Analysis of Supply Chain and Demand for Fertilizer in Ethiopia: Empirical Evidence from Kersaand Malima Woreda of Oromia Region, Ethiopia

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Abstract

The role of the agricultural sector in terms of its contribution to the economy of Ethiopia is large. To accelerate the sector's growth and increase its contribution to the overall economic growth, modern agricultural inputs particularly use of chemical fertilizers for crop production plays a significant role in yield increase. This study, therefore, assessed the factors affecting demand and supply for fertilizer in Ethiopia as a case study in Kersa and Malima woreda in Oromiya National Regional State of Ethiopia. Descriptive statistics were used to analyses supply chain for fertilizer. Descriptive statistics and Econometric model were used to analyze of factors affecting demand for fertilizer in Ethiopia in the case study area. Under the analyses supply chain for fertilizer the result of descriptive statistics of Pearson correlation it is concluded that there is relationship between the seven variables (Estimation of demand for fertilizer purchase, Storage Facility, Custom process and Documentation, Transportation, Collaboration of Stakeholders, Distance from the village to market, Process of Order Issuance) with supply chain performance. Under analyze of factors affecting demand for fertilizer econometric estimation results depicted that price of fertilizer, farm size, access to credit, access to extension services, off-farm income, number of oxen and on time-delivery of fertilizer negatively affected the demand of fertilizer. Hence, an additional store building, computerized system of estimation of demand for fertilizer, subsidy programs on the price of fertilizer, delivering credit, efficient extension system, due attention for timely distribution of fertilizer to the farmers are likely to improve demand and supply for fertilizer in Ethiopia.

Keywords: Chemical fertilizer, demand and supply chain, Kersa Malima Woreda, Ethiopia

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Introduction

In Ethiopia, nearly 85% of the population is directly dependent on agriculture. The Agriculture sector in Ethiopia is mainly characterized by subsistence farming system. .However, the sector is the principal engine of the country's economy growth by accounting for 83% of the labor force, 90% of exports and 45% of gross domestic product (GDP).Despite of the importance of the sector in the country's economy, the agricultural production system is characterized by low productivity, low level use of agricultural technology, lack of infrastructures and market institutions, and vulnerability to climate change. The sector is also based largely on use of low productive techniques where farm production heavily depends on traditional and backward techniques of production on fragmented lands (Abrhaley, 2016).

Aprolonged increase in agricultural production and improved productivity can be achieved through either use of modern agricultural technologies or enhancing the efficiency of production or both (Sisay et.al, 2016).According to Ezeh et al., (2006) and chemical fertilizer is considered as one of the most important inputs for the achievement of increased agricultural production and productivity.

In Ethiopia,30–40 percent of smallholder farmers use inorganic fertilizer. The usage is on average37–40 kilogram/hectare which is below the recommended rates (Spielman, Alemu and Kelemwork, 2013).Low use of agricultural inputs keep the agricultural production and productivity low and made Ethiopiaas one of the food insecure nations of the world (Belay2003). A macro level analysis using the Central Statistical Authority (CSA) and the Ethiopian Rural Household Survey (ERHS) data showed that the high price

of fertilizer is the major constraint for fertilizer application followed by supply shortage and late arrival of fertilizer in the country(Kefyalew, 2010).

Ethiopian Agricultural Business Corporation(EABC) is the one and the only one importer of fertilizers by holding all the ownership and risks pertaining to fertilizers imports (Reta 2016), The main challenges that the enterprise faces are foreign currency problem, delay in customs clearance and transit time and problem with labor force during loading and unloading of fertilizers. EABC had its own marketing network throughout the country, which included marketing centers and service cooperatives for distributing fertilizers to the farmers. Like in many African countries, EABC controlled marketing was inefficient and expensive (ATA, 2012 –unpublished as cited Gebrerufael, 2015). This complete control of fertilizer importation has been enabling the government to take an advantage of economies of scale (bargaining power in the international market and transport cost) but the long domestic supply chain and absence of competition compounded by the poor infrastructure development has led to late delivery of fertilizer to farmers (Gebrerufael, 2015).

According to Simchi-Levi et al., (2000), supply chain is defined as a combinatorial system consisting of four processes namely plan, source, make and deliver, whose constituent parts include suppliers, distribution services and customers linked together. Aitken (1998) defined Supply chain as a network of connected and interdependent organizations mutually and co-operatively working together to control, manage and improve the flow of goods and information from suppliers to end users. Supply Chain is the group of manufacturers, suppliers, distributors, retailers and transportation, information and other logistics management service providers that are engaged in providing goods to consumers (Chow, Heaver and Henriksson,

1999).A supply chain has a sequence of (decision making and execution) processes and (material, information and money) flow that aim to meet final customer requirements that take place within and between different stages along a continuum, from production to final consumption. Supply chain not only includes the producer and its suppliers, but also, depending on the logistic flows, transporters, warehouses, retailers, and consumers themselves (FAO, 2007).Effective management of supply chains has proven to be a very effective mechanism for providing prompt and reliable delivery services at the least cost.

In order to achieve an efficient supply chain, performance evaluation of the entire supply chain is very important. This means utilizing the combined resources of the supply chain members in the most efficient way possible to provide cost-effective services. Hence, overall cost-effective chain efficiency is defined as the efficiency which takes in to account the multiple performance measures related to the supply chain members, as well as the integration and coordination of the performances of those members (Mishra R., 2012). Performance Measurement is the process of quantifying the effectiveness and efficiency of actions. Supply Chain Performance (SCP) refers to the overall supply chain's activities in meeting end-customer requirements, including product availability, timely delivery, and all the required inventory and capacity in the supply chain to deliver that performance in are sponsive manner.

Mishra, R.,(2012),indicated that supply chain performance depends on the efficiency of supply chain. In a business environment supply chain efficiency measurement is an important factor to know the supply chain better, and hence helpful for the company to take corrective measures to check the problem. For the measurement of supply chain performance the efficiency or

the effectiveness of an outcome of a supply chain activity is analyzed (Fugate et al., 2010). Supply chain performance can be looked at as the extent by which supply chain's activities effectively and efficiently ensure realization of organization goals and objectives.

From an economist's market perspective whereby the intersection of the fertilizer demand and fertilizer supply functions determines consumption levels. In other words, consumption is the outcome of the conversion of fertilizer's economic potential into farmers' effective demand and the fulfillment of this demand through fertilizer supply and distribution systems (Desai 1988). In developing countries, fertilizer's economic potential—determined by the prevailing fertilizer responses and prices—is almost always much larger than actual use (Desai 2002).

Kelly (2001) defined fertilizer demand as the quantity of fertilizer that farmers would be willing to purchase if it were available. It is the amount of fertilizer where by farmers are willing and able to buy at the prevailing price over a period of time. service officers.

According to studies of Obisesan, et.al, (2013) the result of the study showed that the factors influencing fertilizer use intensity among the farmers in the study area was years of education, farm size, and access to credit and fertilizer price are significant factors in the use of fertilizer in the study area. Years of education of the farmer is significant at 10% and has a positive sign.

Abrhaley, (2016) study revealed that education positively and significantly affected the intensity of use of inorganic fertilizer. Ownership of livestock had the positive and significant effect on intensity of inorganic fertilizer. Similarly the coefficient of distance to near town market had the expected negative sign and significant effect on the intensity of inorganic fertilizer.

While farm size, had influenced the intensity of use of inorganic fertilizer positively.

As revealed from the Nasrin M. and Bauer S., (2016) according to the result of the study among other variables, off-farm income and extension services showed significant impact on fertilizer use for all categories.

According to Gedefaw (2019), the result of the study showed that among the variables that considered in the analysis, access to extension service, availability of composting materials, sex of household head and health status of household head has significant effect on demand of fertilizer.

As can be seen from the review of the previous studies there exist inconsistencies among the findings of the previous studies. In most cases a variable appear to be statistically significant in one study, the same variable appear to be statistically insignificant in another study and most of them evaluate the factors from the angle they were mostly interested in. The current study thus aims at filling this literature gap by investigating the factors affecting supply chain and demand of fertilizer in Ethiopia.

The objective of this study was to analysis supply chain of fertilizer and to analysis determinants of demand of fertilizer.

Research Methodology

Descriptive of the Study Area

This study was conducted *in* Kersa and Malima woreda, South West Shewa Zone of Oromia Regional State, Ethiopia (Fug.1). The woreda is located at 60 Km south west of Addis Ababa. It is bordered on the south west by Southern Nations, Nationalities and Peoples Region, on the east by East

Shewa Zone on the south by Sodo Dachi on the North East Alemgena, and on the north west by Tole Woredas. Administratively the woreda is divided 31 rural Kebeles and one town administration. In this area majority of the farmers produce cereal crops and most of the farmers having a long fertilizer use history.

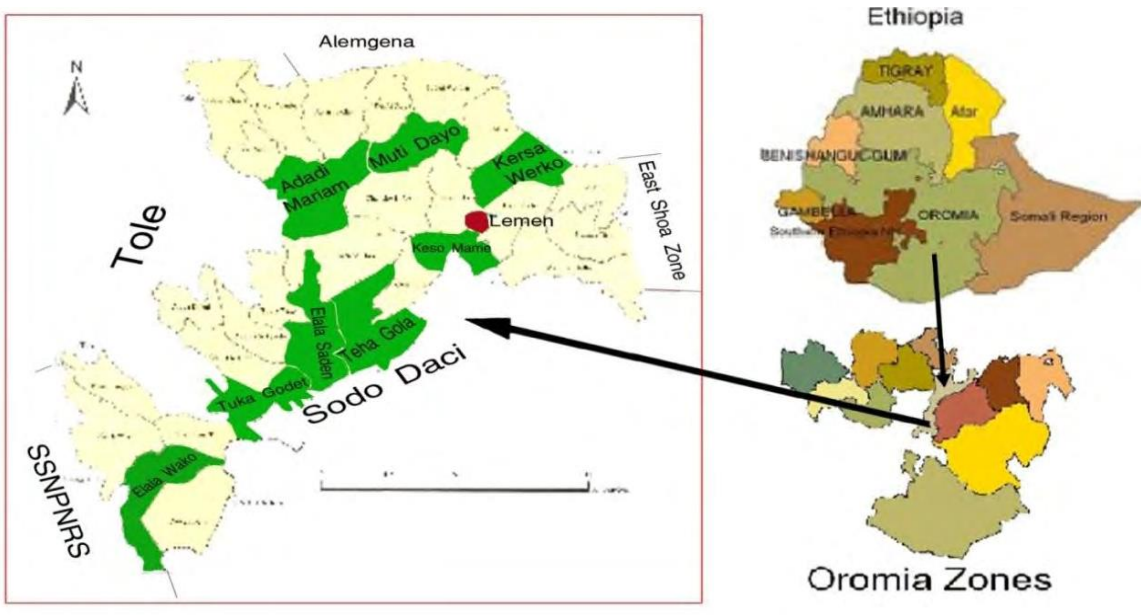

Fig. 1 Map of the study area

Research Design

This study employed both descriptive and cross-sectional (or survey) research design. Descriptive design was selected for this study because it provided numeric descriptions of the population and describes events as they are, as they were or as they will be (Kombo & Tromp, 2006). The design was used to identify the perceptions and attitudes of respondents' about variables related to supply chain and demand of fertilizer. Cross sectional design was chosen because it allows collection of detailed data on respondents at one point in time; it is also suitable for description purposes as well as the

determination of relationships between variables (William, 2002). Cross-sectional study design is a type of observational research that analyzes data of variables collected at one given point in time across a sample population or a pre-defined subset. This design is useful in obtaining an overall 'picture' as it stands at the time of the study. The participants in this type of study are selected based on particular variables of interest. It allows researchers to look at numerous characteristics at once (age, gender, etc.).

Sampling Technique and Sample Size

This study had separate sample frames and two sample categories. For the analysis of supply chain of fertilizer the population of the study comprises of only actors of supply chain. These were managers, team leader and concerned employees involved in supply chain of fertilizer in Ethiopia (including Ethiopian Agricultural Business Corporation, Ethiopian Shipping and Logistic Services Enterprise, Ministry of Agriculture, Primary Cooperatives and development agents of in the wereda). From these main participants samples were selected using convenience, because the research believed that they had good knowledge about the issue of supply chain of fertilizer in Ethiopia. Accordingly a total of 126 samples were selected

But for the analysis of users of fertilizer the population of the study comprises only from users of fertilizer that is farmers in the wereda. There are 31 Kebles in the wereda, out of these four Kebles were selected. The total target population was 2,330. The sample was selected from this target population. The sample size was determined based on the following formula given by Slovin's sampling formula.

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

Where, n = sample size,

N = population size = 2,330

e = sampling error/ a margin of error = 6%.

$$n = \frac{2{,}330}{1 + 2{,}330(0.06)^2}$$

$$= 248$$

According to the formula out of the total target population 248 representative were selected randomly. However, households with inappropriate filled questionnaire and missed data were dropped and the data set to 226 representatives were analyzed for analyzed for users.

Methods of data Collection

Both quantitative and qualitative data types were used in the study. In order to generate these data types, both secondary and primary data sources were used. For supply chain Secondary data collected from related articles, journals, books, reports, publications and records of Ministry of Agriculture, Ethiopian Agricultural Business Corporation, Ethiopian Central Statistical Agency, and Oromia region agricultural office. For users Secondary data collected from related articles, journals, books, Ethiopian Central Statistical Agency, and Oromia region agricultural office.

For supply chain the primary data was gathered through distributing questionnaires to managers, team leaders and concerned employees of Ethiopian Agricultural Business Corporation, Ministry of Agriculture, Ethiopian shipping and Logistics Services Enterprise, primary cooperatives and development agents. For the analysis of demand of fertilizer users primary data was gathered through distributing questionnaires to farmers.

Pre-Test

Before conducting the main survey, a pre-testing (pilot study) was conducted to validate the instrument. A pre-testing study provides an opportunity for the researcher to determine whether the respondents has any difficulty understanding the questionnaire. Moreover, the pre-test offer san opportunity to check whether there are any ambiguous or biased questions. For supply chain the pre-testing study was held on 15 employees for analysis of supply chain and 24 farmers for analysis of fertilizer selected on a convenience basis and 13schedules work responded fully which was good response rate (87%) and for users 24 farmers selected on a convenience basis and 17 schedules work responded fully which was good response rate (71%) and slight changes made on schedule after conducting pre-test.

Method of Data Analysis

For the analysis of supply chain the data collected through questionnaire presented in table form and descriptive statistics is employed. After making the necessary coding, to analyze the usable data collected from respondents SPSS software version 20 is used. Both descriptive and inferential are applied in order to come up with a better result. The data gathered via the likert scale coded, encoded and analyzed using descriptive statistics to interpret demographic data of respondent and summarize response with frequency tables.

For the analysis of users descriptive statistics and Econometric model used to analyses the data. Descriptive statistics were used to provide a summary statistics related to variables of interest. In the econometric analysis multiple linear regressions were used to analysis the data.

Definition of variables for analysis of supply chain

Supply Chain takes a system approach to viewing the Supply Chain as a single entity. This means that the partnership concept is extended in to a stakeholder effort to manage the flow of goods from suppliers to the ultimate customer. Each stakeholder in a Supply Chain directly or indirectly affects the performance of Supply Chain members, as well as the overall performance of the Supply Chain. In this study supply chain performance were used as a dependent variable.

Supply Chain performance: It is a variable that represents the dependent variable.

The explanatory variables of importance in this study are those variables, which are thought to have influence on supply chain performance of fertilizer. The independent variables that are expected or hypothesized to have association with supply chain performance were selected based on theoretical perspective and available literature. The major explanatory variables that are influencing and affecting supply chain performance of fertilizer and their associated hypotheses of the research study are presented below.

Estimation of demand for fertilizer purchase: This is the process of need assessment/estimating the amount of fertilizer that would be purchased/import for the next agricultural year. According to the study of Johanes et.al., (2015), there are four major functions along the supply chain of fertilizer in Ethiopia, they are: import planning and inventory control, Import execution and domestic supply of fertilizer, Marketing and distribution and Final use. Import planning begins with the assessment of fertilizer demand. It is a bottom- up approach. At sub-district level, extension

workers referred as Development Agents (DA) collect farmers' requirements, which are then gradually aggregated at district, zone and region levels by the respective Bureaus of Agriculture (BoA). The final aggregation at national level is carried out by the Agricultural Inputs Marketing Directorate of the Ministry of Agriculture (AIMD/MoA). According to Word bank, (2011) since the market does not play a role in assessing demand and responding to it the amount of fertilizer imported depends on an estimation of demand by the Government for the coming season.

Process of Order Issuance: It is a process that includes prepares the tender documents, invitation of international fertilizer supplier, open bids and evaluate, announcement of winner of international fertilizer supplier and finally issuance of purchase order to supplier.

Custom process and Documentation: It includes Contractual agreement with supplier**,** LC preparation and selection of Inspection Company.

Transportation: This is the transport or distribution of fertilizer from port to regional cooperatives and to EABC store according to their need assessment. Transportation factors, such as the availability of a road network, play an important role in the performance of supply chain (Chakravarty, 2011).Indeed, the existence of a well-developed road infrastructure, for example, facilitate the logistical operations, while a poor road network tends to disrupt and slow down the distribution of relief items. According to World Bank, (2006) as in most countries, transporting fertilizer via trucks over the road is the main mode of transportation in Ethiopia. Ethiopia is a landlocked country and inherently suffers from let delivery and high transportation costs from the ports and this is usually transmitted to farmers in form of higher

prices for imported fertilizer. Inefficient transportation systems, road conditions results for let delivery of fertilizer and high transportation costs all add to high fertilizer distribution costs in Ethiopia.

Collaboration of Stakeholders: this deals about the collaboration between all participants in the supply chain of fertilizer. It defines as to work with another person or group in order to achieve or done something. According to Cohen (2004, p. 139) definition "The means by which companies within the supply chain work together toward mutual objectives through the sharing of ideas, information, knowledge, risks and rewards". As Minear, (2002) explained the supply network is huge and complicated with numerous players (government, and suppliers), and it is hard to coordinate all of them along with all the items that need to be delivered. As along with that the vast geographical spread of country and different number of climates simultaneously at different places at one point of time there is a high need of collaboration among the participants (De block et al., 2012). It is only through collaboration and information sharing between each other that they would be able to achieve the required degree of synchronized activity. The act of information sharing in the supply chain enables accurate and faster business decision making that translates to enhanced performance of the supply chain. (Moberg, Cutler & Gross, 2003).

Distance from the Village to Market: This is deals the distance from study area to fertilizer market. The longer is the distance of the market, the lesser is the probability of buying and using fertilizer. Hence, a negative relation is expected. The poor condition of rural areas adds significantly to the transportation cost of supplying inputs, especially fertilizers, in rural areas. Cost of distribution to more remote areas are high, affecting the price farmers have to pay for fertilizer.

Storage Facility: It is substantial component of supply chain operations that refers to the activities involving storage of fertilizer on a large-scale in a systematic and orderly manner and making them available conveniently when needed. In other words, it means holding or preserving fertilizer in huge quantities from the time of their purchase till their actual use or sale. Thefirstcriterionofeffectivenessinfertilizerdistributionisthattheproductbe available in adequate quantities when and where it is needed. This depends on the existence of suitable storage facilities. According to kassu kubayo seko, (2009) Existence of storage facilities at farmers' disposal would have an advantage for input suppliers to damp and timely deliver agricultural inputs. The presence of storage for agricultural inputs at farmers' disposal may encourage farmers to demand it timely.

Analysis of demand of fertilizer

The Model Specified

Before giving a description of the methods used in data analysis, the term "fertilizer use" needs clarification. The term is used in this study to mean the total amount of chemical fertilizer in kilograms the farmer use per hectare for the last cropping year.

Demand of inorganic fertilizers per unit area is continuous variable. Therefore multiple linear regression were used for analysis.

The model to be estimated in this study was in the following form:-

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_2 X_{3i} + \ldots + \beta_k X_{ki} + U_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y = the dependent variable.

X_i = vector of the independent variable (i = 1, 2,...n).

U_i = the error term

β = is a (Kx1) vector of unknown parameter to be estimated.

ε_i = An error term with the usual stochastic assumptions.

Definition of Variables and Hypotheses

A brief description of the variables in the specific regression model used is as follows:

The dependent variable: Quantity of fertilizer applied per hectares.

The dependent variable retained here is the quantity of chemical fertilizer applied by farmer sin kilogram per hectare.

The Independent variables of importance in this study are those variables, which are thought to have influence on demand of fertilizer. The independent variables that are expected or hypothesized to have association with demand of fertilizer are selected based on available literature and scientific research done somewhere else. The major independent variables that are influencing and affecting demand of fertilizer and their associated hypotheses of the research study are presented below.

Price of fertilizer: It is a dummy variable, it takes a value of one if price is affordable and zero if price is not affordable. Most studies of fertilizer use usually ignore market prices, so the first analysis parallels these standard methods including market price in the analysis. According to the study of Hagos and Holden, (2002) indicated that the most serious constraint faced by farmers for not using fertilizer is high fertilizer prices. Most farmers feel that

the fertilizer prices are so high and they fear that this will contribute to their indebtedness. Therefore, this variable was hypothesized to negatively influence demand of fertilizer.

Household Head's Sex: dummy variable representing the sex of head of household. It takes the value of one if the household head is male and is zero for female-headed households. Male-headed households are theorized to use fertilizer more readily than female-headed households. As indicated in the study of Gedefaw, (2019) that male-headed households were more likely to use organic fertilizers than female-headed household head.

Farm size: in Hectares: households with larger farm size are expected to use fertilizer more than smaller ones. As mentioned by Waithaka et. al., (2007) the amount of fertilizer used on a farm increases significantly with increasing farm size. It was therefore expected that farm size could positively influence demand of fertilizer.

Age of household head in years: Older farmers may accumulate more wealth than younger ones so as to finance fertilizer purchase. Moreover, this variable can be considered as a proxy for experience in using fertilizer. Farmers who have experience demanding higher rate of fertilizer. The result of Olwande et.al, (2009) shows that age has significant influence on use of fertilizer. Therefore, this variable was hypothesized to positively influence demand of fertilizer.

Education level of household head: Education is generally believed to have the effect of widening the mental horizon of a person and preparing him to be receptive new ideas. Farmers with ability to read and write are expected to have an advantage in obtaining information and understand the benefit of fertilizer use. Some empirical studies have demonstrated that literacy is the

important factor influencing demand of fertilizer (Fakoya and Mato, 2003, Waithaka et. al., (2007) and Obisesan et.al, 2013). For example study of Waithaka et. al., (2007) show that the amount of fertilizer used on a farm increases significantly with higher education levels of household head. Literate farmers are therefore expected to use more fertilizer than the illiterate one. Therefore, education was hypothesized to positively influence demand of fertilizer.

Household Size: number of families of any age in the household. It is indirectly represents family labor available for agricultural activities. Larger household sizes increase the labor availability for household tasks. In the study of Olayide et.al., (2009) revealed that intensity of fertilizer use increases with family labor. It is expected to have a positive effect on the demand of fertilizer.

Access to credit: This is a dummy variable, which takes a value 1 if the farm household has access to input credit for fertilizer and 0 otherwise. Availability of credit to purchase fertilizer on the other hand improve the farmers' cash position and hence their ability to purchase fertilizer. It was noted that the farmers who get cash credit do not use it to purchase fertilizer and thus only the credit got in the form of fertilizer is considered here. Different studies have shown that access to credit plays a significant role in enhancing the use of chemical fertilizer (Obisesan, et.al, 2013 and Fakoya and Mato 2003). In this study it was hypothesized that access to credit would have positive influence on demand of fertilizer.

Access to extension services :this is a dummy variable, which takes a value 1 if the household received extension service and 0 otherwise. Extension service is one form of farmer learning and enhances the ability to acquire and

use information required for production. It is assumed that the more of these services a farmer has, the more likely he is to know of the benefits of fertilizers and hence use more fertilizer. The study of Gedefaw, (2019) expressed that farmers who have access to extension service have applied more organic fertilizer compared with those who did not have access. Therefore, it was hypothesized that this variable positively influences intensity demand of fertilizer.

Off-farm income it is a dummy variable which takes a value 1 if involved in off-farm activities, 0 otherwise. It is believed that off-farm income can have a positive impact on rural households' total income or wealth. When households income increase, their risk taking behavior also increase; this may lead to utilizing higher amount of fertilizer use. The study of Holden et al., (2008) revealed that households that had off-farm activities as a secondary income source were more likely to apply chemical fertilizers as compare to others. Thus, a positive relation is expected.

Number of Oxen: it is the total number of oxen the household had. Since ox is the major means of production in the country. Traditionally a pair of draught oxen is required to plough a field. Because of oxen shortage, the farmers may not timely accomplish his /her agricultural activities. The untimely accomplishment of farming operation in turn may attribute to the less demand (or not at all) of fertilizer. Thus it was hypothesized that this variable will influence demand of fertilizer positively.

On time-delivery of fertilizer: it is a dummy variable which takes a value 1 if there is a timely availability of fertilizer, 0 otherwise. This refers to timely availability of sufficient amount of fertilizer in the area, which may be explained by poor delivery time may act as an impediment to demand of

fertilizer. As mentioned in the study of Olayide et.al., (2009) the intensity of fertilizer use increases with physical access to fertilizer.

Result and Discussions

Analysis of Supply Chain

Socio- Demographic Characteristics Households

This sub-section presents the demographic of the 126 sample respondents. These features are found to be of great help in terms of clearly depicting the diverse background of the respondents and the impact this diversity has had on the descriptive, statistical results.

Out of the 126 respondents, 106 (84.1%) were male headed households while the remaining 20 (15.9%) were female headed. Age of the majority 48 (38.1) household heads of the sample respondents ranged from 30 to 39 year while 40 (31.8%) of respondents were between 40 to 49 years, followed by 27 (21.4%) of respondents who are below 30 years and the rest 11(8.7%) of respondents were 50 years and above.

Education level is among those profiles relatively more important and a clue for the respondent's familiarity for the subject matter. Because education level shows information and knowledge, it is indispensable for a good perception. 45 (35.7%) of respondents were diploma, 53 (38.5%) of respondents were first degree while 28 (22.2%) of respondents were Second degree and above.

Table 1: Summary of Demographic Characteristics of the Household

		Number of Respondents	Percent
Gender Representative	Male	106	84.1
	Female	20	15.9
	Total	126	100
Age Category	Below 30 years	27	21.4
	30 - 39 years	48	38.1
	40 - 49 years	40	31.8
	50 year and above	11	8.7
	Total	126	100
Education Level	diploma	45	35.7
	first degree	76	60.3
	Second degree and above	5	4.0
	Total	126	100

Result of Descriptive Statistics

As shown in Table below, the majority of respondents about 77.8% agree that supply chain performance was not efficient and only 8.7 % of them agree that supply chain performance was efficient.

Table2: supply chain performance

	Number of Respondents	Percent	Mean	Std. Deviation
Disagree	11	8.7	3.62	0.62
Neither Agree nor Disagree	17	13.5		
Agree	55	43.7		
Strongly Agree	43	34.1		
Total	126	100		

As shown in Table 3 below, the majority of respondents about 71.4% report that process of fertilizer estimation takes longer time, so this affects performance of supply chain of fertilizer and only 2.4 % of them reported supply of fertilizer was not affect by Estimation of demand for fertilizer purchase. With regard to storage facility, most respondents 78.6 % agree that storage facility affects supply of fertilizer. This implies that, existence of storage facilities at farmers' disposal would have an advantage for fertilizer suppliers to damp and timely delivery of fertilizer, but farmers are subjected to high transport cost and lack of timely delivery of fertilizer due to shortage of storage facility. Similarly 65.8% respondents agree that the Custom process and Documentation affects supply of demand while 6.4% respondents not agree.

Most surveyed 77.8% agree that transportation was the big problem for supply of fertilizer while only 1.6% of respondents was not agree. 73.8% of respondents agree that Collaboration of Stakeholders was the problem for supply of fertilizer. This indicated that there were absence of well coordination between stakeholders along supply chain of fertilizer.

Most surveyed 82.5% agree that Distance from the village to market was the big problem for supply of fertilizer. This indicates that, those who are far from the market may not have a chance to get agricultural inputs timely comparing to the nearby farmers. Finally, 53.2% of respondents agree that Process of Order Issuance there were longer process of order issuance and this affects supply chain of fertilizer while 14.3% of respondents do not agree that Process of Order Issuance not affected supply chain of fertilizer.

Table 3: result of descriptive statistics

		Number of Respondents	Percent	Mean	Std. Deviation
Estimation of demand for fertilizer purchase	Disagree	3	2.4	4.04	0.84
	Neither Agree nor Disagree	33	26.2		
	Agree	46	36.5		
	Strongly Agree	44	34.9		
	Total	126	100		
Storage Facility	Disagree	2	1.6	4.11	0.767
	Neither Agree nor Disagree	25	19.8		
	Agree	56	44.5		
	Strongly Agree	43	34.1		
	Total	126	100		
Custom process and Documentation	Disagree	8	6.4	3.92	0.923
	Neither Agree nor Disagree	35	27.8		
	Agree	42	33.3		
	Strongly Agree	41	32.5		
	Total	126	100		
Transportation	Disagree	2	1.6	4.05	0.744
	Neither Agree nor Disagree	26	20.6		
	Agree	61	48.4		
	Strongly Agree	37	29.4		
	Total	126	100		
Collaboration of Stakeholders	Disagree	1	0.8	4.07	0.791
	Neither Agree nor Disagree	32	25.4		
	Agree	50	39.7		
	Strongly Agree	43	34.1		
	Total	126	100		
Distance from the village to market	Neither Agree nor Disagree	22	17.5	4.14	0.682
	Agree	65	51.6		
	Strongly Agree	39	30.9		
	Total	126	100		
Process of Order Issuance	Disagree	18	14.3	3.55	0.938
	Neither Agree nor Disagree	41	32.5		
	Agree	45	35.7		
	Strongly Agree	22	17.5		
	Total	126	100		

Correlation Analysis between Variable and Supply Chain Performance

The statistical treatment of the study included the determination of the correlation between the supply chain performance and variables. These were

made of Pearson's coefficient to determine the level of association. Pearson's coefficient is the test statistics that measures the statistical relationship, or association, between two continuous variables. It is known as the best method of measuring the association between variables of interest because it is based on the method of covariance. It gives information about the magnitude of the association, or correlation, as well as the direction of the relationship.

A correlation analysis with Pearson´s correlation coefficient (r) was conducted on all variables in this study for two purposes. On the one hand, it was used for conducting the correlation analysis to explore the relationships between variables and one the other hand, to rank the variables that have the strongest influence on supply chain performance.

The level of association as measured by Pearson's co-efficient that falls between -1.0 and +1.0, which indicates the strength and direction of association among variables. In order to interpret the strengths of relationships between variables, the guidelines suggested by Field (2005) were followed, mainly for their simplicity. His classification of the correlation efficient (r) is as follows: 0.1 – 0.29 is weak; 0.3 – 0.49 is moderate; and > 0.5 is strong. The p-value also indicated the probability of this relationship's significance.

The results of the correlation analysis are displayed hereunder in table below.

Table 4: Correlation matrix

		supply chain performance	Estimation of demand for fertilizer purchase	Storage Facility	Custom process and Documentation	Transportation	Collaboration of Stakeholders	Distance from the village to market	Process of Order Issuance
supply chain performance	Pearson Correlation	1	.132*	.174**	.243**	.150*	0.175*	.560**	.284**
	Sig. (2-tailed)		0.047	0.009	0.000	0.024	0.008	0.000	0.000
	N	126	126	126	126	126	126	126	126
Estimation of demand for fertilizer purchase	Pearson Correlation	.132*	1	0.056	.187**	.140*	.251**	.396**	0.100
	Sig. (2-tailed)	0.047		0.400	0.005	0.035	0.000	0.000	0.135
	N	126	126	126	126	126	126	126	126
Storage Facility	Pearson Correlation	.174**	0.056	1	0.068	.139*	0.119	.447**	.243**
	Sig. (2-tailed)	0.009	0.400		0.306	0.037	0.074	0.000	0.000
	N	126	126	126	126	126	126	126	126
Custom process and Documentation	Pearson Correlation	.243**	.187**	0.068	1	0.102	.214**	.454**	0.104
	Sig. (2-tailed)	0.000	0.005	0.306		0.125	0.001	0.000	0.118
	N	126	126	126	126	126	126	126	126
Transportation	Pearson Correlation	.150*	.140*	.139*	0.102	1	0.100	.363**	.165*
	Sig. (2-tailed)	0.024	0.035	0.037	0.125		0.135	0.000	0.013
	N	126	126	126	126	126	126	126	126
Collaboration of Stakeholders	Pearson Correlation	0.175*	.251**	0.119	.214**	0.100	1	.369**	0.055
	Sig. (2-tailed)	0.008	0.000	0.074	0.001	0.135		0.000	0.409
	N	126	126	126	126	126	126	126	126
Distance from the village to market	Pearson Correlation	.560**	.396**	.447**	.454**	.363**	.369**	1	.486**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	N	126	126	126	126	126	126	126	126
Process of Order Issuance	Pearson Correlation	.284**	0.100	.243**	0.104	.165*	0.055	.486**	1
	Sig. (2-tailed)	0.000	0.135	0.000	0.118	0.013	0.409	0.000	
	N	126	126	126	126	126	126	126	126

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The seven variables (Estimation of demand for fertilizer purchase, Storage Facility, Custom process and Documentation, Transportation, Collaboration of Stakeholders, Distance from the village to market, Process of Order Issuance) their relationship with supply chain performance. The result of correlation matrix between each variable and supply chain performance are analyzed as follow:

As it is indicated in the table, there is significant positive correlation between estimation of demand for fertilizer purchase and supply chain performance with a correlation coefficient of 0.132 (r=0.132) and significance is 0.047. Table 4 also depict that as there is positive relationship between Storage facility and supply chain performance with a Pearson correlation coefficient of 0.174 (r=0.174) and significance is 0.009. This significance tells that there is genuine relationship between the two. Additionally Pearson correlation test indicated in the table 4 also described that there is significant positive correlation between Custom process and documentation and supply chain performance. There is positive relationship between transportation and supply chain performance with a Pearson correlation coefficient of 0.175 (r=0.175) and significance is 0.008.In other words distance from the village to market and supply chain performance are Correlated in high relationship (r=0.560) with level of significance less than 0.001. Furthermore there is positive relationship between process of order issuance and supply chain performance with a Pearson correlation coefficient of 0.284 (r=0.284) and with level of significance less than 0.001.

Factors Affecting Demand of Fertlizer

Socio-Demographic Characteristics

This sub-section presents the demographic and socioeconomic features of the

207 sample respondents. These features are found to be of great help in terms of clearly depicting the diverse background of the respondents and the impact this diversity has had on the descriptive, statistical as well as econometric results.

Household Head's Sex

Out of the 207 respondents, 181 (87.4%) were male headed households while the remaining 26 (12.6%) were female headed.

Distribution of sample households by Household Head's sex

Gender Representative	Number of Respondents	Percent
Male	181	87.4
Female	26	12.6
Total	207	100

Age of Household Head

Age of the majority 77 (37.2) household heads of the sample respondents ranged from 30 to 39 year while 63 (30.4%) of respondents were between 40 to 49 years, followed by 47 (22.7%) of respondents who are below 30 years and the rest 20 (9.7%) of respondents were 50 years and above.

Table: Distribution of sample households by Age

Age Category	Number of Respondents	Percent
Below 30 years	47	22.7
30 - 39 years	77	37.2
40 - 49 years	63	30.4
50 year and above	20	9.7
Total	207	100

Education Level of Household Head

Education level is among those profiles relatively more important and a clue for the respondent's familiarity for the subject matter. Because education level shows information and knowledge, it is indispensable for a good perception. 74 (35.7%) of respondents were illiterate, 87 (42%) of respondents were between grade 1 to 6 while 46 (22.2%) of respondents were between grade 7 to 12.

Table 1: Distribution of sample households by Education level

Education Level	Number of Respondents	Percent
Illiterate	74	35.7
1-6 Grade	87	42
7- 12 Grade	46	22.2
Total	207	100

Price of Fertilizer

Price fertilizer is the most serious constraint faced by farmers for not using fertilizer is high fertilizer prices. The survey result has shown in the table below that 39.1% of the total sample farmers obtained argued price of fertilizer was affordable while 60.9% of samples argued that price of fertilizer was not affordable.

Table: Distribution of sample households by Price of fertilizer

Price of fertilizer	Number of Respondents	Percent
no	81	39.1
yes	126	60.9
Total	207	100.0

Farm Size

As can be seen from table below all the respondents own land. Table shows that 5.3% households own less than one hectare, 57% of households own between one and three hectares, 33.8% of households own between 3.1 and 5 hectares and 3.9% of households own above five hectares.

Table: Distribution of sample households by Farm size

Land size in Hectares (Ha)	Number of Respondents	Percent
less than 1 hectare	11	5.3
between 1 and 3 hectare	118	57.0
between 3.1 and 5 hectares	70	33.8
above 5.1 hectares	8	3.9
Total	207	100.0

Household Size

Labor is one of the factors that influence agricultural production in the study area. Households having large number of household size will be in a better position to manage the labor intensive agricultural activities. Moreover, large working labor-force in family means that the household may not need to hire additional labor-force required due to the fact that the cash saved from using own labor-force could be used for purchase of fertilizer required for production. As can be seen from table below 1.9% households had a family of less than 3, 50.2% households had a family between three and five and 47.9% of households 1.9% households had a family above five.

Table: Distribution of sample households by Household Size

Household Size	Number of Respondents	Percent
less than 3	4	1.9
between 3 and 5	104	50.2
above 5	99	47.9
Total	207	100.0

Access to Credit

Credit is very important to resource for farmers who cannot finance fertilizer purchase from their own savings. However, as long as farmers properly used fertilizer, it is expected that they can get better yield and hence better income to finance their fertilizer requirement by their own. The survey result has shown that only 20.3% of the total sample farmers obtained credit while 79.7% of the total sample farmers do not obtained credit.

Table: Distribution of sample households by Access to credit

Access to Credit	Number of Respondents	Percent
no	165	79.7
yes	42	20.3
Total	207	100.0

Access to Extension Services

Access to extension services is expected to have direct influence on the production of the farmers. The higher access to the extension service, the more likely that farmers use fertilizer.

Table below depicts that out of the total respondents sample households, 76.3% had access to extension services. The remaining 23.7% of sample households responded that they did not get any extension services.

Table: Distribution of sample households by Access to extension services

Access to Extension Services	Number of Respondents	Percent
no	49	23.7
yes	158	76.3
Total	207	100.0

Off-farm Income

Out of the total sampled households 69.1% reported that they did not involve in off-farm income while 30.9% involved off-farm income.

Table: Distribution of sample households by Off-farm income

Off-farm Income	Number of Respondents	Percent
no	143	69.1
yes	64	30.9
Total	207	100.0

Number of Oxen

Ox is the major means of production in the country. Traditionally a pair of draught oxen is required to plough a field. Because of oxen shortage, the farmers may not timely accomplish his /her agricultural activities. The untimely accomplishment of farming operation in turn may attribute to the less demand (or not at all) of fertilizer.

As indicated in the table below out of the total sampled households 47.3%

reported that they had less than of less than 2 (pair) of oxen while 52.7% reported had more than of 2 (pair) of oxen.

Table: Distribution of sample households by Number of Oxen

Number of Oxen	Number of Respondents	Percent
less than 2 (pair)	98	47.3
more than 2 (pair)	109	52.7
Total	207	100.0

On time-delivery of fertilizer

This refers to timely availability of sufficient amount of fertilizer in the area, which may be explained by poor delivery time may act as an impediment to demand of fertilizer. Out of the total sampled households 58.9% argued late delivery of fertilizer while 41.1% argued timely delivery of fertilizer.

Delivery	Number of Respondents	Valid Percent
not timely available	122	58.9
timely available	85	41.1
Total	207	100.0

Results of the Econometric Model

Factors Affecting Demand for Fertilizer

The demand of fertilizer is affected by various, demographic, socioeconomic and institutional factors. In view of this, efforts were made to include variables found relevant to the model in order to estimate the effects of the hypothesized explanatory variables on level of demand of fertilizer by farmers. Multiple linear regression model were employed to identify the significant

factors affecting demand for fertilizer by using STATA software version 14 and SPSS software version 20.

For the parameter estimates to be efficient, test of assumptions of OLS were performed using appropriate test statistics. The four most important diagnostic tests Multicollinearity, Heteroscedasticity, Omitted Variable and Normality were conducted.

The variance inflation factor (VIF) values were ranging between 1.05 and 3.35 and the mean VIF value was 1.55. These results indicated the absence of serious Multicollinearity problem among the independent variables. The Heteroscedasticity tests were performed and there was no heteroscedasticity problem. Similarly, omitted variable test result also showed that there was no specification error.

Table 7: Result of Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
Price of fertilizer	1.05	0.952321
Household Head's sex	1.12	0.896408
Farm size	3.27	0.306144
Age of household head	1.35	0.743325
Education level of household head	1.13	0.884322
Household Size	1.47	0.682484
Access to credit	1.05	0.951092
Access to extension services	1.28	0.783792
Off-farm income	1.07	0.931994
Number of Oxen	3.11	0.321305
On time-delivery of fertilizer	1.13	0.883679
Mean VIF	1.55	

Table 8: Result of Heteroscedasticity Tests

. estathettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of qfa
chi2(1) = 15.33
Prob> chi2 = 0.1621

Table 9: Omitted Variable Test Result

ovtest

Ramsey RESET test using powers of the fitted values of qfa
Ho: model has no omitted variables
F(3, 192) = 2.30
Prob> F = 0.1783

Table 10: Normality Test (Shapiro-Wilk W test for normal data)

Variable	W	V	z	Prob>z
Quantity of fertilizer applied	0.96213	5.822	4.06	0.18112
Price of fertilizer	0.96345	2.991	5.016	0.1506
Household Head's sex	0.97128	9.027	5.071	0.19520
Farm size	0.96683	5.099	3.755	0.19009
Age of household head	0.99513	0.749	-0.667	0.74749
Education level of household head	0.99731	0.414	-2.032	0.9789
Household Size	0.98902	1.688	1.207	0.12379
Access to credit	0.96396	1.689	5.667	0.18401
Access to extension services	0.97053	4.531	3.482	0.17025
Off-farm income	0.99654	0.532	-1.456	0.92732
Number of Oxen	0.98158	2.831	2.398	0.15823
On time-delivery of fertilizer	0.99703	0.456	-1.809	0.96479

Table 11: Result of Regression Model

Variables	Coef.	t-Ratio	p-value
Price of fertilizer	-0.199	-2.23	0.027**
Household Head's sex	0.094	0.75	0.455
Farm size	1.150	22.38	0.000***
Age of household head	0.061	1.25	0.214
Education level of household head	-0.087	-1.54	0.125
Household Size	-0.009	-0.32	0.749
Access to credit	0.307	2.85	0.005***
Access to extension services	0.281	2.67	0.008***
Off-farm income	0.248	2.57	0.011**
Number of Oxen	0.168	3.38	0.001***
On time-delivery of fertilizer	0.257	3.04	0.003***
Constant	-0.465	-1.69	0.092*
F- statistics	237.53		
R- squared	0.931		
Adjusted R^2	0.927		

***, ** and * Represents level of significance at 1%, 5% and 10% respectively

Source: model result

F test is used to test the overall significance of the estimated multiple regression model or test of goodness of the model. If computed F value is greater than the critical F value or alternatively, if the p value of Fobtained sufficiently low, the model is significant. As shown in the table 11 the value of F is 237.53which is greater than the critical F value, it shows the model is significant. Coefficient of multiple determinations (R Squared) is used to check goodness of fit for the regression model. As shown in the result the adjusted R Squared is 0.93. It indicates that explanatory variables in the

model have accounted for over 93 percent variation in the demand of fertilizer, hence the model best fits when predicting demand of fertilizer.

Estimates of the parameters of the variables expected to determine the demand of fertilizer are displayed on Table 11. A total of 11 explanatory variables were considered in the econometric model out of which 7 variables (Price of fertilizer, Farm size, Access to credit, Access to extension services, Off-farm income, Number of Oxen and on time-delivery of fertilizer) were found to significantly influence demand of fertilizer. The remaining 4 variables (Household Head's sex, Age of household head, Education level of household head and Household Size) were found have no significant effect on demand of fertilizer.

Price of fertilizer

Price of fertilizer had found negatively determining the demand of fertilizer at 5% level of significance. The result shows that the perception of high price of fertilizer by farmers reduced demand of fertilizer by0.199 kg/ha. This implies that farmer's demand of fertilizer decreased as its price increased and its demand increased as price decreased. This finding is consistent with Kherallah et al., (2001), Ebong and Ebong (2006) and Sharma V. and ThakerH., (2011), revealed that price of fertilizer was negatively related with fertilizers demand.

Household Head's Sex

The result has shown that household head's sex were not statistically influencing on demand of fertilizer. The possible explanation is that there may not be gender discrimination. This insignificant might be also because of women's rights were more respected than they were in previous times. This result is similar with the earlier studies of Waithaka, et. al., (2007) and Doss and Morris, (2001).

Farm size

Farm size had found positively determining the demand of fertilizer at 1% level of significance. A one hectare increased in farm size increased the demand of fertilizer by 1.15 Kg/ha. This implies that farmers with larger farms size use more fertilizer than those with smaller farms sizes. The result is in conformity with the earlier studies of Waithakaet. al., (2007), Obisesan et.al, (2013),Abrhaley, (2016) and Fakoya and Mato (2003) who found that farm size influenced demand of fertilizer positively and significantly. They explain that the amount of fertilizer used on a farm increases significantly with increasing farm size.

Age of household head

The result have shown that Age of household head were not statistically influencing demand of fertilizer. The possible explanation is that while the study have identified a number of important factors explaining demand of fertilizer, this factor did not appear to have a great effect on the demand of fertilizer. That mean age of household head has no importance in the decision of demanding of fertilizer. This result is similar with Croppenstedt and Demeke, (1996).

Education level of household head

Education level of household head was not significant influence on demand of fertilizer. The possible reason could be low level of education in the area hence farmer’s decision making ability to demanding of fertilizer was poor. This is in contrast to the findings of Olwande, et, al, (2009), Abrhaley, (2016) and Ebong and Ebong (2006).

Household Size

Household Size was not significant influence on demand of fertilizer. The possible explanation is that while the study have identified a number of important factors explaining demand of fertilizer, this factor did not appear to have a great effect on the demand of fertilizer. That mean household size has no importance in the decision of demanding of fertilizer. This is in contrast to the findings of Croppenstedtet,al, (1999) and Olwande, et, al, (2009),

Access to credit

Access to credit had found positively determining the demand of fertilizer at 1% level of significance. Based on the study access to credit increases the demand of fertilizer by 0.307 Kg/ha. This indicate that availability of credit improve the farmers cash position and hence their ability to purchase more fertilizer. This finding is similar with the result of Olwande, et,al, (2009) and Obisesan, et.al, (2013) who have indicated that access to credit have significant positive effects on demand of fertilizer.

Access to extension services

As expected, extension was positively influencing the demand of fertilizer at 1% significant level. An access to extension services increase demand of fertilizer by 0.281Kg/ha. This indicate that extension workers effort may also play its own role for this positive outcome. Extension service as a source of information regarding the benefit of fertilizer use, its application rate, etc., has a strong influence on the farmer's demand of fertilizer. This result coincide ewith Nasrin M. and Bauer S., (2016) and Gedefaw (2019) who have reported significant and positive relationship of access to extension services and demand of fertilizer.

Off-farm income

Off-farm income had found positively determining the demand of fertilizer at 5% level of significance. The result shows that farmers who earn income from off-farm activity demand 0.248 Kg/ha more than those who did not have access to off-farm income. This may due to the fact that farmers who had cash from these sources demanded more fertilizers. This finding is similar with Nambiro E. and Okoth P. (2013) and Nasrin M. and Bauer S., (2016) who found that off-farm income influenced demand of fertilizer positively and significantly. They explain that farmers with an additional source of income will be willing to take risk in demanding of more fertilizer.

Number of Oxen

Oxen ownership is another factor, which was positively related to the dependent variable at 1% significant level. The result of the study shows that each additional unit of oxen increases the demand of fertilizer by 0.168 kg/ha. The implication is that oxen are important sources of cash income in rural area, which can be used for purchasing more fertilizer. In addition, ox is the major means of production in the agricultural sector of the area. Hence, having more oxen may mean being able to plough the land at the appropriate time than waiting for hired oxen. As a result, farmers having more oxen can plough their land at the right time and extract higher yield which could be an incentive and source of income for demanding more fertilizer. Similar result was reported by Abrhaley, (2016) who argued that number of oxen influenced demand of fertilizer positively and significantly.

On time-delivery of fertilizer

On time delivery of fertilizer is significant at 1% and has a positive sign which indicates that an increases demand of fertilizer by 0.257 kg/ha. Similar result was reported by Olayideet.al., (2009) who found that on time-delivery of fertilizer influenced demand of fertilizer positively and significantly.

CONCLUSION AND RECOMMENDATIONS

Conclusions

The agricultural sector of Ethiopia is well known for its being traditional and use of backward. Different studies and practical observation argued that the application of modern agricultural inputs and practices can contribute a lot for productivity enhancement of the sector of agriculture. The fate of the sector in terms of increasing its contribution to the overall growth of the economy and securing food self-sufficiency depends on the development and application of appropriate farm inputs especially chemical fertilizer.

Today, there is a general consensus that fertilizer is considered as one of the most important inputs for the achievement of increased agricultural production and productivity in Ethiopia. Optimal fertilizer utilization is a key important thing for increasing agricultural production and productivity in Ethiopia, and it will have an impact on alleviating the poverty and food insecurity issues for many smallholder producers.

This study has analyzed supply chain for fertilizer and factors affecting demand for fertilizer in Kersa and Malima woreda of Oromiya Regional State of Ethiopia. Descriptive statistics were used to analyses supply chain for fertilizer while descriptive Multiple linear regression models were used to analyses factors affecting demand for fertilizer. In the case of supply chain for fertilizer, the descriptive statics results has verified that the majority of respondents about 77.8% agree that supply chain performance was not efficient. The majority of respondents about 71.4% report that process of fertilizer estimation takes longer time. With regard to storage facility, most respondents 78.6 % agree that storage facility affects supply of fertilizer. Similarly 65.8% respondents agree that the Custom process and Documentation affects supply of demand. Furthermore 77.8% agree that

transportation was the big problem for supply of fertilizer and 73.8% of respondents agree that Collaboration of Stakeholders was the problem for supply of fertilizer. Most surveyed 82.5% agree that Distance from the village to market was the big problem for supply of fertilizer. This indicates that, those who are far from the market may not have a chance to get agricultural inputs timely comparing to the nearby farmers. Finally, 53.2% of respondents agree that Process of Order Issuance there were longer process of order issuance and this affects supply chain for fertilizer.

The second, result from this study was to identify the factors that influence household's demand for fertilizer using multiple linear regression model. A total of 11 explanatory variables were considered in the econometric model out of which seven variables were found significantly influenced the demand of fertilizer. The remaining four variables were found to have none significant effect on the use of fertilizer.

Recommendations

The results of the study showed that demand for fertilizer purchase was take longer time. This implies that the method of estimation takes longer time duration. Therefore, the traditional way of estimation of demand for fertilizer should be replaced by computerized system. Another variable that influenced supply of fertilizer is storage facility. This indicates that there is a shortage of storage facilities that makes shortage of fertilizer stock at the time of need. Therefore additional stores should be built in order to alleviate this problem. Moreover, to make the supply chain of fertilizers well integrated, all the stakeholders, importers, retailers, logistics service providers, regulatory and financial institutions and final users have to be in the same page about need, challenges and mitigating mechanisms. Those stakeholders all together have

to involve in supply chain plan of fertilizers for effective and efficient supply chain performance.

The result of the study showed that price of fertilizer is one of the most significant factors that negatively influenced demand of fertilizer. Thus, it is suggested that, the government should look for those poor farmers who cannot afford market prices a smart subsidy system that can be designed targeting such groups. Such subsidy programs need to be carefully designed and clearly articulated to all players and with clear exit strategies.

Inaccessibility of credit is found to be serious problem to demand of fertilizer in the area. Hence, it is recommended to improving the efficiency of credit system, timely and sufficient amount of delivering credit to farmers who engaged on crop production has to be considered so as to improve consumption of fertilizer by farmers. The other important variable that negatively influenced demand of fertilizer is on time-delivery of fertilizer. Timely distribution of fertilizer according to the demand of fertilizer is crucial to boost up production and productivity of farmers. Therefore, the Oromiya Agricultural Office has to give attention for the timely distribution of fertilizer to the farmers.

On the other hand econometric model analysis access to extension service is a very important variable that positively influenced the demand fertilizer. Hence, it is recommended to assign efficient extension system, updating the extension agent’s knowledge and skills about the benefit and utilization of fertilizer.

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