high-value food products in developing countries is creating incentives for expansion of supermarkets (Neven et al., 2006). Therefore, to meet rising consumer concerns, emerging supermarkets increasingly adopt tighter vertical coordination involving direct procurement from farmers. These changes have crucial implications for farm households. While there is potential for exclusion of some farmers due to the stringent requirements imposed by supermarkets, there are also potential welfare gains for farmers who have access to these channels. Stable prices and contractual arrangements offered by supermarkets for instance, improve income flows for farmers in supermarket channels. Expansion of supermarkets in developing countries can therefore have substantial effects on farm household income and on rural poverty in general (Rao Elizaphan and Matin, 2010).

Most vegetables have a short shelf life and are not processed before reaching consumers (except for slicing, dicing, mixing, and packaging). These characteristics mean that the marketing system which links farmers and consumers of fresh produce has a preponderant effect on the level and stability of supply and prices on the real incomes of consumers and especially farmers; and on the quality and safety of these foods. As the domestic agri-food systems experience increasing demand for high-value food products, there has been a tendency to modernize the supply chain systems to match market demand needs. These changes in Kenya have received a great deal of attention over the past two years, especially as regards to the “rapid rise” of supermarkets and their potential effects on farmers and consumers (Ayieko et al., 2006).

Over 90% of the volume, over 70% of the value and the vast majority of the producers in Kenya’s horticultural industry target the domestic market (Neven and Readerson, 2003). This implies that a change from traditional to modern channels in these domestic-market-oriented supply chains would have a potentially much larger impact than just on the minority that caters for the export market. However, many of the small scale farmers are challenged by the operational arrangements of modern supply chains. This study was undertaken to determine the factors hindering the shift from traditional market channels to supermarket supply chains in Nairobi and Kiambu Counties. Kiambu County is located in relative proximity to Nairobi, and even before the spread of supermarkets, it has been one of the main vegetable-supplying areas for the capital city.

## PROBLEM STATEMENT

The change in food supply systems and rise of one-stop supermarkets is likely to affect smallholder farmers negatively as a result of their inherent weaknesses in capital, technology and economies of scale. Supermarkets prefer to source/procure their products from large to medium farms and large processing/manufacturing firms in the developed countries (Reardon and Berdegue, 2002; Weatherspoon and Reardon, 2003). This implies that small-scale farmers, processors and manufactures may be potentially excluded from these lucrative urban markets.

The potential marginalization of small scale farmers, processors and manufacturers has been documented in many developing countries, such as in Latin America, South East Asia and Africa (Reardon, 2003). Various factors combine to make it difficult for small-scale farmers and processors to access and supply to supermarkets. Supermarkets respond to the demand for goods and services by consumers and this enables them to maximize profits in the face of stiff competition from other supermarkets and traditional food retailers. In order to remain competitive and to survive in the market place, supermarkets have set high quality standards for their products. They also may offer low prices to other smaller food retailers. To reduce transaction costs, supermarkets may integrate their supply chain and centrally procure products (Weatherspoon and Reardon, 2003). The growth of supermarkets is likely to have significant socioeconomic implications for farmers in general and small-scale farmers in particular. These include their capacity to participate in supermarket supply chains (Cervantes, 2005). However, because of high transaction costs associated with small-scale producers, supermarkets prefer to source from large-scale farmers and processors further marginalizing the smallholder farmers. Hence the problem of small scale vegetable farmers is that supermarkets are very demanding customers. They require higher and more consistent quality, consistent year round delivery, larger volumes, more stringent and payment terms. Suppliers who are successful in meeting these criteria face great growth opportunities, but those who cannot make the grade are likely to be dropped. Ultimately, thousands of small farmers are challenged by this shift.

Fresh vegetable farmers may need to invest on cold

storage and transport facilities in order to deliver products of high quality in time to supermarkets. However, many small producers in developing countries in Latin America and Africa may not be able to meet these conditions and many are struggling to comply with requirement set by supermarkets (Reardon, 2003). Urbanization, rising income, changing tastes and standards and the offer of many goods under one roof is also driving consumers to purchase more from supermarket than from retail markets. The situation is even worse for small vegetable producers whereby the retail markets are no longer profitable and small farmers have no access to supermarkets. In Kenya, vegetable producers can hardly make their produce to reach the supermarkets because of high standards and regulations in the supermarket supply chain system. As a result of the emerging supermarket procurement practices and requirements such as quality and food safety standards, packaging, volume, consistency and payment practices etc., new information is required to guide policy and strategize interventions which would enhance the development of equitable and efficient vegetable market supply systems in Kenya. Therefore, the main purpose for this study is to determine the factors that influence the choice of participation in the supermarket supply channel as compared to the traditional market channel. It focused on determining the factors hindering the shift from traditional market channels to supermarket supply chains in Nairobi and Kiambu Counties.

## RESEARCH METHODOLOGY

### Theoretical framework

In analyzing cross-sectional data involving marketing and management decisions, binary responses are often encouraged because of the categorical nature of the choice decisions. Technical, educational, institutional and farm characteristics are generally thought of influencing farm level choice of marketing supply channel in agriculture. Some selected socio-economic variables can therefore be used to develop the concept of threshold level of making the choice of supply channel and to develop a predictive model to determine the probability that a farmer in a given situational-function setting would be well positioned to make a supermarket supply channel choice compared to the traditional marketing channel. The appropriate model to analyze such types of decision problems is the qualitative response model, which is also known as the binary or discreet model.

There are many statistical approaches to predictive probability modelling (for example, density transfer, density regression, significance regression, discriminant function analysis and logistic regression analysis). However, the most popular of these models is the logit or logistic regression model (Carmichael, 1990). Logistic regression, although very similar to discriminant function analysis, is less constrained by statistical assumptions as it provides more powerful and consistent predictions (Kvamme, 1983). Logistic regression analysis readily accepts mixtures of nominal, ordinal, interval, and ratio scaled independent variables. In agriculture, qualitative response models, particularly the logit and the probit models have been extensively utilized in marketing choice decisions and technology adoption studies. There are no major differences between the two models, except that the error term in the probit model assumes a normal distribution while in the logit model it has a logistic distribution (Judge et al., 1988). Both models have been used successfully to investigate the probability of marketing decisions in supply chain adoption. Among the studies that have used, the logit model includes Zwart and McLeay (1997) and Mburu et al. (1995). The various advantages associated with the logit model analysis make it a simpler method for use in choice participation.

The logit model is based on the cumulative probability function:

$$P_i = F(Z_i) = 1/(1+e^{-z_i}) = 1/(1+e^{-(\alpha+\beta x_i)}) \quad (1)$$

Where, $P_i$ represents the probability that an individual will make a certain choice, given knowledge of $X_i$. Since it is similar to the cumulative normal function, but computationally more tractable, the logit function is often used as a replacement for the cumulative normal function. An equation to be estimated is obtained by rewriting equation 1 as:

$$(1+e^{-z_i})P_i = 1 \quad (2)$$

Then $$e^{-z_i} = (1-P_i)/P_i \quad (3)$$

And $$e^{z_i} = P_i/(1-P_i) \quad (4)$$

Taking logarithms of both sides yields:

$$Z_i = \log(P_i/1-P_i) \quad (5)$$

Thus, $$\log(P_i/1-P_i) = \alpha + \beta X_i \quad (6)$$

Where, $X_{i's}$ represent the explanatory variables that influence the log odds of participating in supermarket supply chain. The marginal effects are then calculated using equation 7.

$$\partial P_i/\partial X_j = \partial F(Z_i)/\partial(Z_i) * \partial Z_i/\partial X_j = f(Z_i) * \beta j \quad (7)$$

Where $F(Z_i)$ is the cumulative distribution function of $Z_i$, $f(Z_i)$ is the probability distribution function of $Z_i$, and $\beta_j$ are respective coefficients for the independent variables $X_{i's}$. Marginal effects are the actual probabilities of smallholder farmer participation in the supermarket supply chain given the independent variable.

**Model specification**

A number of variables were identified in assessing the determinants of the participation of small-scale farmers in the supermarket supply chain. Such variables were classified into three broad sets: productive, demographic and socio-institutional characteristics. Within the productive set of variables, factors which are related to the technological traits of the small-scale farmers are land size, use of tractor technology and labour cost. Demographic characteristics included the gender of the head of the household, age of the farmer and the level of education. The socio-institutional characteristics included: extension assistance, method of supply, group participation, formation of a supply relationship, ownership of transport, access to credit, sources of farming and marketing information. All sets of variables were included so as to determine their influence in farmers' decision to supply vegetables. In the logit regression analysis, the dependent variable corresponds to the decision of farmers to integrate with the supermarket's supply chain, and assumes a categorical value of "1" and "0" otherwise. The model equation was specified as follows:

$$Y_i = \log(P_i / 1 - P_i) = \alpha + \beta X_i + e_i \quad (8)$$

Where: $Y_i$ = Dummy variable that takes the values of 1 for farmers selling vegetables to supermarkets and 0 otherwise;
$\log(P_i/1-P_i)$ = logit for market channel choice;
$P_i$ = Probability of participation in supermarket supply chain;
$1-P_i$ = Probability that farmers have not organized to supply vegetables to supermarkets;
$X_i$ = Vector of independent variables (productive, demographic and socio-institutional variables);
$\beta_i$ = Parameters to be estimated;
$e_i$ = error term.

**Data and variables**

Cross sectional household survey was done in June 2012 in Nairobi and Kiambu Counties. Primary data were collected through a survey of farmers producing vegetables and supplying them to both open-air traditional markets and supermarkets in Nairobi. Five supermarkets were selected within Nairobi (that is, Tuskeys, Uchumi, Naivas, Nakumatt and Ukwala) based on the volume and supply of vegetables by farmers. Key informant interviews were done with the procurement managers at each supermarket to gather information on the sources of fresh vegetables and the supermarket requirements for farmers to qualify for a supply contract. The information from key informant interviews on vegetable supply sources was confirmed with agricultural officers in Kiambu County. Horticultural crops office in Kiambu County in conjunction with various supermarkets keeps records of farmers supplying vegetables to supermarkets as well as major traditional open air markets in Nairobi. In order to get a representative sample of the main supply areas within Kiambu County, purposive and stratified sampling of supply areas was undertaken. Random sampling technique was then used to select farmers in the selected strata and areas. A total of 60 smallholder farmers who participate in supplying vegetables to supermarket chains, and 60 smallholder farmers who supply vegetables to traditional open air markets in Nairobi either directly or through middlemen were selected. A structured questionnaire was then administered to the sample household heads through face-to-face interviews. In the absence of the head of the household, the spouse or any family member who is directly involved in the farming activities and management were interviewed. The variables used in this study were then extracted from the questionnaires administered to farmers. Table 1 describes the various variables and the expected associated signs.

**EMPIRICAL RESULTS AND DISCUSSION**

**Descriptive statistics results**

The descriptive statistics of vegetable farmer socio-characteristics are presented in Table 2. The results showed that the majority of the farmers interviewed were males (70.8%) and the others (29.2%) were females. 29.2% of the farmers producing vegetables had post-secondary school education, 57.6% had attained secondary school education, 13.3% had attained primary school and 0.8% had not attended formal schooling. It was observed that the majority of farmers had secondary school education and above. Well educated vegetable farmers are able to negotiate contracts with supermarkets on their own and access better prices. They are also able to adopt extension information and apply it in their production and marketing activities. The results further showed that the majority of the farmers (60%) were over 60 years, 34.2% ranged between 30-60 years and 5% were below 30 years of age. These results imply that most of the farmers have long period of experience in vegetable farming. However, this trend is worrying since most of the farmers are aging and there seems to be very little replacement with youth farmers.

**Table 1.** Description and expected sign of variables included in the Logistic Regression Model.

| Variable name | Variable description | Variable coding | Expected sign |
|---|---|---|---|
| lnfarms | Area of land under vegetables | Natural logarithm of number of acres | + |
| Lnlab | Labor cost (Kshs) per acre | Natural logarithm of labor costs | + |
| Tractec | Use of tractor technology for ploughing | 1 if farmers uses tractor, 0 otherwise | + |
| Gender | Manager of vegetable farm | 1 if male, 0 if female | +/- |
| Age | Age of manager | 1 if below 30, 0 otherwise | + |
| Education | Category of farmer's education (for example, none, primary, secondary etc.) | 1 if secondary level and above, 0 primary and below | + |
| Extentas | Access to extension services | 1 if has access to extension, 0 otherwise | + |
| Suplymeth | Method of supplying vegetables | 1 if supplies directly, 0 if through middlemen | - |
| Group | Group or individual participation | 1 if group, 0 if individual | + |
| Relaform | Relationship with buyer | 1 if there is a relationship, 0 otherwise | + |
| Transprod | Method of product transportation | 1 owned transport, 0 public or hired | + |
| Credit | Access to credit | 1 if access, 0 otherwise | + |
| Farminf | Source of farming information | 1 if from extension officers, 0 otherwise (Radio, farmers, etc.) | + |
| Markinf | Source of marketing information | 1 if from extension officers, 0 otherwise (Radio, farmers, etc.) | + |

**Table 2.** Socio-characteristics of vegetable suppliers in Kiambu County.

| Demographic properties | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 85 | 70.8 |
| Female | 35 | 29.2 |
| **Total** | 120 | 100.0 |
| | | |
| **Age group** | | |
| Under 30 | 6 | 5.0 |
| Between 30-60 | 41 | 34.2 |
| Over 60 | 73 | 60.8 |
| **Total** | 120 | 100.0 |
| | | |
| **Level of education** | | |
| None | 1 | 0.8 |
| Primary | 16 | 13.3 |
| Secondary | 68 | 56.7 |
| Post-secondary | 35 | 29.2 |
| **Total** | 120 | 100.0 |

Source: Sample survey of small-scale farmers' producing vegetables in Kiambu County, June 2012.

Table 3 shows farmer access to supermarkets and their observation on changes in outputs and labour use in vegetable production and supply. The results showed that 23.3% of the farmers supplied vegetables to Nakumatt supermarket, 28.3% to Uchumi and about 23.3% to Nakumatt and Uchumi, whereas the rest supplied to Ukwala and Tusky's respectively. The results further revealed that 48.3% supplied directly to supermarkets whereas the majority (51.7%) of them supplied their produce through middlemen. 88.3% of the farmers reported that there was observed increase in outputs and incomes since joining the supermarket supply channel.

**Table 3.** Farmers' access to supermarkets.

| Variable | Frequency | Percentage |
|---|---|---|
| **Farmers supplying to supermarkets** | | |
| Nakumatt | 14 | 23.3 |
| Uchumi | 17 | 28.3 |
| Naivas | 6 | 10.0 |
| Ukwala | 5 | 8.3 |
| Tusky's | 4 | 6.7 |
| Nakumatt-Uchumi | 14 | 23.3 |
| **Total** | 60 | 100.0 |
| | | |
| **Method of supply** | | |
| Direct to the supply channel | 52 | 43.3 |
| Through middlemen | 68 | 56.7 |
| **Total** | 120 | 100.0 |
| | | |
| **Change in outputs and income after joining supermarket supply chain** | | |
| Increased | 53 | 88.3 |
| No change | 7 | 11.7 |
| **Total** | 60 | 100 |
| | | |
| **Change in the number of farm workers after joining supermarket supply chain** | | |
| Yes | 55 | 91.7 |
| No | 5 | 8.3 |
| **Total** | 60 | 100 |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.

Only 11.7% reported no change before and after supplying to supermarkets.

The descriptive statistics further revealed that 91.7% of the farmers reported increases in the number of workers on farms since they started supplying to supermarkets. A plausible explanation for this observation could have been due to the supermarket requirements in terms of quantity, quality, food safety standards, packaging, etc. Hence in an endeavour to meet these requirements, farmers have to increase the number of farm workers. Only 8.3% of farmers reported that there was no change in the number of farm workers before and after they joined the supermarket supply chain. It is possible that these farmers had enough number of farm workers handling the produce to the satisfaction of supermarket supply chains.

Farmers reported different sources of information for farming and marketing (Table 4). The results show that 51.7% of farmers accessed farming information such as use of fertilizer, best planting seeds and crop protection practices from extension services. 39.2% reported that they accessed farming information from radios. Only 9.2% reported that their source of farming information was their fellow farmers. The descriptive results further showed that 55% of farmers accessed vegetable marketing information from the extension officers. 23.3% reported that their source of marketing information was from fellow farmers whereas 21.7% reported that they accessed information from the radio. These results imply that farmers have awareness of farming and marketing of vegetables. The findings are in line with that of Stokke (2009) which showed that supermarkets do have farm assistance programs that improve the productivity of local suppliers.

Table 5 shows the status of farmers' relationships with the supply channels for vegetables. The results showed that the majority of the farmers (81.7%) had a supply relationship with marketing channels. The farmers were also asked to evaluate the level of trust in the supply relationship. 51.7% reported that the level of trust was excellent, 30.8% reported high level of trust, while 17.5% reported low or no trust with marketing channels. The farmers were also asked about the benefit that they received due to the relationship between them and the marketing channels. Most of the farmers (56.7%) reported that it provides them with sustainable markets for the produce as well as a good sum of money paid at once which helps them plan for their farming activities.

**Table 4.** Sources of information for farming and marketing.

| Variable | Frequency | Percentage |
|---|---|---|
| **Source of information for farming** | | |
| Radio | 47 | 39.2 |
| Extension officers | 62 | 51.7 |
| Other Farmers/friends | 11 | 9.2 |
| **Total** | 120 | 100 |
| **Source of information for marketing** | | |
| Radio | 26 | 21.7 |
| Extension officers | 66 | 55.0 |
| Other famers/friends | 28 | 23.3 |
| **Total** | 120 | 100 |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.

**Table 5.** Farmers' relationships and partnerships with marketing channels for vegetables.

| Variable | Frequency | Percentage |
|---|---|---|
| **Have a supply relationship with supermarket/traditional buyers** | | |
| Yes | 98 | 81.7 |
| No | 22 | 18.3 |
| **Total** | 120 | 100 |
| **The level of trust formed for the relationship** | | |
| None | 11 | 9.2 |
| Low | 10 | 8.3 |
| High | 37 | 30.8 |
| Excellent | 62 | 51.7 |
| **Total** | 120 | 100 |
| **Benefit received due to the relationship** | | |
| Sustained market for the produce | 68 | 56.7 |
| All the money paid at once | 31 | 27.5 |
| Not applicable | 19 | 15.8 |
| **Total** | 120 | 100 |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.

Table 6 shows market preference of farmers between supermarket chains and traditional market chains. The results show that 88.3% of the farmers would prefer selling their products to supermarkets. They argue that supermarkets had an advantage of better prices and relatively larger volumes of vegetable delivery than traditional markets. The reason they gave for their preference of traditional markets was that there was no quality and volume requirements for these markets. These results imply that most farmers expect to sell their produce through the supermarket supply chain if they are helped to overcome some of the technical and institutional aspects in smallholder agricultural markets.

**Table 6.** Market preference by farmers.

| Variable | Frequency | Percentage |
|---|---|---|
| Supermarket chains | 106 | 88.3 |
| Traditional markets | 3 | 2.5 |
| Don't know | 11 | 9.2 |
| Total | 120 | 100 |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.

Table 7 shows the contractual status of supplying vegetables to supermarkets. The results showed that 61.7% of the contracts were verbal, and 38.3% of them were formal. The farmers reported that written contracts in most cases were applied when the produce is processed. The preference for verbal contract largely depended on the increased flexibility provided by the supermarket buyers or their agents. Informal contracts provided more flexibility for the small-scale farmers since they are not able to meet all the delivery requirements by supermarkets. The results further showed that 33.3% of the farmers who supply vegetables to supermarkets had to sign a contract and meet certain contractual conditions. Farmers with verbal contracts (61.7%) had agreed to meet certain quality standards and formed trust with supermarkets for delivery of vegetables. 78.3% of the farmers reported that they usually received their payments for supplying vegetables from the supermarket in less than a month, whereas 21.7% reported receiving their payment after one to two months. Most of the farmers reported that they have a good investment plan for their proceeds such as buying new land or acquiring technology that can help them increase vegetable production and supply.

Table 8 shows the mode of transport used by farmers for vegetable delivery to supermarkets. The results showed that 55.0% of the farmers use public transport to take their produce to supermarkets or distribution centres, 25.8% hired pick-ups to transport their vegetables while 19.2% use their own pick-ups for transportation.

Table 9 shows the various constraints farmers face as they supply vegetables through marketing channels. The majority of the farmers (44.2%) reported that the major constraint in transporting vegetables to supermarkets or distribution centres was poor road networks. This constraint had increased the cost of transport for

**Table 7.** Farmers' supermarket condition and supply arrangements.

| Variable | Frequency | Percentage |
|---|---|---|
| **Kind of farmers contract with supermarket** | | |
| Verbal | 37 | 61.7 |
| Formal | 23 | 38.3 |
| **Total** | 60 | 100 |
| | | |
| **Condition to meet in order to supply to supermarkets** | | |
| Sign contract/meet certain quality standards | 20 | 33.3 |
| Meet certain quality standards/formed trust relationships | 37 | 61.7 |
| Sign contract/meet certain quality standards/formed trust relationship/granted credit period | 3 | 5.0 |
| **Total** | 60 | 100 |
| | | |
| **Period for receiving the payment after supply** | | |
| Less than a month | 47 | 78.3 |
| One to two months | 13 | 21.7 |
| **Total** | 60 | 100 |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.

**Table 8.** Mode of transportation of vegetables to supermarkets/distribution centres.

| Variable | Frequency | Percentage |
|---|---|---|
| Public transport | 66 | 55.0 |
| Hired pick-ups | 31 | 25.8 |
| Own Pick-ups | 23 | 19.2 |
| Total | 120 | 100.0 |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.

vegetables. 25% of the farmers reported traffic jam along the roads as one of the constraints. This affected the delivery time to the supermarkets and makes farmers fail to meet the supermarket requirements in regards to the contract and the delivery days for the product. 24.2% of the farmers reported high costs of transportation especially due to limited number of vehicles for hire. The majority of the farmers (55.8%) indicated that they were not able to access credit for production. This could have effect on the quantity and quality of produce. Failure to meet grade and quality standards required by the supermarket was reported by 71.7% of the farmers. These factors hinder production and marketing activities and make farmers not to attain supermarket requirements.

Farmers supplying directly to supermarkets realized more gross revenues from supermarket chain participation compared to their counterparts supplying through traditional markets (Table 10). The results showed that farmers supplying to supermarkets generated monthly mean revenue of Kshs 99,808.4 while those supplying to traditional markets generated a monthly mean revenue of Kshs 21,338.4. It is also observed that their farm sizes, labour costs, number of labourers and input costs are higher than those of traditional market suppliers. The mean monthly revenues and inputs for farmers supplying through supermarket chain are significantly ($p<0.001$) greater than that of those supplying through traditional markets. The estimated gross margin (Gross revenue less costs of labour and inputs) for farmers supplying to supermarkets is Kshs 35,346.00 whereas that of those supplying to traditional markets is Kshs (-1847.00). Hence, farmers supplying to traditional markets experience a loss on average. These results are similar to those of Rao Elizaphan and Matin (2010) who found that there could be limited access to supermarkets for disadvantaged farmers. However, those with access to supermarket supply chains could realize improvement in household incomes due to better prices and steady flow of revenues.

## Logit model results

The model on decision of farmers to supply to supermarket chains is determined by the logit model (Equation 8). The probability of selling to the supermarket channel is influenced by the explanatory variables included in the model. Table 11 presents the results of the logit estimates of the factors that influence farmers' participation in the supermarket supply chains. The results showed that the model is highly significant in

**Table 9.** Farmers' constraints to participation in supermarket supply systems.

| Variable | Frequency | Percentage |
|---|---|---|
| **Transportation constraint** | | |
| Traffic Jam | 30 | 25.0 |
| Poor road networks | 53 | 44.2 |
| Damage caused by the method of transportation | 8 | 6.7 |
| High cost of transport | 29 | 24.2 |
| **Total** | 120 | 100 |
| | | |
| **Credit access** | | |
| Access | 53 | 44.2 |
| No access | 67 | 55.8 |
| **Total** | 120 | 100 |
| | | |
| **Constraints experienced in adhering to grades and standards** | | |
| Failure to meet quality standards | 43 | 71.7 |
| Failure to meet required quantity volumes hence selling at local markets | 9 | 15.0 |
| Market buy end up making loss due to high cost of production | 6 | 10.0 |
| Pest and diseases increased cost of buying manure | 2 | 3.3 |
| **Total** | 60 | 100 |

Source: Sample survey of small-scale farmers' producing vegetables in Kiambu County, June 2012.

**Table 10.** Mean monthly comparisons of input use and sales returns for farmers supplying to supermarket and traditional supply chains.

| Variable | Mean | Standard error of mean | t-value | p-value |
|---|---|---|---|---|
| **Monthly revenue (Kshs.)** | | | | |
| Supply to supermarket | 99808 | 43822 | 13.41*** | < 0.001 |
| Supply to traditional market | 21338 | 11536 | | |
| | | | | |
| **Farm size (Acres)** | | | | |
| Supply to supermarket | 2.458 | 0.1330 | 2.63*** | 0.010 |
| Supply to traditional market | 1.891 | 0.1697 | | |
| | | | | |
| **Labour cost (Kshs.)** | | | | |
| Supply to supermarket | 32942 | 13692 | 9.81*** | < 0.001 |
| Supply to traditional | 10033 | 11689 | | |
| | | | | |
| **Number of labourers** | | | | |
| Supply to supermarket | 5.333 | 1.866 | 11.92*** | < 0.001 |
| Supply to traditional market | 2.367 | 0.486 | | |
| | | | | |
| **Input costs (Kshs.)** | | | | |
| Supply to supermarket | 31520 | 17861 | 5.17*** | < 0.001 |
| Supply to traditional market | 13152 | 20926 | | |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.

estimating the factors that influence farmers' decision for the choice of the marketing channel. The Log likelihood statistic was -28.556857. The computed Log likelihood ratio with 14 degrees of freedom (that is, LR chi2 (14) is

**Table 11.** Logit model results on farmers' participation in supermarket supply chain.

| Variable name | Marginal effects | Std. Err. | z-Statistic | P-Values | Odds ratio |
|---|---|---|---|---|---|
| Lnfarms | 0.1061* | 0.0574 | 1.85 | 0.064 | 4.2658 |
| Lnlab | 0.2340*** | 0.0566 | 4.13 | 0.000 | 24.5089 |
| Tractec | -0.0085 | 0.0750 | -0.11 | 0.910 | 0.8902 |
| Gender | 0.0661 | 0.0739 | 0.89 | 0.371 | 2.4703 |
| Age | -0.0451 | 0.2079 | -0.22 | 0.828 | 0.5395 |
| Education | 0.3138*** | 0.1107 | 2.83 | 0.005 | 72.9976 |
| Extentas | -0.2331*** | 0.0552 | -4.22 | 0.000 | 0.0413 |
| Suplymeth | -0.1966*** | 0.0588 | -3.34 | 0.001 | 0.0680 |
| Groupp | 0.1476** | 0.0591 | 2.50 | 0.012 | 7.5241 |
| Relaform | 0.1592** | 0.0691 | 2.30 | 0.021 | 8.8156 |
| Transprod | -0.0454 | 0.0613 | -0.74 | 0.459 | 0.5378 |
| Credit | 0.0112 | 0.0568 | 0.20 | 0.843 | 1.1660 |
| Farminf | -0.0403 | 0.0548 | -0.74 | 0.462 | 0.5762 |
| Markinf | -0.0712 | 0.0567 | -1.25 | 0.210 | 0.3778 |

Source: Sample survey of small-scale farmers producing vegetables in Kiambu County, June 2012.
N = 120, log Likelihood = -28.556857, LR chi2(14) = 109.24, Prob > chi2 = 0.0000, Pseudo R2 = 0.6567.
*, ** and *** denote statistical significance at 10, 5 and 1% confidence levels respectively.

109.24). The model has a Pseudo R-square value of 0.6567. The model chi-square of 109.24 is significant at 0.1% level with a p-value of 0.000. These tests imply that in overall the model identifies the factors influencing farmers' choice of participation in supermarket supply chains. Hence all the factors together are jointly important in determining the probability of farmer's choice of supermarket supply chain. Among the individual explanatory variables, farm size, labour cost, education level, access to extension, method of supply, group participation and forming supply relationships are statistically significant. However, use of tractor technology, household gender, age of household head, ownership of transportation, access to credit, source of farming information and marketing information are statistically insignificant.

Farm size had a positive sign for supermarket supply chain choice, which is consistent with the *a priori* expectations. The marginal probability value (0.1061) has significance p-value of 0.064. These findings imply that there is enough evidence to support that an increase in the area under vegetables results in supermarket participation. These results are collaborated by descriptive statistics which showed that for the same type of vegetable, farmers supplying to supermarkets have slightly larger plots than those of farmers supplying to traditional markets (Ismail, 2012). The odds ratio value of 4.2658 associated with farm size indicates that the probability of participating in supermarket supply chain increases with increased area under vegetables.

The marginal probability of labour cost (0.2340) in vegetables is significant at 0.1% level (p-value=0.000). The positive sign on its coefficient indicates that improvement on the size and quality of farm labour costs results in increased supermarket supply chain participation choice by households. The large value of odds ratio (24.5089) shows that households are most likely to increase participation in supermarket supply chain with increased costs of labor use. The descriptive statistics indicated that 91.7% of households reported increased number of farm workers since they started supplying to supermarket chains. Increased number of farm workers could be an endeavour by farmers to meet supermarket requirements of quantity, quality, food safety standards, packaging etc.

The level of education has a marginal probability of 0.3138 which is significant (p-value = 0.005) at 1% level. The positive sign explains that more education for farmers results in households shifting from traditional markets to supermarket choice participation. The relatively large odds ratio (72.9976) indicates that households are most likely to choose supermarket supply chains with increased levels of education. More educated farmers are expected to have better understanding of business dealings such as supply arrangements, contracts and price negotiations.

The marginal probability for access to extension services (-0.2331) significantly (p-value=0.000) influenced farmers choice to participate in supermarket supply chain at 0.1% level. However, this variable has a negative sign which is against the choice of supermarket supply chain and is inconsistent with the *a priori* expectations. It is further observed that the marginal probabilities associated with sources of farming (-0.0403) and marketing

(-0.0712) information variables are negative and insignificant. The low values of odds ratios for access to extension (0.0413) source of farming information (0.5762) and source of marketing information (0.3778) show that households are most unlikely to make a choice for supermarket supply chain given the current state of extension access and information sources. The descriptive statistics (Table 4) indicated that 51.7 and 55.0% of farmers get farming and marketing information from agricultural extension officers. The current results are inconsistent with the findings of Cervantes (2005) in Mexico which showed that access to technical assistance increases smallholder probability to participate in supermarket supply systems. The current scenario would require investigation of the quality of the extension information reaching farmers as well as the method of delivery systems. Quality and up to date extension information delivered using current information technology systems can play a big role in helping farmers to change marketing perceptions from traditional channels to modern supermarket supply chains.

The results shown in Table 11 for "method of vegetable supply" are consistent with the *a priori* expectations. The marginal probability for this variable (-0.1966) is significant (p-value=0.001) at 1% level. The low odds ratio value (0.0680) fortifies the evidence to support that when households sell their produce through middlemen, there is a lower chance of participating in supermarket supply channel. This is because supermarket supply chains tend to favour large volumes as one of their requirements whereas smallholder farmers tend to have many small volumes which occasion high transaction costs. These results imply that the higher the percentages of the vegetable produce farmers sell to middlemen, the lesser the percentages of the vegetable available to supply to supermarket chains. Thus, loyalty to supermarket supply chains and their requirements encourages market penetration among smallholder farmers who find it difficult to gain market access.

The results for group participation are consistent with the *a priori* expectations. The probability of group participation (0.1476) significantly (p-value=0.012) influenced farmers' choice to participate in supermarket supply chain at 5% level. The value of odds ratio (7.5241) further supports that when households participate in groups as members there is a higher chance of participating in supermarket supply chain. Thus, group participation encourages market penetration among smallholder farmers who find it difficult individually to gain market access.

Expectations were that availability of a supply relationship between the farmers and the buyer in the supply channel could have a positive influence on the choice of marketing channel. The *a priori* expectations hold true for the supermarket supply chain. The results showed that the probability of making a decision for supermarket supply channel (0.1592) was significant (p-value = 0.021) at 5% level. These results were corroborated by descriptive statistics which showed that 81.7% of the farmers had a form of a relationship with the buyer in the supply channel whereas only 18.3% had no relationship with the buyer. The remaining variables (use of tractor technology, gender, age, transportation of produce, credit access, source of farming information and source of marketing information) do not significantly differ from zero.

## CONCLUSIONS AND RECOMMENDATIONS

This paper attempted to determine the factors that influence the choice of participation in supermarket supply channel compared to the traditional market channel in Kiambu County, Kenya. The methods of analysis used were descriptive statistics and the logit model. Data for the study were collected from a sample of 120 farmers - 60 supplying to supermarket supply chains and 60 supplying to traditional marketing channels. Multistage random sampling procedure was used to construct the sample. A structured questionnaire was then administered to individual farmers in a face to face cross-sectional survey interview conducted among the households sampled. The results showed that farmers participating in supermarket supply chain have significantly higher value of revenues, farm sizes, number of farm labourers, labour costs and input costs compared to those supplying to traditional markets. The logit model analysis indicated that the marginal probabilities for farm size, labour costs, education level and extension access, method of supply, group participation and formation of a supply relationship are statistically significant. As corroborated by descriptive statistics, these results imply that there is enough evidence that these factors determine farmers' choice for supermarket supply chain.

These findings suggest that an adjustment in each one of the identified variables can significantly influence the probability of supermarket supply chain participation. Technological improvements, development of partnerships and relationships as well as creation and build-up of institutional infrastructure that affect the behavioural systems of the vegetable value chain actors can largely influence farmers' choice for supermarket supply chain. It has to be appreciated that smallholder farmers face challenges in surmounting supermarket procurement requirements such as quality and food safety standards, packaging, volume, contractual agreements and payments.

One of the main challenges facing smallholder farmers is their small size both in terms of low quantity volumes and negotiating power. Hence, beneficial social and institutional innovations can help them band together in the form of group marketing arrangements. This approach can mitigate the constraints of low quantity volumes and

improve collective ability to negotiate effectively with supermarkets, as well as sharing the cost of inputs, and investment in infrastructure. They can also help the extension service to disseminate new farming ideas and market information to farmers, and reduce the cost of meeting supermarket procurement requirements. Often, strengthened producer market organizations are essential if smallholders are to reduce transaction costs and establish a stronger bargaining position in the supermarket supply chain. Public and private policy needs to support the development of social and institutional capital among small-holder farmers. Smallholder producer market groups, cooperatives and out grower schemes can greatly help farmers to get over the scale problem. Ultimately, supermarkets can help in a number of ways such as providing technical and financial support, reviewing buying practices, simplifying their codes, supporting the harmonization of codes and treating stallholder farmers as equal partners.

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