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**FACTORS AFFECTING SUPPLY OF AGRICULTURAL
INPUTS BY NON STATE ACTORS: A CASE OF
SELECTED NON STATE ACTORS IN LAIKIPIA
COUNTY, KENYA**

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FACTORS AFFECTING SUPPLY OF AGRICULTURAL INPUTS BY NON STATE ACTORS: A CASE OF SELECTED NON STATE ACTORS IN LAIKIPIA COUNTY, KENYA

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Abstract

Purpose: The purpose of this study was to determine the factors affecting sustainable supply of agricultural inputs in Kenya.

Methodology: Descriptive research design and correlational research design was employed. The target population comprised of employees from 5(five) NGOs in Laikipia County which are involved in agricultural support work. The sample size was 83 respondents. This study used stratified random sampling. Primary data was utilized in this study. Statistical package for social sciences (SPSS) was used for analysis. The statistics generated were frequencies, descriptive statistics and inferential statistics.

Results: Regression results showed that there is a positive and significant relationship between technology's related factors, private sector input financing factors, agricultural market information systems factors and sustainable agricultural input supply.

Unique contribution to theory, practice and policy: The study recommends improving the efficiency of credit systems, encouraging farmers to join cooperatives to reduce dependency, Apex body to help with the coordination of market activities and Development and extension of rural services

Keywords: *sustainable supply, agricultural inputs*

1.0 INTRODUCTION

1.1 Background of the Study

As the world enters an era of rapidly growing demand for food, declining resource availability and rising volatility, leaders in global food processing have recognized the need for more sustainable food production and are beginning to implement strategies for improved environmental, social and economic performance in their supply chains (Redecop, 2012). The issue of sustainable food production is a key topic of discussion among global representatives from government, NGOs and the food industry, who have all recognized the challenges ahead as the world enters a new era, marked by scarcer resources, greater demand and higher risks of volatility (WEF, 2011).

Agricultural supply in Kenya has recently been depressed by changing weather conditions (Reid, 2015). These depressing factors have reduced the potential for higher yields due to less than sufficient rains as well as late rains. These weather episodes have been associated with the global phenomenon of climate change. The arid and semi-arid parts of East Africa, particularly in northern Kenya, have been worst hit by prolonged drought spells causing livestock deaths due to shortage of water and vegetation for grazing. In the East African region the changing rainfall patterns can be associated with the declining agricultural supply (Redecop, 2012).

Despite Africa's rich agricultural resource endowment, the African continent remains the only region of the developing world where the agricultural input business is not well-developed. Despite the importance of agriculture in their economies, many countries on the continent are yet to establish a systematic focus in their agricultural planning history that shows a conscious effort to purposely prioritize the development of the agricultural input business. Economic growth and poverty reduction in Africa can be achieved by enhancing the productivity and profitability of agriculture through the development of the agricultural input sector (ECA, 2014).

Agricultural production remains an important sector in the economy of Kenya. Overall, agriculture contributes at least 23.9 percent of gross domestic product (GDP) and over 75 percent of total direct employment (UNDP, 2005). Agriculture is divided between large scale and small-scale production and there exist a wide range of crops that are produced. In the last few years, large-scale producers have declined significantly due to changes in land use. Close to 70 per cent of Kenyan farmers reside in rural areas where smallholder agriculture is their main livelihood activity. According to conducted research, more than two-thirds of all people surviving on less than \$1 a day live and work in rural areas (UNDP, 2005). Kenya's rural populations whose incomes and food are rooted in the agricultural sector are mainly poor and themselves victims of unfair trade practices. These practices hamper rural agricultural progress. Access to inputs and services important in increasing their agricultural supply become difficult due to their meager incomes. It is documented that every year \$350 billion is the amount of direct and indirect subsidies that are pumped into the agricultural sector (UNDP, 2005). It has been argued that this has far reaching effects on rural farmers in agricultural countries such as Kenya compared with developed country farmers in international markets. Subsidized exports undercut them in global and in local markets, driving down proceeds received by farmers and the wages received by agricultural laborers.

1.2 Problem Statement

Inputs supply and product market constrain agricultural supply response, particularly in developing countries. An overwhelming majority of the population in Africa relies on subsistence agriculture for their livelihoods. In Africa, agricultural productivity is extremely low, which is correlated with several intertwined factors, such as the low use of improved technologies, market failure, obsolete or lack of basic infrastructure and poor health during the beginning of the cropping season (Chambers and Conway, 2012).

Agricultural supply in Kenya has recently been depressed by changing weather conditions (Reid, 2015). These depressing factors have reduced the potential for higher yields due to less than sufficient rains as well as late rains. These weather episodes have been associated with the global phenomenon of climate change. The arid and semi-arid parts of East Africa, particularly in northern Kenya, have been worst hit by prolonged drought spells causing livestock deaths due to shortage of water and vegetation for grazing. In the East African region the changing rainfall patterns can be associated with the declining agricultural supply (Redecop, 2012).

Despite the efforts of the government to transform the agricultural sector, modern inputs (such as fertilizers, improved seeds and agro-chemicals) that are critical to the attainment of the desired productivity increases and output targets under the ongoing agricultural transformation agenda are not available in the right quantity, quality and price. Although the agricultural sector has been recording positive growth rates in recent times, the input distribution system has been in a parlous state. The inputs at the disposal of an average farmer remain grossly inadequate and are anything but modern, being of low quality and sub-optimal productivity.

It is on this basis that, locally registered NGOs, are running agricultural input supply schemes to improve crop production. However, in recent times critics have questioned the appropriateness of the approach of directly handing out free inputs to farmers on the basis that it undermines the traditional private agricultural input markets and also that it promotes the dependency syndrome among farmers (Chambers and Conway, 2012). To date however, there are no indications of food security among the disadvantaged households.

A key challenge affecting smallholder farmers' productivity is the lack of access to quality farm inputs. While many NGOs have implemented projects with objectives to enhance access, many of these projects have been unsustainable. There is no continuity after the project ends. The study will aim to look at the development agency strategies influencing sustainable supply of agricultural inputs. Studies on this area are scarce. Invariably there is still some homework to be done in the area of NGOs and sustainable input supply. Knowledge gaps, for example, the unavailability of a research that specifically looks at Kenya, county or national level, provide the impetus and rationale for undertaking this study. Inevitably the study does not share similarities with other studies that have been done in the past and what differentiates it from the rest is its issue and area specificity.

1.3 Research Objectives

To determine the best practice models pertaining to sustainable agricultural input supply

To investigate the technology related factors in the supply of agricultural input supply by non-state actors in Laikipia County

To examine the private sector input financing factors in the supply of agricultural input supply by non-state actors in Laikipia County

To investigate the agricultural market information systems factors in the supply of agricultural input supply by non-state actors in Laikipia County

2.0 LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Diffusion of Innovation Theory

Diffusion theory is a very important theory that describes the process of change, for example, diffusion of innovations in a community. This theory attempts to predict the behavior of individuals and social groups in the process of adoption of innovation, considering their personal characteristics, social relations, time factor and the characteristics of the innovation (Padel, 2013). According to Rogers (2013), diffusion of innovation is a kind of social change. It is a social process that involves interpersonal communication. Communication is a process in which participants create and share information with one another in order to reach mutual understanding. Diffusion is a special form of communication related to new ideas. It is a specific form of social change, defined as a process by which alteration occurs in the structure and function of a social system. Hall (2013) states that in the study of innovation the term diffusion is most often used to describe the process by which individuals or groups (companies) in the society/economy adopt a new technology or replace old technology with new. The four main elements in the diffusion of new ideas are: the innovation, communication channels, time and the social system. This process relies heavily on human capital. The innovation must be widely adopted in order to self-sustain. Within the rate of adoption, there is a point at which an innovation reaches critical mass. The categories of adopters are: innovators, early adopters, early majority, late majority, and laggards. Diffusion manifests itself in different ways in various cultures and fields and is highly subject to the type of adopters and innovation-decision process.

This theory is relevant to the study as it informs on the variable technology transfer. The theory asserts that technology transfer leads to innovations.

2.1.2 Supply Chain Management Theory

Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders (Lambert *et al* 2014). In brief, SCM is the management of relationships among the network of organizations, from original suppliers to end customers using key cross-functional business processes to create a value added service focusing on reducing the total cost for customers and all the stakeholders (Lambert, 2014). Basically, it is a process-oriented management approach and relationships internally within an organization, with immediate suppliers, with the focus on sourcing, production and delivery of goods and services to the end customer (Harland, 2012). Implementing an effective supply chain management approach is now essential to achieve competitive advantage in the global market economy (Lambert 2014). Historically, the importance of SCM was only limited on annual cost reduction, revenue growth and performance of the individual organization (Chandra & Kumar, 2011). Ultimately, the goal of optimizing supply chain management in a firm has

become to achieve competitive advantages by adding value to create efficiencies and effectiveness of material and information flow, thereby increasing customer satisfaction, thus benefitting on returns on investment and assets (Stock & Boyer, 2014). Consequently, with the increasing customer awareness and necessity of achieving customer satisfaction, the focal point of SCM trend moved towards the Customer Relationship Management (CRM) and Supplier Relationship Management (SRM). CRM and SRM creates an important link with the external companies within the network and attempts to develop and maintain relationship with the major customers by increasing the value offered to both customers and suppliers respectively (Lambert, 2014). However, the current trend of SCM is more inspired by the sustainability of operations management (Kleindorfer et al., 2015).

This theory is relevant to the study as it informs on the process of supply chain management. The theory asserts that proper SCM creates a value added service focusing on reducing the total cost for customers and all the stakeholders.

2.2 Empirical Review

Ali *et al* (2013) investigated the role of private sector in promoting Integrated Pest Management (IPM) practices among the farming community in Punjab, Pakistan. Sixty (60) extension personnel of a private extension agency and some 408 farmers were selected for interview by using simple random sampling technique through Fitzgibbon table. The data was collected through validated interview schedule and analyzed by using SPSS. The results of the study revealed that the mean value for the physical, cultural, and biological control methods was below 2 indicating that pesticide companies are less interested to promote Impractical. Farmers also reported that private extension staff emphasized on the aggressive use of pesticides rather than its judicious use. It is suggested that private sector should not recommend an extensive use of pesticides alone, but should also make efforts to promote other pest control methods in combination with chemical control.

Evenson and Mwabu (2014) examined effects of agricultural extension on crop yields in Kenya controlling for other determinants of yields, notably the schooling of farmers and agro-ecological characteristics of arable land. A quintile regression technique was used to investigate productivity effects of agricultural extension and other farm inputs over the entire conditional distribution of farm yield residuals. Results show that productivity effect of agricultural extension is highest at the extreme ends of distribution of yield residuals. Complementarity of unobserved farmer ability with extension service at higher yield residuals and the diminishing returns to the extension input, which are uncompensated for by ability at the lower tail of the distribution, are hypothesized to account for this U-shaped pattern of the productivity effect of extension across yield quintiles. This finding suggests that for a given level of extension input, unobserved factors such as farm management abilities affect crop yields differently. Effects of schooling on farm yields are positive but statistically insignificant. Other determinants of farm yields that we analyze include labour input, farmer experience, agro-ecological characteristics of farms, fallow acreage, and types of crops grown.

Ilemona et al (2014) assessed the economic impact of improved agricultural technologies on cassava productivity in Kogi State, Nigeria. The results were drawn from a household survey covering the agricultural season of 2009/2010. The data obtained from interview schedule was subjected to descriptive and inferential statistical analysis. Descriptive statistics for this

study include frequency, percentages and means. The hypothesis was tested using chi-square. The result shows that 79.33% of the respondents adopt the use of improved variety within the period under study. The analysis done on the revenue of the respondents before and after the adoption of the improved agricultural technology shows that revenue of farmers after the adoption of innovations are better off than revenue generated before adoption by N27,750 on the average per farmer. This result shows that the impact of improved agricultural technologies on cassava productivity is positive. Additionally, the results attest to the importance of increasing agricultural productivity in tandem with improvements on the adoption and use of improved agricultural technologies and its availability to the reach of farmers with the farmers' ability to store food. This finding is consistent with Idachaba and Ayoola, (2012) who observed that improved agricultural technologies helped in increasing agricultural productivity.

Laporte (2013) assessed the impact of the adoption of technological packages in agriculture Kenya on the farming households, as promoted by the National Agriculture and Livestock Extension Programme (NALEP), a program run by the Government of Kenya. To this end, the study collected data on beneficiaries through a survey of 1000 households in the district of Lugari, in Western Kenya. The study used propensity score matching to compute the average treatment effect on the treated. The study found evidence that program beneficiaries picked up a set of practices and technologies, treated households increased their fertilizer dosage by at least 24.91%, treated households were more likely to use improved water harvesting techniques, in terms of production, treated household appear to have followed the promoted practices of crop rotation, yet productivity per acre is not affected by the treatment and treated households also improved post-harvesting handling and marketing.

Olomola (2014) sought to examine the issues influencing the decisions of agro-dealers to participate in the loan market, analyze the demand for business loan by the agro-dealers and articulate policy measures for sustainable financing of agro-input business enterprises in Nigeria. The study employed primary data collected through structured questionnaires from 300 agro-dealers and used a Tobit type-II model for the analysis. The results show that interest rate, debt, value of asset, membership of trading association and source of credit are major determinants of loan demand. Agro-dealers need to organize themselves into input trading associations to enhance their creditworthiness and unleash the inherent social capital and information advantages for improved agro-dealership financing. Moreover, diversification of product coverage by agro-dealers and a value-chain approach that links internal financing in the form of trade credit within the agro-input sector with external financing from the commercial banks are strongly recommended.

Lanzing (2012) analyzed the impact of agricultural market information systems (MIS) activities on market performance in Mozambique. This report analyzes factors that are associated with reception of improved agricultural market information from the MIS and other sources among farmers in Mozambique, and how the reception of improved agricultural market information affects prices obtained by sellers of maize in Mozambique. Results indicated that providing improved agricultural market information helps to link farmers to markets, a process that improves their welfare, and moves them to more efficient market outcomes.

Shaikh (2013) aimed at highlighting the significance and importance of utilizing Marketing Information System (MKIS) on decision-making, as well as to describe the process of decisions taken by the managers using MKIS. The study also aims to lay out the necessary requirements for the successful implementation of MKIS in decision-making. The empirical research method was expert assessment, conducted by means of questionnaires. Correlation analysis was employed to test the validity of the procedure. The empirical study findings confirmed positive relationships between top management adopting MKIS elements and the success of an organizational decision making.

2.3 Conceptual Framework

Independent Variables

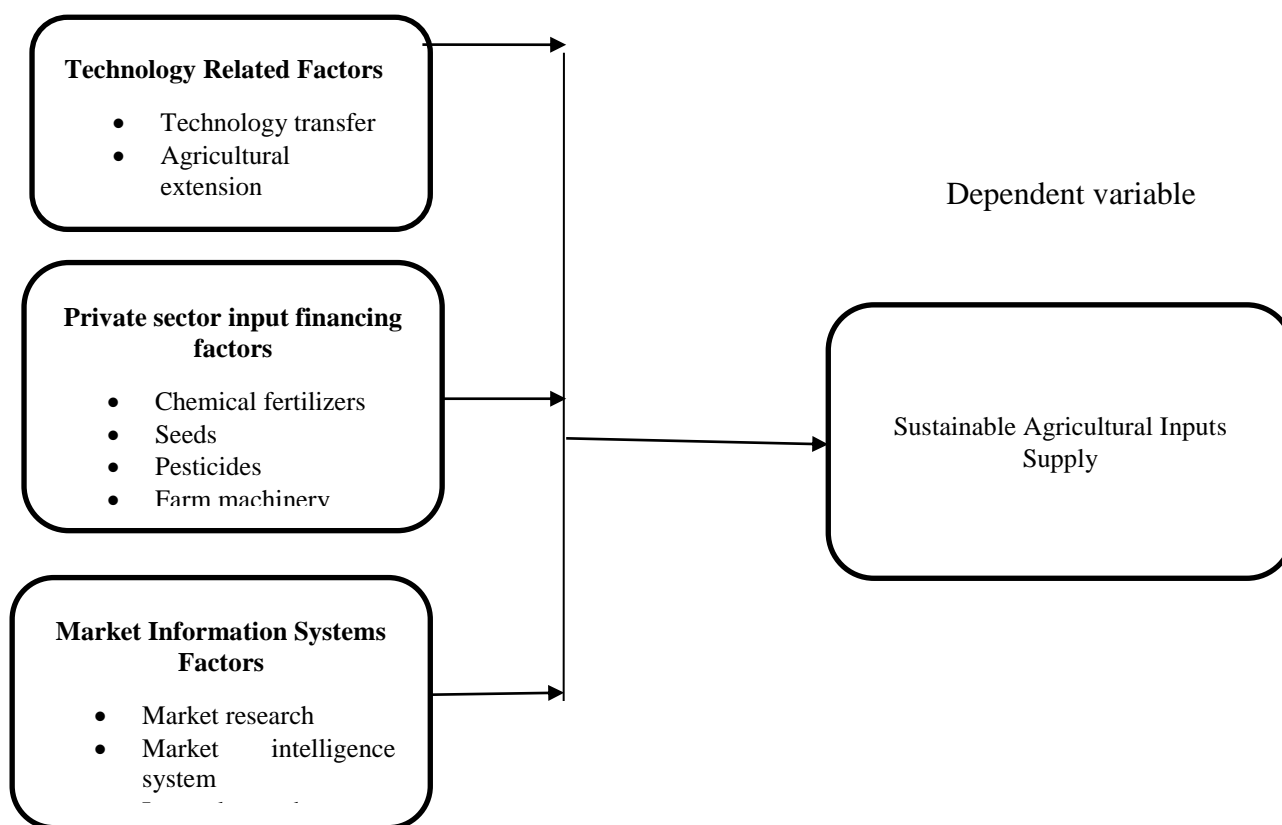


Figure 1: Conceptual Framework

3.0 RESEARCH METHODOLOGY

The descriptive research design and correlational research design was employed. The target population comprised of employees from 5(five) NGOs in Laikipia County which are involved in agricultural support work. The total population was 600 employees. The sample size was 83 respondents. Primary data was utilized in this study to enhance originality of the study. Data collection was carried out by use of questionnaires. After quantitative data was obtained through questionnaires, it was prepared in readiness for analysis by editing, handling

blank responses, coding, categorizing and keyed into statistical package for social sciences (SPSS) computer software for analysis. The statistics generated were frequencies, descriptive statistics and inferential statistics. Microsoft excel was used to complement SPSS especially in production of diagrams and tables. The pearson product movement correlation coefficient (r) was used to determine the strength of the relationship between different variables by use of the correlation coefficient, r, with a confidence interval of 95%. A multivariate regression model was used to link the independent variables to the dependent.

4.0 RESULTS AND DISCUSSIONS

4.1 Response Rate

The number of questionnaires that were administered was 83. A total of 67 questionnaires were received out of a possible 83 questionnaires. This is a response rate of 80.7%. The unsuccessful response rate was 16 questionnaires (19.3%). According to Mugenda and Mugenda (2003), a response rate of more than 50% is adequate for analysis. Babbie (2004) also asserted that a return rate of 50% is acceptable for analysis and publishing. He also states that a 60% return rate is good and a 70% return rate is very good. The achieved response rate was 81.9% which implies that the response rate was very good since it implies representativeness. The sample drawn for the questionnaire research compares well with the population of interest. The response rate matrix is presented on Table 1.

Table 1: Response Rate

Details	Frequency	Percent
Returned Questionnaires	67	80.7%
Unreturned Questionnaires	16	19.3%
Total	83	100%

4.2 Demographic Information

This section presents the descriptions of the respondents in terms of their gender, age, level of education and period of work.

4.2.1 Gender

The respondents were asked to indicate their gender. The majority of respondents were male as supported by a percentage of 58% while the female respondents represented 42% of the respondents. The findings are presented in Figure 2.

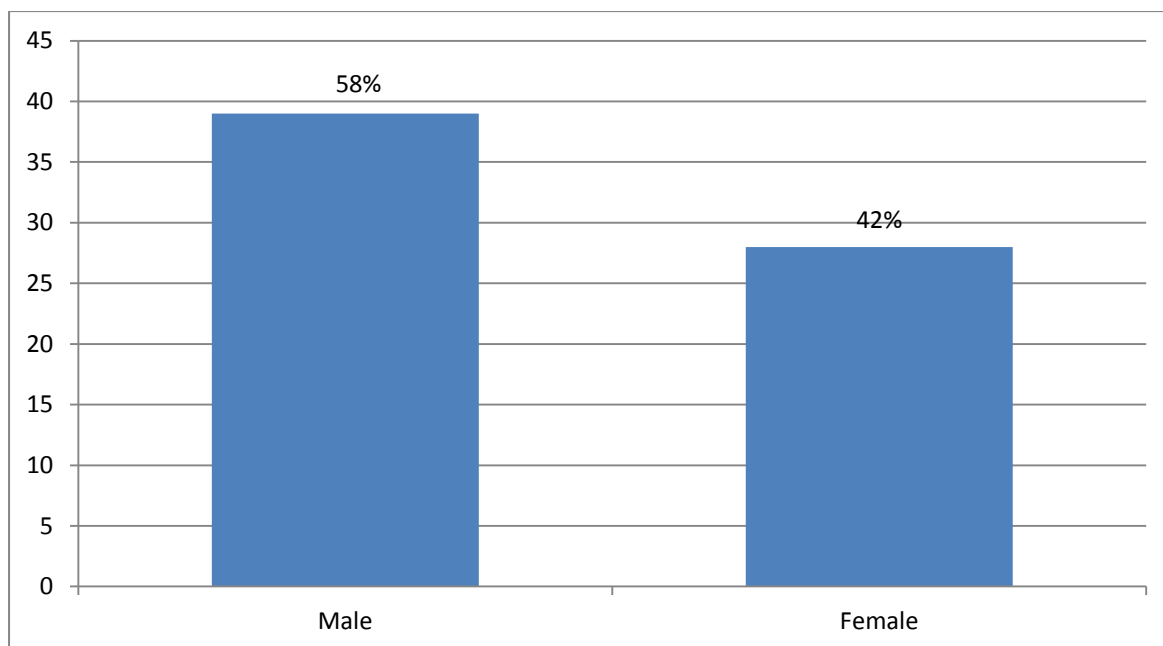


Figure 2: Gender of Respondents

4.2.2 Age of Respondents

The respondents were asked to indicate their age. According to study findings, 19 percent of respondents are aged below 35 years, 30 percent aged between 35-44 years, 21 percent were aged between 45-54 years and 30 percent aged 55 years and above. This implies that the respondents are mature enough and were able to understand the questionnaire. The findings are presented in Figure 3

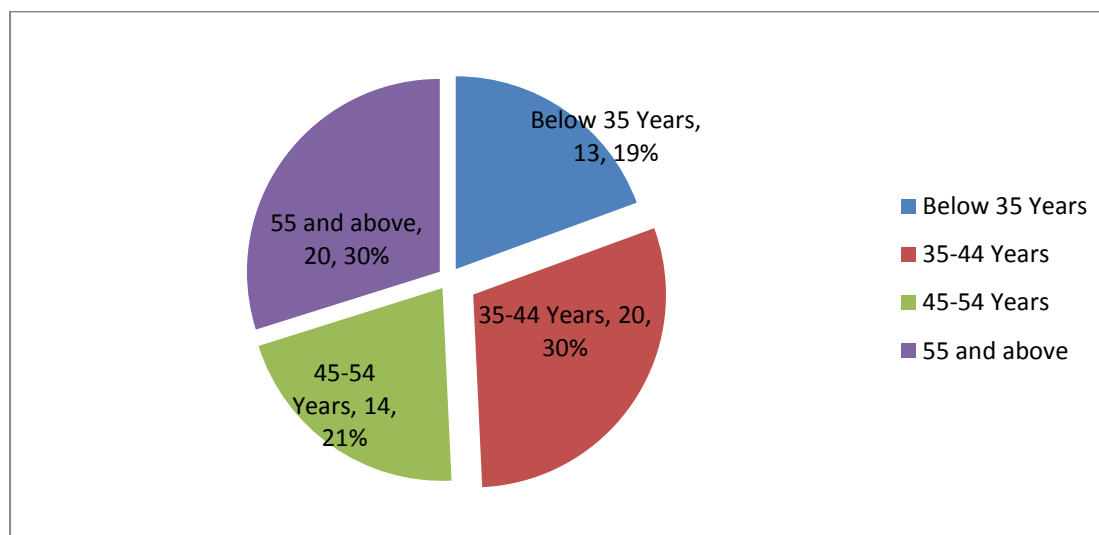


Figure 3: Age of Respondents

4.2.3 Academic Rank

The respondents were asked to indicate their highest levels of academic rank achieved. 21 percent of the respondents indicated they had a certificate level academic rank, 28% had a

diploma, 26% had reached the graduate level while 25% had a postgraduate education. The results are presented in Figure 4

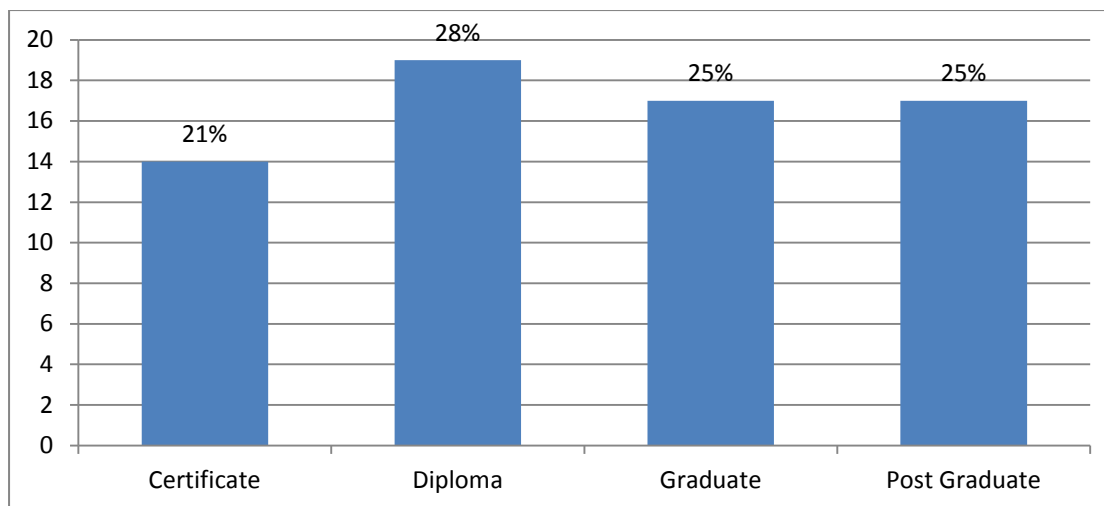


Figure 4: Academic Rank of Respondents

4.2.4 Years Employed in Current Position

The respondents were asked to indicate how many years they had been employed in their current positions. 30% of the respondents had been in the organizations for less than two years, 28% had been employed for 3-5 years while 42% had been working in the NGOs for more than 5 years. The finding implies that the respondents are experienced enough to answer the study questions. The findings are presented in Figure 5

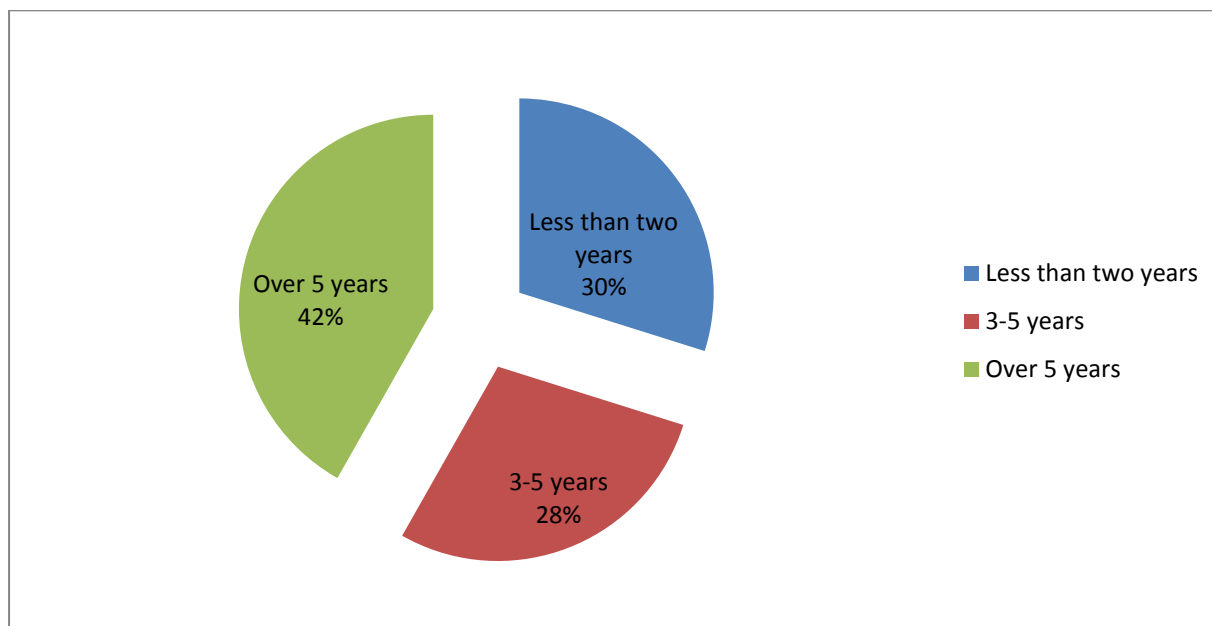


Figure 5: Years Employed in Current Position

4.3 Descriptive Statistics

This section presents the descriptive results on technology transfer, agricultural extension, private sector input financing and agricultural market information systems.

4.3.1 Best Practice Models in Agricultural Supply

The first objective of the study was to determine the best practice models in agricultural input supply. The results are presented in Table 2. Majority of the respondents, 60% were disagreeing to the statement that the best model is where the government and non-state actors provides the inputs free of charge, 29% of the respondents agreed while 10% were neutral. On the statement that the best model is where the farmers fully pay for the inputs, 55% of the respondents disagreed, 18% were neutral while 26% agreed to the statement. Finally, 34% of the respondents disagreed with the statement that the best model is a cost sharing arrangement between the non-state actors and the farmers, 15% were neutral while 51% agreed. On a five point scale, the average mean of the responses was 3.3 which means that majority of the respondents were agreeing to the statements in the questionnaire. The standard deviation was 1.4 meaning that the responses were clustered around the mean response.

Table 2: Best Practice Models in Agricultural Supply

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dev
The best model is where the government and non state actors provides the inputs free of charge	30%	30%	10%	19%	10%	3.4	1.5
The best model is where the farmers fully pay for the inputs	27%	28%	18%	10%	16%	3.5	1.3
The best model is a cost sharing arrangement between the non state actors and the farmers	21%	13%	15%	30%	21%	3.2	1.5
Average						3.3	1.4

4.3.2 Technology Related Factors

The second objective of the study was to determine the influence of technology related factors in promoting sustainable agricultural input supply. The results are presented in Table 3. A slight majority of the respondents, 50.8% of the respondents were in agreement with the statement “We frequently train farmers on the balanced use of fertilizer” 11.9% were neutral while 37.3% disagreed. Another 53.7% of the respondents agreed that they empower farmers to break out of their poverty, 10.4% were neutral while 35.8% disagreed. On the question on whether the organization identifies farmers’ needs, match them to scientific opportunities, 23.9% of the respondents strongly disagreed, 14.9% disagreed, 23.9% of the respondents were neutral, 22.4% agreed while 14.9% strongly agreed. 34.3 % affirmed that incentives

were provided to them to collaborate with international researchers, 20.9% were neutral while 44.8% did not agree to the statement. Another 41.8% of the respondents indicated that high quality research to complement internationally available technologies is provided by the organizations, 14.9% were neutral while 43.3% of the respondents did not agree with the statement. On a five point scale, the average mean of the responses was 3.0 which means that majority of the respondents were agreeing to the statements in the questionnaire. The standard deviation was 1.5 meaning that the responses were clustered around the mean response.

Table 3: Technology Related Factors

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dvn
We frequently train farmers on the balanced use of fertilizer	19.40%	17.90%	11.90%	23.90%	26.90%	3.2	1.5
We empower farmers to break out of their poverty.	22.40%	13.40%	10.40%	31.30%	22.40%	3.2	1.5
We help farmers to set up, structure and develop organizations	22.40%	22.40%	19.40%	16.40%	19.40%	2.9	1.4
We encourage farmers to become involved in extension activities	20.90%	17.90%	16.40%	22.40%	22.40%	3.1	1.5
The organization identifies farmers' needs and match them to technological opportunities	23.90%	14.90%	23.90%	22.40%	14.90%	2.9	1.4
There are incentives for staff to collaborate with international researchers	23.90%	20.90%	20.90%	14.90%	19.40%	2.9	1.4
We conduct high quality research to complement internationally available technologies	17.90%	25.40%	14.90%	20.90%	20.90%	3.0	1.4
Average						3.0	1.5

4.3.3 Private Sector Input Financing Factors

The third objective of the study was to determine the impact of private sector input financing in promoting sustainable agricultural input supply. The respondents were required to state their level of agreement/disagreement on a likert scale to some statements relating to private sector input financing. Only 41.8% of the respondents affirmed the statement that their

organization extends loan schemes to farmers, 16.4% were neutral while 41.8% were not in agreement with the statement. On the question of improving agro-dealer access, 35.8% agreed that their organization had improved agro-dealer access to the farmers. On a five point scale, the average mean of the 2.9 which means that majority of the respondents were agreeing to the statements in the questionnaire. The standard deviation was 1.4 meaning that the responses were clustered around the mean response.

Table 4: Private Sector Input Financing Factors

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std.Dvn
Loan schemes to farmers	22.4%	19.4%	16.4%	22.4%	19.4%	2.970149	1.456128
Agro-dealer access	17.9%	29.9%	16.4%	22.4%	13.4%	2.835821	1.332542
Farm machinery to smallholder farmers in the region.	25.4%	17.9%	17.9%	13.4%	25.4%	2.955224	1.541672
Our organization provides seeds to smallholder farmers in the region	19.4%	25.4%	19.4%	16.4%	19.4%	2.910448	1.411332
Average						2.91791	1.435418

4.3.4 Agricultural Market Information Systems and Sustainable Agricultural Input Supply

The study further sought to determine the impact of agricultural Information systems on sustainable input supply. 47.8% of the respondents were in agreement that their organization collects and provides information on transportation costs, 44.8% agreed that their organization carries out market analysis covering opportunities and outlook for selected commodities, 47.7% agreed that their organization estimated quantities of commodities available for sale while 47.8% of the respondents agreed that their organization provides price information for a range of consumer products. On a five point scale, the average mean of the responses was 3.9 which means that majority of the respondents were agreeing to the statements in the questionnaire. The standard deviation was 1.5 meaning that the responses were clustered around the mean response.

Table 5: Agricultural Market Information Systems and Sustainable Input Supply

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dvn
Collects and provides information on transportation costs	23.9%	13.4%	14.9%	22.4%	25.4%	3.1	1.5
Market analysis covering opportunities and outlook for selected commodities	22.4%	14.9%	17.9%	22.4%	22.4%	3.1	1.5
Estimated quantities of commodities available for sale	20.9%	10.4%	20.9%	32.8%	14.9%	3.1	1.4
Price information for a range of consumer products	16.4%	23.9%	11.9%	26.9%	20.9%	3.1	1.4
Average						3.9	1.5

4.4 Inferential Statistics

Inferential analysis was conducted to generate correlation results, model of fitness, and analysis of the variance and regression coefficients.

4.4.1 Correlation Analysis

The Table 6 presents the results of the correlation analysis. The results presented in the Table 6 shows that best practice models and sustainable agricultural input supply are positively but not significantly related ($r=0.112$, $p=0.367$). Technology transfer models and sustainable agricultural input supply are positively and significantly related ($r=0.379$, $p=0.002$). The table further indicates that private sector input financing is positively and significantly related to sustainable agricultural input supply ($r=0.340$, $p=0.005$). Finally, results showed that agricultural market information systems and sustainable agricultural input supply were positively and significantly related ($r=0.398$, $p=.001$).

Table 6: Correlation Matrix

		Sustainable Supply	Technology Transfer	Private sector input financing	Agricultural Market Information Systems
Sustainable Supply	Pearson Correlation	1	.379**	.340**	.398**
	Sig. (2-tailed)		0.002	0.005	0.001
Technology Transfer	Pearson Correlation	.379**	1	-0.063	0.23
	Sig. (2-tailed)	0.002		0.612	0.061
Private sector input financing	Pearson Correlation	.340**	-0.063	1	-0.009
	Sig. (2-tailed)	0.005	0.612		0.941
Agricultural Market Information Systems	Pearson Correlation	.398**	0.23	-0.009	1
	Sig. (2-tailed)	0.001	0.061	0.941	

4.4.2 Regression Analysis

The results presented in table 7 present the fitness of model used of the regression model in explaining the study phenomena. Agricultural extension, technology transfer, private sector input financing and agricultural market information systems found to be satisfactory variables in explaining sustainable agricultural inputs supply. This is supported by coefficient of determination also known as the R square of 0.383. This means that the independent variables explain 38.3% of the variations in the dependent variable which is sustainable agricultural inputs supply. This results further means that the model applied to link the relationship of the variables was satisfactory.

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.619	0.383	0.344	0.55779

The overall model was significant with an F statistic of 9.634 as shown in table 8 below.

Table 8: Analysis of Variance

ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Regression	11.990	4	2.997	9.634	.000
Residual	19.290	62	0.311		
Total	31.280	66			

Regression of coefficients results in table 9 shows that there is a positive and significant relationship between technology transfer factors (B=0.271, p=0.006) private sector input financing 0.397(0.000), agricultural market information systems 0.248(0.002) and sustainable agricultural input supply. This implies that a unit increase in technological factors will lead to a 0.271 increase in sustainable agricultural input supply, a unit increase in private sector input financing leads to a 0.397 increase in sustainable agricultural input supply while a unit increase in agricultural market information systems leads to a 0.248 increase in sustainable agricultural input supply.

Table 9: Regression Analysis

		B	Std. Error	T	Sig.
Model	(Constant)	0.692	0.496	1.394	0.168
	Technology transfer factors	0.271	0.096	2.83	0.006
	Private sector financing	0.397	0.107	3.698	0.000
	Agricultural MIS	0.248	0.076	3.246	0.002

The multiple linear regression model is as shown below.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$$

Where:

X₁ = Technology related factors

X₂ = Private sector input financing factors

X₃ = Agricultural market information systems factors

Y = sustainable agricultural input supply

Thus, the optimal model for the study is;

$$\text{Sustainable agricultural input supply} = 0.692 + 0.271 \text{ Technology transfer models} + 0.397 \text{ Private sector input financing} + 0.248 \text{ Agricultural market information systems}$$

5.0 DISCUSSION CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

The first Objective of the study was to determine the best practice models for sustainable agricultural input supply. Results revealed that the two variables have a positive non significant relationship (r=0.112, p=0.367). These findings agree with those Lanzing (2012) who analyzed agriculture input related taxes and tariffs policies and their impact on input prices, production costs and profitability, focusing on the greenhouse sector in Albania. The study combines desk research and expert interviews to collect data and to analyze the main policy reforms and the tariff regime. A financial cost benefit analysis is implemented in order to observe the effect of the change of taxes in both sides: at farm gate profitability of Albanian farmers as well as in terms of revenues forgone in the state budget based on revenues collected. According to the research findings, tax exemption on inputs such as agrochemicals and fuel would significantly affect positively the profitability at the farm level and the overall agriculture sector competitiveness.

The study sought to determine the effect of technology transfer factors on sustainable agricultural input supply. The results revealed that technology transfer factors and sustainable agricultural input supply have a positive significant relationship ($r=0.379$, p -value 0.002). These findings corroborate those of Ilemona *et al.*, (2014) who assessed the economic impact of improved agricultural technologies on cassava productivity in Kogi State, Nigeria. The results showed that the impact of improved agricultural technologies on cassava productivity is positive. Additionally, the results attest to the importance of increasing agricultural productivity in tandem with improvements on the adoption and use of improved agricultural technologies and its availability to the reach of farmers with the farmers' ability to store food.

The findings also agree with those of Laporte (2013) who assessed the impact of the adoption of technological packages in agriculture on the farming households in Kenya. The study found evidence that program beneficiaries picked up a set of practices and technologies, treated households increased their fertilizer dosage by at least 24.91%, treated households were more likely to use improved water harvesting techniques, in terms of production, treated household appear to have followed the promoted practices of crop rotation, yet productivity per acre is not affected by the treatment and treated households also improved post-harvesting handling and market.

These findings are in line with those of Pan (2014) who examined the impact of agricultural extension on farmer nutrient management behavior. Survey data about rice farmers in seven provinces of rural China are used. The empirical results indicate that participation in agricultural extension has a positive impact on rationalizing farmer nutrient management behavior. The findings also agree with those of Evenson and Mwangi (2014) who examined effects of agricultural extension on crop yields in Kenya controlling for other determinants of yields, notably the schooling of farmers and agro-ecological characteristics of arable land. Results showed that productivity effect of agricultural extension is highest at the extreme ends of distribution of yield residuals. The results further corroborate those of Hasan *et al.*, (2013) who examined whether agricultural extension improves household crop productivity and found that participation in agricultural extension programs significantly raised crop productivity and household expenditure per capita.

The third objective of the study was to determine the effect of private sector input financing on sustainable agricultural input supply. The results revealed private sector input financing and sustainable agricultural input supply have a positive significant relationship ($r=0.340$, p -value 0.005).

The fourth objective of the study was to determine the effect of agricultural marketing information systems on sustainable agricultural input supply. The results revealed agricultural marketing information systems and sustainable agricultural input supply have a positive significant relationship ($r=0.398$, p -value 0.001). Findings are in line with those of Shaikh (2013) who aimed at highlighting the significance and importance of utilizing Marketing Information System (MKIS) on decision-making, as well as to describe the process of decisions taken by the managers using MKIS. The empirical study findings confirmed positive relationships between top management adopting MKIS elements and the success of an organizational decision making. These findings also corroborate those of Lanzing (2012) who analyzed the impact of agricultural market information systems (MIS) activities on market performance in Mozambique and results indicated that providing improved

agricultural market information helps to link farmers to markets, a process that improves their welfare, and moves them to more efficient market outcomes.

5.2 Conclusions

The study was conducted with a view to determine the factors affecting sustainable supply of agricultural inputs in Kenya. To accomplish the study purpose, a model for sustainable agricultural input supply function was specified and estimated considering technology related factors, private sector investment factors and agricultural market information systems factors as independent variables. The main findings of the study confirm with statistical significance that to bring sustainable agricultural development and ensure food self sufficiency of the nation, actors involved in the sector should act synergistically. Services like extension, inputs supply, credit provision, research and development are amongst all the most significant for the realization of bringing about change at the agricultural inputs supply sector. Agricultural inputs like seed, fertilizer, pesticides, and improved farm tools, supplied in line with efficient extension services would lead to enhanced production and productivity.

5.3 Recommendations

Inaccessibility of credit is a serious issue that inhibits farmers' productivity in the sector. This, in response, disfavors the majority of small scale farmers in shifting their livelihood status and resulting in food shortage. Therefore, improving the efficiency of credit systems, timely and sufficient delivery of credit to farmers who engage on crop production has to be considered as a central and core component of any development intervention in the sector.

There is need to encourage farmers to join cooperatives to reduce dependency. In addition, there is need for a well-planned exit strategy for assistance, and realistic goals to ensure sustainability.

There is a need for an apex body to help with the coordination of market activities, such as accessing market information and communication with the farmers. This would also provide an excellent network amongst the farmers and hence, it would increase their influence in the market.

Development and extension of rural services and enhancing production resources of the farming community that leads to improvement of life quality can have a considerable influence on agricultural sustainability.

5.4 Areas for Further Research

The study was successful in identifying the factors that determine sustainable agricultural input supply. Nevertheless, the following areas are suggested for future research: Considering that the situation in other parts of the country may be different from that which Laikipia County is facing, this research suggests that a cross sectional study is undertaken. Further research could also test to what levels the identified factors are affecting sustainable agricultural inputs supply.

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