TEA SUPPLY RESPONSE IN KENYA, 1990 - 2014

BY

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DECLARATION

This is my own original work and has never been presented for the award of any degree in any other university.

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DEDICATION

I wish to dedicate this paper to my beloved parents, Isaac Kaiyaga Kuria and Rachel Mwihaki Kaiyaga, my brothers, David and Harun and my sister Joyce for their sacrifices to facilitate my education.

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First, I express my gratitude to almighty lord for the opportunity and good health he has given me to purse my master degree in Economics at University of Nairobi. I am greatly indebted to my supervisors Dr. George Ruigu and Dr. Odhiambo Sule who devoted much of their time to guide me through the entire paper. Their constructive criticisms, comments and advice have been a great inspiration in the completion of this paper.

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To all who have been of help I say thank you and may the lord reward you richly. Finally, any error likely to be found in this paper sorely remains mine and should not be attributed to anyone else.

ACRONYMS AND ABBREVIATIONS

ARD:	Agricultural Research & Development
ASDS:	Agriculture Sector Development Strategy
CRF:	Coffee Research Foundation
DR:	(Rainfall) Weather patterns
EATTA:	East Africa Tea Trade Association
FAO:	Food and Agricultural Organization of the United Nations
GDP:	Gross Domestic Product
GOK:	Government of Kenya
IP:	Input Prices
KARI:	Kenya Agricultural Research Institute
KEFRI:	Kenya Forestry Research Institute
KESREF:	Kenya Sugar Research Foundation
KETEPA:	The Kenya Tea Pluckers Limited
KMFRI:	Kenya Marine and Fisheries Research Institute
KTDA:	Kenya Tea Development Agency
KTGA:	Kenya Tea Growers Association
MOA:	Ministry Of Agriculture
PM:	Price of milk
RER:	Real Exchange Rate
SCDA:	Special Crops Development Authority
TBK:	Tea Board of Kenya
TP:	Tea Price
TRF:	Tea Research Foundation
TS:	Tea supply
WR:	Wage rate

ABSTRACT

The Tea sector is one of the fourteen priority sectors identified in the National Export Strategy (NES). This strategy aims at improving Kenya's overall tea performance by creating new and expanding existing export markets as well as promoting local consumption through diversifying the export base, enhancing market access and strengthening institutional support networks and increasing effectiveness. Despite the establishment of this strategy the supply of tea has been volatile. Therefore, this paper sought to explore tea supply response in Kenya. The study used time series data collected for the period 1990 to 2014 with the following study variables; tea supply, tea prices, input prices, real exchange rate, wage rate, price of milk and dummy variable representing weather pattern. The study employed dynamic Nerlovian model and conducted pre- and post-estimation tests. At 1%, 5% and 10% significance levels; the first difference of the first difference of the tea prices, the first difference of the input prices, the first difference of the wage rates and the first difference of real exchange rates were found to be statistically significant in determining the current quantity of tea supplied in Kenya. However, the first difference of milk prices and the weather patterns were found to be statistically insignificant in determining the quantity of tea supplied in Kenya. On the other hand, it was shown that the first differences of input prices and the first difference of real exchange rates significantly reduce the current quantity of tea supply while the first differences of tea prices and wage rate were shown to be statistically significant in increasing the current quantity of tea supply in Kenya. The study suggests that as a developing country, which intends to be a dominant supplier, the government should give special attention to tea pricing policies which are major impediment to increased production in the agricultural sector and seek for both regional and international markets in addition to offering farmers incentives through input subsidies of the important inputs like fertilizers which go into the production process as well as seeking for new markets for tea. Further, the study recommends a review of the wage policies by KTDA to adjust wage rates to reasonable rates as a motivation towards increased tea supply in Kenya while adjusting the real exchange rates to stabilize overall tea prices.

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CHAPTER ONE: INTRODUCTION

1.1 Background

Kenyan economy has relied on agricultural sector since independence. About one third of Kenya's agricultural products are exported, which corresponds to 65% of the country's total exports. Agricultural sector is one of the critical sectors in both small scale and large scale farming in Kenya and thus contributes a larger share of the Gross Domestic Product (GDP). Further, about 75% of the total labour force is employed in agricultural sector. This sector provides most of the food requirements for the nation. About 60% of the foreign exchange is as a result of this sector (Dolan, 2008). Thus, Agricultural sector remains the main source of livelihood for the majority of the Kenyans making it a main driver of economic growth. As one of the six sectors, agricultural sector is shown to have the capacity of delivering the 10% economic growth rate as indicated in Kenya's vision, 2030.

In 2011, agricultural sector directly contributed 24.5% of the total GDP valued at Kshs 741 billion, (Kenya Economic Survey, 2012). Approximately 27% of the total GDP is contributed by Agricultural sector albeit indirectly via linkages such as manufacturing, distribution and other related sectors (Republic of Kenya, 2012). In sub-Saharan Africa, agricultural sector has been critical however, the performance of this sector in the region and even in Kenya has been unimpressive since (Nzioki, 2005).

According to Vision 2030, agricultural sector seeks to be an innovative and thus commercial leading to modernizing agriculture through improving rural development sector. Agricultural sector has both institutional and policy frameworks used in guiding the sector. They include the 2009-2020 Agriculture Sector Development Strategy (ASDS) and other sub-sector policies within the sector. The sector policies include increasing agricultural productivity through: generation and advocating for relevant technologies; value addition; exploiting irrigation potential; increased commercialization of activities in the sector; ensuring an appropriate legal and policy framework; improving governance of sector institutions; land development; promotion of sustainable management of resources and increasing resource allocation to the sector among other policies.

1.2 Realignment of the Agricultural Sector in Kenya

To attain maximum production, the agricultural sector was realigned and some of the subsectors created to achieve Kenya's Vision 2030 were: Lands; Fisheries Development; Agricultural Research & Development (ARD); Livestock Development; Cooperative Development and Marketing; Forestry and Wildlife and National Land Commission with their respective research and development institutions, (Republic of Kenya, 2012). Consequently, the agricultural sector emphasizes research and development whereby the main role of institutions involved specifically is to undertake critical research of deliberate national importance. Further, the established institutions were meant to distribute appropriate technologies, information and knowledge aimed at increasing output and effectiveness in the sector. This has led to establishment of tea research institutions tasked with promotion of research as well as investigating of problems related to tea production. This institution is meant to enhance quality and sustainability of land in relation to tea planting and thus high yield, (TBK, 2012a).

It should be recognized that the government of Kenya has put much efforts in favor of research and extension services despite the minimal allocation of resources towards these relevant research institutions. Made et al, (2009) noted that only about 0.01% of the governmental budget in 2008 was directed to research and development and implementation of the established sub sector policies.

1.3 Tea production in Kenya

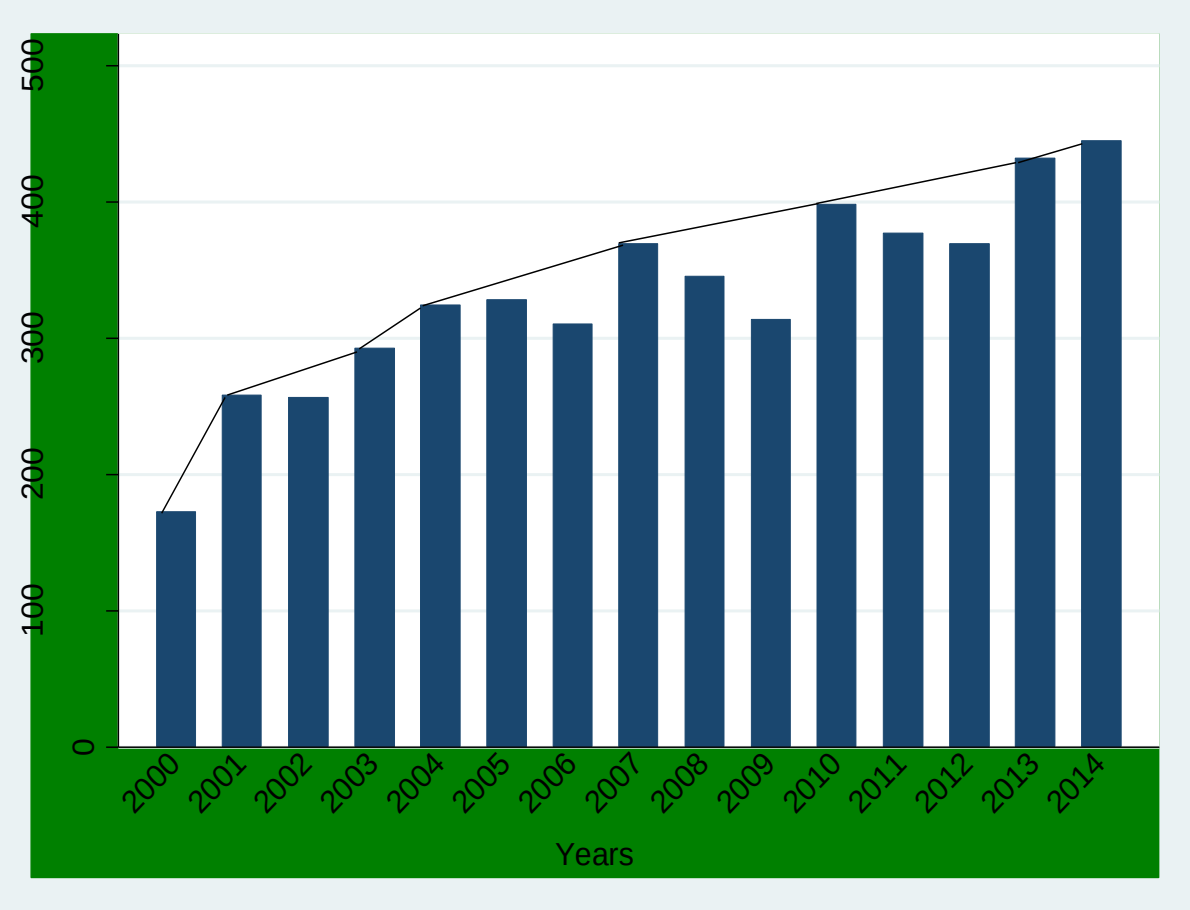
Commercial production of tea in Kenya began in the 1920s; however it was introduced in Kenya in 1904. After the Second World War, the industry expanded fast although expansion was restricted to commercial estates up to 1957 following the adoption of Swynnertton plan (1954) which was aiming to deepen growth of agricultural sector in Kenya, (Lamb and Muller, 1982). The whole programme was meant at improving cash crop production in Kenya through improved and up to date technologies. These included available markets and infrastructure, the gradual consolidation and enclosure of large holdings and the distribution of appropriate inputs. Upon realization of potential in the smallholder tea growing as a driver for rural development and economic empowerment of the indigenous Africans, the Kenyan government permitted growing of tea, (Nyangito, 2003; Nyaga and Doppler, 2009). The initiative was marked as very successful. This led to fast increase in smallholder tea production exceeding estates tea area in 1972 and production in 1987.

According to TBK, (2011) a large number of people in the world consume tea thus making it one of the most popular and lowest cost beverages. This has also led to high demand and therefore key ingredient of world beverage market. Kenya has experienced the planting and production of tea rapidly increase since independence in 1963, (Jabara,1985; Nyangito and Kimaru, 1999).

Based on the Kenya Economic Survey of 1995 tea output increased from 18,000 tonnes in 1963 to 294,170 tonnes in 1994 which guaranteed Kenya the third position after India and Sri Lanka, in the global tea exporters list thus commanding 21 percent of all tea exported to the world and about 10 percent of the world tea production, (Mwaura and Muku, 2007). Today, Kenya is the third leading tea producer accounting for about 14% world tea production and the largest exporter currently responsible for 23% of tea exports, (TBK, 2012b; 2014). On the other hand, local tea consumption has considerably increased. For example, in 2013, local tea consumption rose to 5-year higher in 2013 as more and more Kenyans consumed tea due to increased marketing drive for the cash crop. It is indicated that local consumption rose by 16.7% in 2013 that is 26.5 million Kilograms up from 22.7 million Kilograms in 2002 (TBK, 2014).

Tea supply in Kenya has witnessed an ever ascending trend from 170 million metric tonnes in 2000 to 444.8 million metric tonnes in 2014. However, there have been periodic movements or changes over time due to what is believed to be economic shocks leading to unstable tea supply. For example, the year 2002 had a lower tea output compared to the previous year 2000 (256.5 and 258.6 million metric tonnes respectively). Similarly, there was a great negative variation in total tea supply between year 2005 and 2006 of 17.8 million metric tonnes. Another decline (negative variation) is observed between year 2008 and 2009 from 345.6 and 314.1 million metric tonnes. This trends are however systematic from one year to another as indicated in Figure 1 below.

Figure 1: Trends in Tea Supply in Kenya (2000-2014)



Source: Adapted from Tea Board of Kenya, (2014)

To steer the process of increased production, the Nyayo Tea Zones was developed through a development corporation established as a semi-autonomous government agency under Commercial / Manufacturing Corporations which is mainly tasked to protect the forest cover effectively and thus high yield and quality for tea exports, local consumption and thus total tea supply (Mwaura and Muku, 2007).

The Tea Board of Kenya is mandated with the production and promotion of high quality tea to both domestic markets and international markets. This is also accompanied with serving as a regulatory agency in terms of management and production of tea in Kenya, (TBK, 2012a). This empowered the tea industry to focus on increased productivity, sustainability and world effectiveness through advanced research (Republic of Kenya, 2012).

1.4 Contribution of Tea to the Kenyan Economy

The tea industry has been recognized as a great contributor in the agricultural sector and the economy at large. Tea output is shown to give approximately 11% of the agriculture sector's contribution to the economic growth. Tea exports accounted for about 97 billion Kenya Shillings in 2010. This made tea to be the leading foreign exchange earner. It was trailed by horticulture sub sector at 78 billion Kenya shillings, (MOA, 2011). Locally, tea consumed has been on the rise as indicated in years 2012, 2013 and 2014 with 22.7, 26.5 and 32.1 million kilograms respectively leading to a consequent economic boost in the country, (TBK, 2014).

Tea sector supports approximately 5 million Kenyans. This makes it one of the leading sources of livelihood. Consequently, growing of tea as well as manufacturing is carried out mainly in the rural areas. This contributes significantly to the welfare of the rural communities as well as rural infrastructure (Kagira, et al., 2012). Most of the smallholder farmers in this sub sector reside in the countryside with rare economic opportunities and abject poverty is prevalent. These individuals persistently played a vital role in the cultivation of tea in Kenya. Small scale farmers are estimated to contribute up to 60% of the total tea supply in Kenya whereas large scale tea estates account for the rest (40%) (TBK, 2012a).

Under crop development and organization, productivity and value of tea especially among smallholder and large scale farmers has not only improved but also has experienced sustenance. This means that the released varieties and technologies are under different stages of adoption and commercialization. However, most of those employed in this labour intensive sector are women, (Made, et al., 2009).

1.5 Kenya's Tea Growing Areas

Tea is indicated to have high yield where the soils are appropriate. These are located mainly in the highlands 1,500m above sea level, (Brown, 1960). Specifically, the regions known to be suitable with good climate are; the Rift Valley (foothills of Aberdares) as well as Mt Kenya. Also, there are other parts of the region like Muranga, Nyeri, Kiambu, Kirinyaga, Embu, Meru, Nyambene, Tharaka Nithi District and Mau contributing to a good portion of total tea supply. On the other hand, other region covers Nyamira, Nandi, Kericho, Bomet, Kisii, Kakamega, Vihiga, Trans Nzoia and Elgeyo Marakwet Districts, (TBK, 2011).

Kenya produces mainly Crushed -Torn-Curled (CTC) referred to as black teas. However, there have been attempts in the recent to spread tea production to other conventional black and green teas. The Kenya Crushed -Torn-Curled teas are assumed to be of high quality which led to efforts of developing technologies that enhance production of these teas. This was associated with optimization of the aflavins[1] and the arubigins[2]as a way of quality enhancement (Owuor, 2005). Further, Kenyan teas are high altitude grown mixed with aroma which is critical element for clonal teas, (Owuor *et al.*, 1988). Remarkably, Kenyan teas are shown to combine excellent taste together with aroma.

1.6 Governing Bodies and Structure of the Tea Sector

The Kenya Tea Development Authority (KTDA) was established in 1964 as a state corporation charged with overseeing the smallholder sector. Smallholders must obtain a license from the KTDA in order to grow tea and they can only sell their output through the KTDA. The farmers get a registration number when they start to deliver tea to the buying center. The company had three sections that is: Tea Extension Services responsible for provision of extension services to the farmers on good farm husbandry such as plucking standards, weeding, pruning and maintenance of a good plucking table; Leaf Collection Services, responsible for ensuring timely delivery of tea to the factory as well as in good condition; and lastly the Production unit which undertakes the processing of the leaf leading to high quality made tea ready for consumption, (Lamb and Muller, 1982).

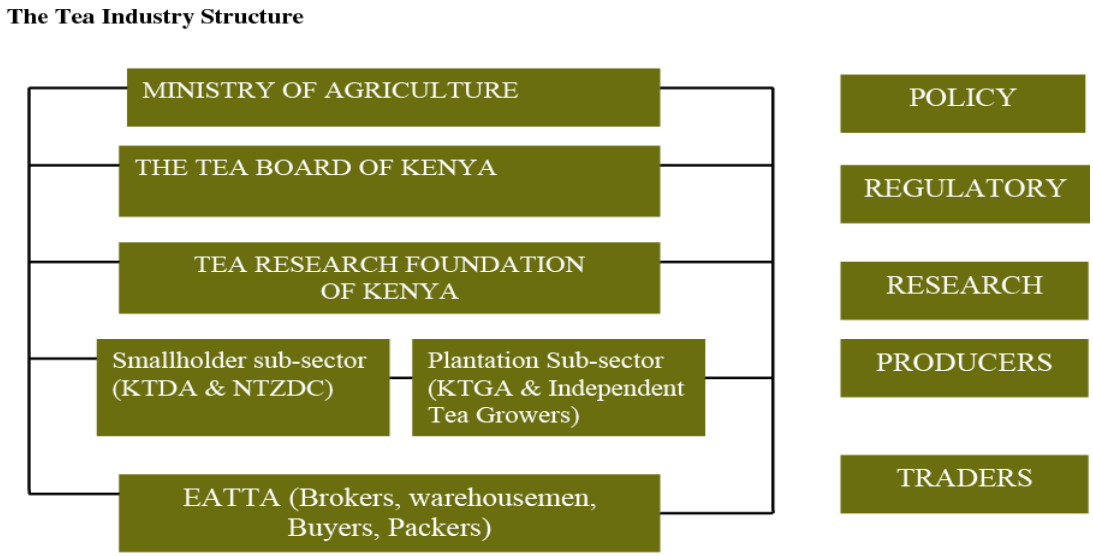
Nyayo Tea zones were also established in 1986 with responsibility for managing the government's tea projects around the forest zones. It has membership from large farmers who own approximately 10 hectares of land.

The East African Tea Trade Association (EATTA) is among the bodies related to tea which brings together mainly large tea growers, brokers as well as tea buyers in the entire East African region. On the other hand, The Kenya Tea Packers Limited (KETEPA) supplies tea to the domestic market and for export. This is the leading packer and distributor of tea in the domestic market in Kenya, (Mukumbu, 1993).

[1] A type of Tea aroma
[2] A type of Tea aroma

Despite the existence of these governing bodies, there was inefficiency and low productivity or supply of tea which may be linked to increased cost of fertilizers, energy and transport as a result of poor infrastructure and insufficient extension services identified particularly from the existing bodies governing tea sector, (Republic of Kenya, 2012). The following is the structure in tea industry.

Figure 2: The Structure of the Tea Industry, 2014



Source: Tea Board of Kenya

The most important organ in management structure of the industry is Tea Board of Kenya (TBK) which plays a regulatory function. It monitors tea trade and liaises tea industry with the government. Besides that responsibility, TBK collects and disburses produces and also interacts with eight state corporations on common programmes and other Government programmes.

Given the above structure as indicated by Figure 2, Kenyan tea is vended through two major outlets, the Mombasa auctions and the London auctions. The weekly Mombasa auction brings together tea brokers who act on behalf of tea factories in the East African region, on the one hand, and international tea buyers, on the other (Bowfield and Dolan, 2010). In 1992, the Mombasa auction accounted for more than 67% of total export sales, its share expanding rapidly after the 1992 policy change allowing auctions to be conducted in US dollars. The main incentive for smallholder tea producers was the increase in tea prices in Kenyan shillings during the period.

Approximately 90% of the tea traded globally is controlled by seven multinationals (Van der Wal, 2008). These companies are shown to control the most profitable activities in the tea value chain activities. These activities are conducted mainly at the consumer country and the whole world market, (Bowfield and Dolan, 2010). This implies that other companies have straight control through the ownership and management of complementaries tea plantation, freight companies, trading companies, processing, blending and packaging companies and retail marketing subsidiaries, (Kagira, et al., 2012). For the smallholders, their value adding in the country ends at the sale of bulked tea at the Mombasa auction or through direct sales, (Made et al, 2009). No more processing is done upon the initial conversion from green leaf made tea.

1.7 Tea supply and Policies that Govern the Tea Sector in Kenya

In the tea supply shackle, the prices of made tea are a result of the costs of production and transportation costs (Van der Wals, 2008). On the other hand, the most significant cause of dwindling prices of tea is insistent situation of overflow on the international markets and the tight competition among tea producing countries for the market share, (Etherington, 1973). Similarly, there is irregular value spreading where the tea supply chain tends to be composite. These complexities in supply shackle are as a result of many actors such as involvement of producers, collectors, brokers as well as packers. The dominance on the other hand in buying and retailing end of the market is basically by a few of multinational companies that benefit from retail prices, (TBK, 2012a).

Despite plantations having either improved management, organization and/or processing quality standards, there is a consistent production of low quality tea compared to that produced by small scale farmers, (Kagira, et al., 2012). This may be as a result of big part of tea quality as suggested by Ochieng, (2007) depends on the plucking process and a plantation since it is paid per weight. Thus it is difficult to control the system employed by the workers in the wide fields.

Small scale farmers preferred staple food which proved more profitable to tea while there is no substitution effect detected in the market, (Buch-Hansen, 2012). Consequently, liberalization of the foreign exchange market do not benefit farmers directly since their payment is through KTDA. Due to this most small-scale farmers end up being demotivated leading to low production of the crop (Nyangito, 2001). Services rendered by farmers such as processing,

storage, bulking, transportation and overhead costs among other charges determine their payout. This seems to demoralize the farmers. Success of price incentives has been noted to depend on the absenteeism of intermediaries who are main influencers in the devaluation's which is passed to producers, (Boccara and Nsengiyumva, 1995). Therefore, the need of appropriate policies is necessary to challenge likelihood of lower productivity in the tea industry.

The government overtime introduced policies meant to revitalize tea supply in Kenya. Firstly, there was provision of licenses and permits of growing tea. This was also associated with creation of an institution in the agricultural sector which was responsible for controlling production of tea in Kenya. The duty of regulation in terms of issuance of licenses and permits is now under Tea Board of Kenya which also regulates the tea industry in Kenya (Etherington, 1973).

Secondly, the Kenya government introduced a policy to improve competition within economy and the tea sector as indicated by the Kenya Vision 2030. At the sector level, the 2004-2014 Strategy for Revitalizing Agriculture (SRA) introduced in 2008 was supposed to convert agriculture into a profitable, commercial orientation and raise competition of the sector while the National Export Strategy (NES) of 2003-2008 was expected to grow Kenya's export performance through creating and extending emerging markets, diversifying the export base away from reliance on traditional exports, enhancing market access, and strengthening institutional support networks which was majorly on trade facilitation and enhancing attractiveness, (Kenya's Vision, 2030). Despite these measures, major players in the world tea sector failed to show intention of relocating their tea packaging to Kenya, (Van der Wal, 2008).

A third policy established by the government of Kenya (GOK) is the search for new emerging markets with strong potential. The identified markets included China, Eastern Europe, the countries of Near East as well as North America, (TBK, 2011). In 2010, the Tea Board of Kenya and other stakeholders developed a stamp of origin which was mainly concerned with consolidating the identity of Kenyan tea especially in the international markets. A higher percentage of output (approximately 94%) is exported in bulk for use in blends whereas about 6% of output which reaches the market purely Kenyan.

The consumer countries have mounted increased interest and pressure for the production of sustainable and fair-trade tea. However, there are few Kenyan smallholder farms who have been certified, (Buch-Hansen, 2012).

1.8 The Statement of the Problem

Kenya has the desire to produce the best tea in the word amidst declining world prices and tea consumption. Kenya exports 95% of its tea production and consumes only 5 %, (TBK, 2011). Nevertheless, tea supply in Kenya has increased over the years leading to a constant increase in cultivated areas most of which are owned by small holders. Specific annual up-and-downs in the production are due to changes in the production yields. Several Agricultural reforms have been undertaken including policies meant to stabilize the tea industry through research and development, (Republic of Kenya, 2012). However, the performance of tea is still affected by several other factors such as the cost of production, cost of fertilizers, price of crude oil and producer prices, (Mwaura and Muku, 2007; Kagira, et al., 2012). Some of the factors are experienced globally, for instance; compliance with international standards, bilateral and multilateral agreements and consumer requirement which determines the value of exports. Literature has mostly considered tea exports and its influencing factors but failed to consider locally consumed tea and thus total production (Were, et al., 2002; Miano, 2009; Jeptoo, 2010). Therefore, this study seeks to investigate the main factors behind tea supply response in Kenya and fill both the country and the empirical gap. More factors are considered as suggested in the literature (Kabubo, 1991) not included in the other studies that may influence tea supply such as climatic conditions, a good market for the tea and setting standards under which tea can thrive to enhance more returns.

1.9 Research Questions

The following questions are investigated;

i. What are the factors that influence tea supply response in Kenya?
ii. What are the effects of the price and non-price factors on Tea Producers' Supply response?
iii. What are the relevant interventions that can be drawn from the study findings?

1.10 Objectives of the Study

i. To investigate the factors that influences Tea Supply Response in Kenya.
ii. To determine the effect of price and non-price factors on Tea Producers' Supply response.
iii. To draw conclusions and make policy recommendations based on the study findings.

1.11 Scope of the Study

In exploring factors associated with Tea supply in Kenya, due to data shortage, the study considers the study period ranging from 1990 to 2014. The unit of study is the smallholder and large scale tea farmers in Kenya.

1.12 Justification of the Study

This study sought to investigate decision making among tea farmers when handling production of tea amidst declining world prices. The study may be of importance to tea farmers especially when implemented by the government as it may lead to provision of subsidized inputs such as fertilizer, good infrastructure, accessible funds and effective market channels, aiding in the production of tea and improved performance in the tea industry. This is in accordance with, (Sabur et al., 2000) who suggests improved marketing system for tea through value additions, branding as well as diversification of markets. This is shown to have and thus lead to better returns to farmers. The study shall indicate whether there is a significant improvement in the living standards of tea workers, increased employment level and reduction of poverty given stability of the tea industry through wage rates offered. The study findings may be of significance to policy makers to come up with long run and short run policies meant to develop an enabling environment. This is done through suggesting appropriate policy, legal and regulatory frameworks which are anchored on strategic administrative and direction for financial management for both local and foreign stakeholders in tea industry. Lastly, the study results may also be used by the researchers to inquire more on tea production in Kenya, as well as the academicians to understand more on factors influencing tea supply response in Kenya.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents theoretical and empirical literature reviews on tea supply response in Kenya. Theoretically, studies are presented indicating theories on supply and empirically, studies are examined suggesting the relevant factors that are likely to affect tea supply response in Kenya. Finally, an overview of the literature review is conducted summarizing the major factors and the models employed by different authors.

2.2 Theoretical Literature Review

According to Thomas and Nash, (1991)a country which is not a dominant producer produces large quantity for export, its export earnings are more likely to rise with no measurable fall in the market price despite its contribution to the direction of usage of resources and thus flow of goods and services to the consumers. Therefore, a country which intends to be a dominant producer should consider the price of that produce, prices of other goods and the input prices which goes into the production process.

Pricing policies in many countries especially emerging economies have been great impediment to production especially in the agricultural industry. The World Bank (1986) observes that country's domestic price is a true reflection of the distorted export and import parities. Further, it was suggested that supply response of certain agricultural crops in Africa rarely depend on their own prices. This implies that some other exogenous factors come into play like exchange rate and exchange rate policies. Oyejide (1986) argued that the direction of economic growth and relative prices can be determined by policy regarding exchange rate of a country. Real rate of exchange is based on the country's trade policy as well as foreign prices.

The agricultural sector has an interconnection with other sectors and is thus subject to the macroeconomic policies and decisions which later affect the real exchange rate, (Valdes, 1989). But what is this real exchange rate? Oyejide (1986) defined real exchange rate as terms of trade between two sectors that is traded and non-traded sub sector in an economy giving signals for resource utilization while Valdes (1986) defined real exchange rate as the proportion of the price of tradables e.g. tea and coffee in the agricultural sector to the price of home goods. The two authors together conclude similarly that the real exchange rate is maybe the most significant price which affects incentives.

Considering the influence of Structural Adjustment Policies (SAPs) on agricultural productivity, Binswanger (1989) suggests that agricultural growth increased considerably given effective implementation of SAPs. SAPs were mainly meant to keep exchange rates on check, do away with subsidies and industrial protection all of which favors terms of trade. The agricultural sector is responsive to policy changes. In Kenya, SAPs had positive influence on productivity in agricultural sector.

Another non-price factors which affect productivity in the agricultural industry is the favorable climatic conditions which motivate production of Tea. Nzioka (2005) suggests that input costs, weather and infrastructure greatly determine tea exports and thus the overall supply in Kenya. The agricultural sector through relevant tea governing bodies has not done enough in terms of monitoring current supply and demand trends in the tea market. This limits appropriate information to smallholder tea farmers on not only quality, cost and optimum production levels, (TBK, 2012).

2.3 Empirical Literature Review

Kabubo (1991) carried out a study on supply response of wheat in Kenya using the Nerlovian Model. Two equations were estimated, one for output and the other for hectarage. The study found out that rainfall was a significant factor influencing output at any given time. The Price ratio of competing crops, time trend variable, output, acreage in the previous period, and current acreage planted were found to affect positively the supply of wheat. The yield of wheat in the previous period was also found to influence the hectarage planted to wheat in the current period.

Arize (1996) examined the relationship of tea supply and real exchange rate for developing economy through the long run equilibrium export demand function. He used a time varying measure of exchange rate volatility as a proxy for uncertainty in the exchange rate which was built by growth rate of the real effective exchange rate through the sample standard deviation. The study used multivariate co-integration together with error correction techniques and concluded that real exchange rate uncertainty portrayed a negative and significant effect on tea supply.

The Nerlovian Model was used by Miano (2009) on the determinants of tea export supply in Kenya. The exchange rate was found to influence the quantity produced and the quantity exported. A positive relationship suggests that tea producers may be reactive to price incentives through exchange rates and total tea exports. The price of inputs was found to be very important in the enhancement of the tea industry in Kenya especially the export sector

Jeptoo (2010) carried out a study on Kenyan tea exports and exchange rate volatility. The study used time series analysis and found negative and relatively significant evidence on the impact of RER volatility on tea exports. The study was carried out on the post liberalization period (1993-2007) and examined the effects of RER on Kenyan tea exports using co-integration approach. The results showed that volatility of exchange rate had a relatively significant negative short and long run effects on Kenyan tea exports.

To analyze the performance of Kenyan tea supply, Were et al (2002) carried a study in which they determined the factors that influence the levels of tea supply in Kenya affecting the total export. The study specified an empirical model alongside the standard trade model that helps to incorporate real exchange rate and foreign income. To distinguish short run and long run elasticities, the study employed error correction formulation. The Exchange rate was found to be profound in the influence of export performance in Kenya. The supply response was also found to be influenced by the tea prices available in the market as well as exports to outside markets. The study showed that non-price factors (costs of inputs like fertilizers, labour costs and access to credit) played important function in the production and export supply response. The study showed that the exchange rate flexibility was in accordance with the essentials of the economy.

Odada (1975) carried out a study on the supply of Kenya pyrethrum using the Nerlovian Model. The study found out that compared to short run, farmers' response to price is higher in the long run. The regions which were more developed and have more farm production alternatives have the highest short run as well as long run elasticity coefficient. The regions which were less developed had the lowest elasticities in both short run and long run.

Binswanger (1989) examined the policy response on agricultural output using the Nerlovian Model. The results indicated that agricultural production was affected by market size, infrastructure, education, irrigation, farm subsidies, taxes, research, marketing, health and

structural adjustment programs (SAPs). The study observed SAPs influenced the removal of overvalued exchange rates, abolition of subsidies, reduction of industrial protection and fiscal austerity. Binswanger argued that SAPs influenced production positively. Further, the author indicated that exchange rate also affects agricultural production and thus total supply because when the local currency is devalued; it encourages exports and discourages imports.

2.4 Overview of the Literature Review

From both theoretical and empirical literature reviewed, it is evident that the quantity of tea supply is affected by the price and non-price factors, (Nzioki, 2005). That is, the prices of inputs, real exchange rates, the price oil and labour costs and effects of weather. These factors are the main cause of increase or decrease of tea supply in a country and the agricultural sector in general, (Oyejide, 1986; Valdes, 1989). The studies reviewed have shown that when prices are distorted, the output of agricultural products will be affected through reduced allocative efficiency however through the long run negative effects on agricultural labour supply and investment (Odada, 1975). Relative price changes, however, are likely to influence these factors.

Studies focusing on the effects of prices have rarely considered the effect of these prices from the periods succeeding the actual study periods. In agricultural sector, investment takes time to yield output and thus decisions for tomorrow depends on the actions of today. For example, Miano (2009) and Nzioki, (2005) who investigated the influencers of tea export supply in Kenya and the latter exploring effect of tea supply in Kenya but fail to address the effects of the previous year's prices and input costs. This paper is not only comprehensive by studying price factors, that is, prices of inputs, the real exchange rate and other non-price factors like weather patterns but it also adopts Nerlovian model (as used by Odada, 1975; Kabubo, 1991; Miano, 2009) to show the contribution of these factors in determining the quantity of tea supplied in Kenya. This study employs time series data set for a period 1990-2014 to estimate the factors affecting tea supply response and evaluates the impact of lagged variables on tea supply. Estimation issues, that is, pre estimation as well as post estimation tests are considered to validate the model.

CHAPTER THREE: METHODOLOGY

3.1 Theoretical Framework

This study employs the Nerlovian Model which has been adopted by most studies focusing on supply response in agricultural sector. In the model, lags are utilized which are dynamic as they take into consideration the future expectations as well as the length of adjustment process. The model show output as a function of price and adjustments in total output. It also reflects the way in which past experience determines the expected prices in one lag. The following two equations show its expression;

$$A_t^* = a_0 + a_1 P_t^* + a_2 Z_t + U_t \quad 0 < \alpha \leq 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.1$$

$$P_t^* = P_{t-1}^* + b(P_{t-1} - P_{t-1}^*) \qquad 0 < b \leq 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.2$$

Where A_t^* is expected/desired output at time t; P_t^* is expected/desired price at time t; b is the expectation coefficient while Z_t represents exogenous determinants influencing supply at time t. In equation 3.1 above farmers revise their expectation by a portion of the error they have made in order to estimate elasticity of acreage with respect to expected price while in equation 3.2 above, farmers revise their price expectation by a portion of the error they made in price prediction. If b tends to 0, this means that there is no likelihood of the difference between the current year's expected price and as well as the previous year's actual price. Further, if b=1, then the expected price is equal to previous year's actual price.

On the other hand, if the tea farmers alter their prospects of the upcoming price with regards to preceding experience, then, substituting equation (3.2) into (3.1) gives

$$A_t^* = \beta_0 + \boldsymbol{\beta_1 p_{t-1}^*(1-b)} + \beta_2 b P_{t-1} + \beta_3 Z_t + \boldsymbol{G_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3$$

Where random residual G_t is;

$$\boldsymbol{G_t} = u_t - (1-\beta)u_{t-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.4$$

Substitute, b=1 in the expected price and in the random residual to get the following equation;

$$A_t^* = \beta_0 + \beta_1 P_{t-1} + \beta_2 Z_{t-1} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.5$$

$\beta's$ are the parameters to be estimated

Z_t=Exogenous variables

Hence the ratio last years' anticipated and real price compose the current year expected price. The price prospects are a weighted moving average of past prices in which the weights drop geometrically. This model used integrated time series data which is subject to the danger of spurious regression. Similarly, one cannot differentiate between elasticities in both short run and long run. The quantity functions have been used to analyze the effect of price and non-price factors in the quantity of tea supply.

3.2 Model Specification

This study will use a functional model developed from the Nerlovian Model as,

$$Q_t = \beta_0 + \beta_1 TP_{t-1} + \beta_2 Q_{t-1} + \beta_3 PM_t + \beta_4 RER_t + \beta_5 IP_{t-1} - \beta_6 WR_t + \beta_7 DR_t + \mu_t \ldots\ldots\ldots 3.6$$

Where Q_t=Current Tea Output

TP_{t-1}= prices of tea in the previous year

Q_{t-1}=Previous tea output

PM_t=Current Price of milk

RER=Real Exchange rate

IP_t=Input prices

WR_t=Real Wage Rate

DR_t= Dummy variable representing Rainfall/weather patterns

μ_t=Error term

$\beta's$ are the parameters to be estimated

The equation above is a function of previous year's price of tea, previous price of milk, real exchange rate, input prices, wage rate and weather pattern.

3.3 Estimation Method

The study used the Nerlovian Model as an estimation model due to the nature of the data and variables used with the aid of STATA version 12.1 to establish the relationship between total tea supplied and other factors as indicated in equation 3.6. Stationarity test was conducted to identify integration order and how variables are co-integration. If study variables were of different orders and not co-integrated then we had to run the Nerlovian model but if they were of the same order and co-integrated, then error correction technique was to be used in the study.

3.4 Diagnostic Tests

The pre estimation tests were conducted to determine model specification. They included; Normal distribution of the random error term, constant variance of error term across observations, no serial autocorrelation of the error terms, no perfect correlation between any pair of independent variables and stationarity. Therefore, diagnostic tests were undertaken so as to validate the estimates that were yielded.

3.4.1 Unit Root Tests

The study tested whether the variables were stationary or to test the level of integration through the Augmented Dickey Fuller (ADF) test. The Ordinary Least Square estimates of the variants of the DF test were to be inefficient if the error term was to be serially auto correlated. The study employed ADF test of the following form.

$$\Delta Y_t = \beta_0 + qT + \beta_1 + Y_{t-1} + \beta_i \sum_{1}^{n} \Delta Y_{t-1} + \mu_i \qquad \text{.....3.7}$$

Where T is the time variable, μ_i is the disturbance term and β_1, β_2 and $\beta_3$are the estimated coefficients. In each equation, the null hypothesis is the existence of non stationarity. The acceptance of the null hypothesis confirms the presence of a unit root. This implies that the null hypothesis for this test requires that the coefficients of the autoregressive parameter of the variable be equal to one and the alternative hypothesis states that it is less than one. In case of non stationarity, the first differences are conducted to correct them back to stationarity.

3.4.2 Co-Integration Test

This test is necessary against the loss of information relating to possible long-term relationship in a model specified in first differences. This involves using the Engle-Granger (1987) two step procedure due to its simplicity. The model is subjected to co-integration analysis to ensure that there is a long-term association between the explained variables and the regressors. Error Correction Model would be estimated if results revealed the presence of co-integration and if found not co-integrated, then Nerlovian model shall be applied.

3.5 Expectations

Table 1: Variables definition, measurement and respective expected sign

VARIABLES	MEASUREMENT	EXPECTED SIGN
Total Tea Output (TS)	Quantity of total tea Exported and Domestically Consumed in metric tonnes	
Input prices (IP)	Total costs for purchasing inputs in Kenya shillings	Negative
Current Price of Milk (PM)	The current cost of purchasing a liter of milk in Kenya shillings	Negative
Wage Rate (WR)	The amount paid to an individual working in tea farm in Kenya shillings	Negative
Previous Price of Tea (TP)	The previous amount paid back to the farmer after selling tea per kilogram in Kenya shillings	Positive
Real exchange rates (RER)	Purchasing Power	Negative or positive (This depends on depreciation or appreciation of the currency)
Dummy weather pattern (DR)	These are periods when the climatic condition are reported to be favorable (Rainfall)	Positive

3.6 Data Sources

This study used secondary data set for the period, 1990-2014. The data (partly) was obtained from the Kenya National Bureau of Statistics (KNBS). Specifically, monthly tea supply which included the Domestic and exported tea prices and values were obtained from the Tea Board of Kenya (TBK).Other statistical abstracts were useful in obtaining other study variables.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents factors that influence tea supply in Kenya where the Nerlovian model was applied to establish the relationship between tea supply, price and non-price factors using the data sourced from various sources.

4.2 Descriptive Statistics

The study utilized the mean which is the average value, standard deviation which considers deviations from the mean, minimum and maximum, skewness indicating the (normality) distribution of the series and kurtosis showing the peakness of the distribution. The variables used are the Tea supply (TS), Wage rate (W), the input prices (IP), the price of milk (PM), the price of Tea (TP), the real Exchange rate (RER) and a dummy for Rainfall/weather (DR).

On average, the value for tea supplied for the entire period of study was 273.25 million metric tonnes with a variation of 94.76 million metric tonnes. The seasons when productivity was low, the quantity produced was 146.4 million metric tonnes while in good seasons when the yield was high, the total quantity produced and supplied was 444.8 million metric tonnes.

However, Table 2 indicates that approximately, 68% of the time period was characterized by good weather or presence of adequate rainfall with a considerable variation of 47.6%. This implies that the climatic conditions were favorable for most part of the study period. Considering the factor that has great influence on the tea prices, it was found that, on average, the real exchange rate between Kenya and the importing countries was 213.13 units with the least rate being 107.87 units while the highest rate was found to be 287.43 units. The price of milk on average was Kenya shillings 16.78 per liter but neither did it neither exceed Kenya shillings 29 per litre nor lower than Kenya shillings 4.90 per liter. The previous year's price of tea traded between Kenya shillings 29 and Kenya shillings 238.33 per kilogram of made tea. However, on average over the entire period of study, tea traded at approximately Kenya shillings 129.24 per kilogram of output. Table 2 summarizes the details.

Table 2: Summary Statistics

Variables	Observations	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
TS	25	273.252	94.76163	146.4	444.8	0.1819183	1.80377
W	25	3.856	1.626366	1	6.8	-0.0337421	1.888851
IP	25	89.0644	40.89261	30.33	141.88	-0.280816	1.476264
PM	25	16.7828	7.15448	4.9	29	0.2167803	2.235885
TP	25	129.2372	60.1532	29	238.33	0.2807585	2.404746
RER	25	213.1264	47.28546	107.87	287.43	-0.6581835	2.481125
DR	25	0.68	0.4760952	0	1	-0.7717436	1.595588

Further, it was shown that, on average, the wage rate was Kenya shillings 3.68 per kilogram of green tea output with the least being Kenya shillings one and the highest paid was Kenya shillings 6.8 per kilogram of output.

For the skewness, input prices, wage rate, real exchange rate and dummy for rainfall were negatively skewed while tea supply, price of the milk and previous tea prices were positively skewed. Considering the distribution of variables I terms of normality, all variables were not normally distributed since their corresponding kurtosis values were less than 3.0 as expected.

4.3 Correlation Analysis

This is used to measure the linear relationship between the dependent (tea supply) and independent variables. The association measured is not expected to exceed |0.6| beyond which we suspect the presence of Multicollinearity. From Table 3 below, we found out that almost all pairs of the relationships were above the threshold value except the relationship between dummy for rainfall and (price for milk and real exchange rate) implying that there was Multicollinearity. The presence of Multicollinearity leads to the spurious estimates. Further, Table 3 shows that almost all relationships were positively correlated except the association between real exchange rate and the dummy for rainfall which had negative correlation.

Table 3: Correlation Matrix

VARIABLES	TS	TP	IP	PM	WR	RER	DR
TS	1.0000						
TP	0.8429	1.0000					
IP	0.9171	0.8304	1.0000				
PM	0.9067	0.9450	0.8478	1.0000			
WR	0.9501	0.8480	0.9477	0.9093	1.0000		
RER	0.8861	0.7709	0.8710	0.8524	0.9230	1.0000	
DR	0.1418	0.1743	0.1354	0.1462	0.1802	0.0384	1.0000

Since the correlation matrix shows us which variables to retain or to drop due to collinearity, we conducted VIF test to establish the specific variables which led to high collinearity among the pairs of tea supply and independent variables.

Table 4: Variance Inflation Factors

Variable	VIF	1/VIF
W	28.04	0.035666
PM	20.87	0.047925
IP	12.21	0.081929
TP	12.07	0.082848
RER	7.91	0.126430
DR	1.23	0.814113
Mean VIF	13.72	

Table 4, show that wage rate, price of the milk, input prices and tea prices had high VIFs exceeding 10 while the tolerance level was far below 0.1 as required implying presence of Multicollinearity. To remedy this problem, we undertook the first differences of the correlated variables as indicated by Table 4. Other results are as shown in Table 5 below.

Table 5: Corrected High VIF

VARIABLE	**VIF**	**1/VIF**
TP	6.00	0.166562
RER	3.78	0.264329
DW	1.53	0.652004
DR	1.46	0.683293
DPM	1.18	0.846856
DIP	1.18	0.848632
Mean VIF	3.10	

NB: Where DW, DIP and DPM are the first differences of the wage rate, input prices and price of the milk respectively.

Table 5 shows that the all VIFs and 1/VIFs were far below 10 and above 0.1respectively implying absence of Multicollinearity. However, we further computed spearman's rank correlation matrix to determine the association between the specific variable(s) to ascertain the VIFs results. Table 6 indicates the results together with their significance. In other words, we established whether the association was significant or not.

Table 6: Spearman's Rank Correlation Matrix

Variables	TS	TP	DIP	DPM	DW	RER	DR
TS	1.0000						
TP	0.8213*	1.0000					
DIP	-0.0187	-0.0200	1.0000				
DPM	0.0195	0.0412	-0.2910	1.0000			
DW	0.0518	-0.0439	0.2203	-0.0736	1.0000		
RER	0.8649*	0.7609 *	-0.1213	0.1576	0.1123	1.0000	
DR	0.1189	0.2378	0.1405	-0.1578	0.4524*	0.1546	1.0000

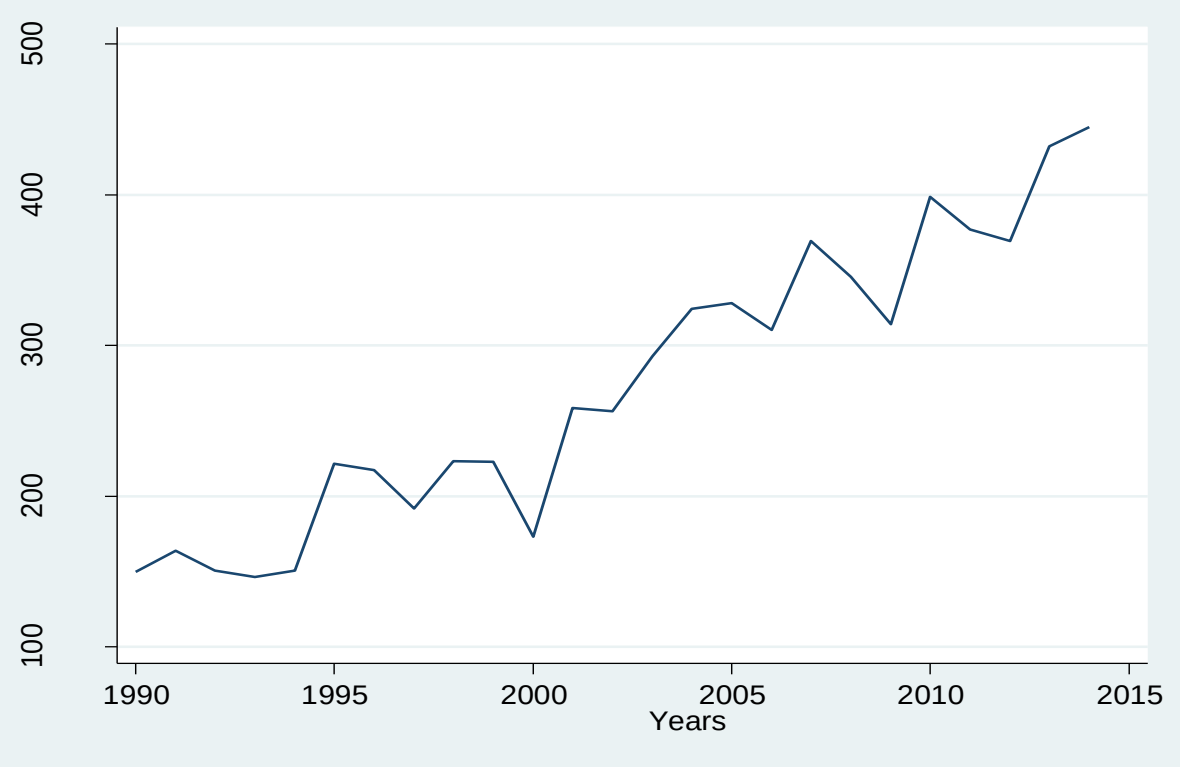
NB: The bold and italics values represent significance * Pairs with high correlation.

Table 6 shows that the relationship between tea supply and RER; and the relationship between RER and previous year's tea prices were highly correlated. Despite high correlation, it was established that the relationship was significant and thus we retained the variables as they were considered significant in our estimation process.

4.4 Trends and Pattern Illustration of Study Variables

Trend analysis indicates that, over the entire period of study, there has been a consistency increase in the quantity of tea supplied in Kenya. As can be observed in Figure 3 below, some periods experienced scarcity of tea supply attributed to political instability or tough economic situations in the country. The experienced fluctuations may be as a result of the change in climatic conditions or the trends in supply of inputs (like fertilizers) which are key determinants in the production of the crop. For example, in the year 1993 which show a slight decline may be associated with the then political events and inflation as a result of high circulation of money. In year 2000 and 2001, the country experienced a low supply which may be as a result of the process of change of the regime and mixed expectation by farmers.

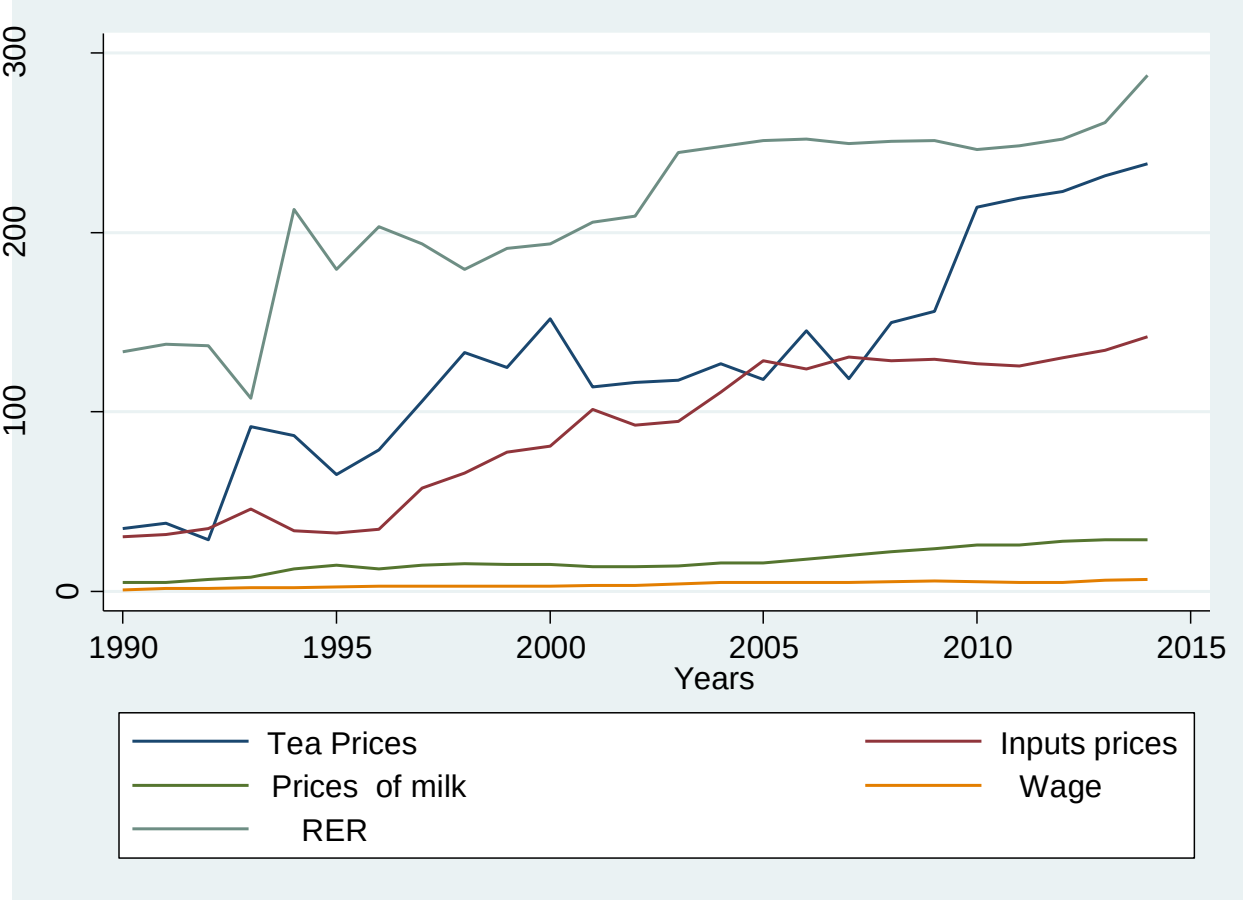
Figure 3: Tea Supply in Kenya



In our trend analysis, we further explored the behavior/pattern of the explanatory variables whereby, it was revealed that tea prices of the previous year, input prices and real exchange rate show a wavy rise over the entire time period implying that forces of demand and supply in the market contributed towards the productivity of this crop. As shown by Figure 5 below, both variable increase but at a decreasing rate.

On a closer look, previous year's tea prices and real exchange rate tend towards steadiness from the beginning of the years 2004 and 2005 respectively. This may be attributed to the various government policies put in place including the economic stimulus program and maybe the other policies e.g. macroeconomic policies controlling inflation which affects prices of agricultural inputs.

Figure 4: Trends by Tea Prices, Prices Of Milk, Input Prices, RER and Wage Rate



4.5 Post-Estimation Tests

4.5.1 Heteroscedasticity

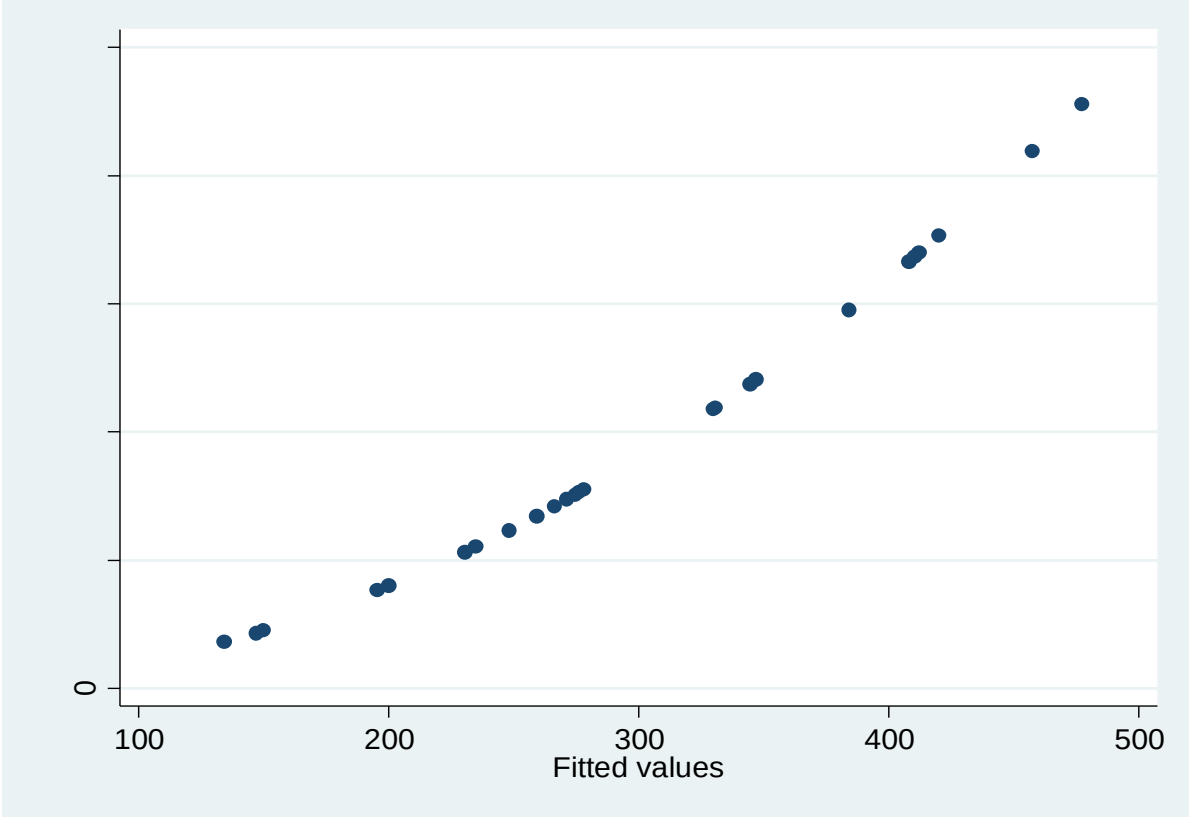
Heteroscedasticity is necessary to confirm whether there is no variation of the error terms across observations or lack of constant variance by the study variables. Our study used Breusch pagan test for heteroscedasticity. From Table 7 below, it can be seen that show that 12.98% is greater than 5% significance level which implies that there is no constant variance. In this case, we shall apply Robut test to serve as a solution.

Table 7: Cook-Weisberg Test for Heteroscedasticity

Variables: Fitted values of the quantity of Tea supplied Ho: Constant Variance
Chi2(1) = 6.90 Prob > Chi2 = 0.0086

Figure 6 below shows the scatter plots which exhibit a fairly systematic pattern. This implies that there is constant variance. This conforms to the findings in Table 7.

Figure 5: A Graph of Residuals Squared against Fitted Values



4.5.2 Autocorrelation

Autocorrelation refers to the correlation of the random error terms in the subsequent time periods. If Autocorrelation is present before and after estimation, then its biasness leads to wrong estimates. Our study employed Breusch-Godfrey test for Autocorrelation. Table 8shows the probability value of 35.3% was greater than the significance level of 5%. Therefore, we do not reject the null hypothesis that there is no autocorrelation.

Table 8: Breusch-Godfrey LM test for Autocorrelation

LAGS (P)	CHI2	DEGREES OF FREEDOM	PROB > CHI2
1	0.864	1	0.3526
H_0: No Autocorrelation			

4.5.3 Normality Test

The Shapiro Wilk is used to test for normal distribution of the random error terms. The null hypothesis (that the error terms are normally distributed) as;

$H_0: \varepsilon \sim N$

Since the p-value of 0.08693 as indicated by the table below is more than 0.05 (significance level), we confirm that the data is normally distributed.

Table 9: Shapiro Wilk Test for Normality

Variable	Observations	W	V	z	Prob>z
Residuals	25	0.93000	1.945	1.360	0.08693

4.5.4 The Unit Root Test

Unit root test confirms whether variables are integrated of the same order. To test for stationarity or Non-Stationarity we used ADF test. Upon conducting the ADF test as shown in Table 10, it was found that all variables contained unit root implying that they were non stationary at levels since their test statistic(s) were less than the critical value which led us into failing to reject the null hypothesis of no unit root. However, Dummy representing the weather pattern was found to be stationary at level since its test statistic (6.633) was more than the critical value (3.000) as indicated. To remedy this problem, we further conducted first differences to make them stationary.

Table 10: Unit Root Test

Variables	**At Level with Intercept t-statistic**	**At First Difference t-statistic**	**Order of Integration**
TS	-0.546	-7.060	I(1)
TP	-0.748	-6.415	I(1)
IP	-0.717	-4.872	(1)
PM	-0.392	-4.133	I(1)
W	-0.536	-3.794	I(1)
RER	-1.466	-8.053	I(1)
DR	-6.481	-	I(0)

NB: The critical value at 5% of variables, both at levels and at first difference is -3.000

The results as shown in Table 10 indicate that all variables are integrated of order 1 implying the presence of one unit root except the dummy variables. We therefore conducted the first differences of non-stationary variables, they became stationary. The model appears as follows;

$$DTS = \beta_0 + \beta_1 DTP + \beta_2 DPM + \beta_3 DRER + \beta_4 DIP + \beta_5 DW - \beta_6 DR + \mu_t \ldots 4.1$$

DTS= fist difference of Tea Supply

DTP_t= fist difference of Tea Prices

DPM=first difference of Price of Milk

DRER=fist difference of Real Exchange Rate

DIP=first difference of Input Prices

DW=first difference of Real Wage Rate

DR= Dummy Variable representing weather patterns

μ_t=Error term

$\beta's$ Are the parameters to be estimated

4.5.5 Testing for Co-Integration

This condition is exhibited when a regression of these variables is conducted and residuals are subjected to unit root test and found to be integrated of the same order. Two or more variables may be non-stationary but a linear combination of these variables form a long run and/or equilibrium relationship between them. Under these condition, albeit the individual variables are I(1) that is they have stochastic trends, their linear combination is I(0) and the regression from these variables is not spurious but give a meaningful interpretation and these variables are said to be co-integrated. Variables, found to be co-integrated must be integrated of the same order. In our study we applied the Johansen co-integration test to test as to whether the variables have a long term/run relationship. The results are as indicated in Table 11 below:

Table 11: Johansen Test of Co-integration

Unrestricted Co-integration Rank Test (Trace)					
Hypothesized		Trace Statistic	Critical Value	Max-Eigen Statistic	Critical Value
No. of CE(s)	Eigenvalue				
None*	0.985391	105.7663	111.75366	101.74837	84.07757
At most 1	0.891240	97.01797	88.81889	82.59080	71.87687
At most 2	0.687552	71.42717	63.85613	65.42965	49.58434
At most 3	0.540182	53.99753	39.79707	44.31539	33.13162
At most 4	0.236484	46.68213	27.49471	35.666248	23.26460
* Denotes acceptance of the null hypothesis at the 0.05 level					

The results reveal that according to the trace and max statistic that there is no co-integration of the variables. This therefore concludes that there is no cointegration with all other independent variables indicating that there is a short term relationship. Since the study variables are not co-integrated, we go ahead to run a Nerlovian Model. This further implies that there is short run causality running from each independent variable to the dependent variable in this case, tea supply.

4.6 Short Run Causality Test

Since co-integration test failed to establish long run causality, we explored whether indeed our study variables causes quantity of tea supplied. We conducted further analysis of whether in the short run; those variables significantly caused tea supply in Kenya. This also implies causation and prediction between two time series. Table 12 shows the findings.

On joint significance in causing the quantity of tea supplied, it was established that all the variables affected tea supply. All of them had p values less than 5% hence they specifically caused quantity of tea supplied. However, the first difference of previous year's price of tea, wage rate and weather pattern were not significant in causing tea supplied. The rest of the variables illustrated significant short run causality.

Table 12: Granger Causality Test

EQUATION	EXCLUDED	CHI2	DF	PROB > CHI2
DTS	DTB	9.8248	2	0.007
DTS	DIP	59.433	2	0.000
DTS	DPM	48.14	2	0.000
DTS	DW	12.426	2	0.002
DTS	DRER	13.153	2	0.001
DTS	DR	22.985	2	0.000
	ALL**	**169.8**	**14**	**0.000**
DTP*	DTS	29.543	2	0.000
DIP*	DTS	8.2019	2	0.017
DPM*	DTS	8.2019	2	0.017
DW*	DTS	20.444	2	0.000
DRER	DTS	0.92478	2	0.630
DR*	DTS	11.146	2	0.004

*The amount of Tea supplied affects these variables except real exchange rates

**All of these variables jointly and significantly cause Quantity of Tea supplied

4.7 Estimation of the Nerlovian Model

This study aimed at establishing the key factors that influence the tea supply response in Kenya. Several multiple series for pre-test with key focus on presence of unit and co-integration needed in estimation were conducted. The pretests, conducted before analysis were necessary as they guided on the right transformation which led to determination of the appropriate transformation that could lead to stationarity of variables and the relationship they exhibited through co-integration test. From cointegration, the variables were not cointegrated and there is a short run relationship between them.

Based on the Nerlovian model as indicated by Table 13, if all factors were kept constant, tea supply would be 6.343 million metric tonnes. However, for a unit increase in tea prices there was a rapid increase in the quantity of tea supply by 0.0711 million metric tonnes holding other factors constant. Further, input prices had a negative relationship whereby for a unit increase in the input prices, there was a consequent decline in the current tea supplied by 0.5094 million metric tonnes holding other factors constant.

It was established from the study that a unit increase in milk prices led to an increase in the current quantity of tea supplied by 1.2358 million metric tonnes holding other factors constant. The unexpected positive sign of the milk in the results is attributed to complementarity nature of milk on tea. Farmers are likely to sell more milk to earn extra income associated with higher prices and purchase other inputs which goes into the production process of tea. On the other hand, for every a unit increase in wage rate, led to an increase in the quantity of tea supplied by 5.0254 million metric tonnes holding other factors constant. This implies that for an increase in the wage rate labour productivity increases which ultimately increases total tea supplied. Real exchange rate showed a negative relationship with the quantity of tea supplied whereby there was a consequent decline in the quantity of tea supplied by 0.0132 million metric tonnes holding other factors constant. This may be attributed to increase in prices associated with the inputs thus leading to lower productivity of this crop. Finally, for a change in weather patterns, there was a consequent decline in the quantity of tea supplied to market by 9.8865 million metric tonnes.

The model is as follows:

Table 13: Findings from Nerlovian model

Robust				
VARIABLES	**COEFFICIENTS**	**STD. ERR**	**T**	**P>t**
DTP	0.21413	0.071140*	3.01	0.08
DIP	-0.50942	0.239164**	-2.13	0.033
DPM	1.23583	1.021347	1.21	0.215
DW	5.02541	1.955412**	2.57	0.017
DRER	-0.01324	0.006932**	-1.91	0.055
DR	-9.78763	9.886495	-0.99	0.351
Constant	6.34324	1.682557	3.77	0.000
Number of Observation = 24 F(6, 23) = 22.43 Prob > F = 0.0007 R^2 =0.7722 Adjusted R^2 = 0.7111				

Significant at ***1%, **5% and *10% significance levels

Source: Author's computation

From the Nerlovian model results above, tea prices, input prices, wage rates and real exchange rates were significant factors in determining the current quantity of tea supplied in Kenya. On overall model fitness, it was revealed that the probability value of 0.0007 which was less than 0.01 significant level implied that all the independent variables jointly and significantly determined current quantity of tea supplied in Kenya. Considering R^2 the value of 0.7722 imply that the total proportion of dependent variable explained by independent variables is 77.22% while 22.78% is explained by other variables which are not considered in the regression or omitted variables.

The following is the model subject to discussion describing significant factors that determine tea supply in Kenya generated and expressed as follows;

$$DTS = 6.3432 + 0.2141DTP - 0.5094DIP + 5.0254DW - 0.0132DRER \ldots\ldots 4.2$$

Where DTS is the first difference of tea supply

DTP is the first difference of the tea prices

DIP is the first difference of the input prices

DW is the first difference of the wage rate

DRER is the first difference RER

4.8 Discussion of the Study Results

Based on the above model (4.1), Kenya's goal of growing native cash crop output through improved modern markets and infrastructure, there is need for provision of appropriate inputs and the steady consolidation and enclosure of large holdings as suggested in the literature. In order to maintain and improve the current status of Kenya at the third position with about 14% global tea supply according to TBK (2012b); tea prices, input prices, wage rates and real exchange rates need to be understood and addressed appropriately.

From the model, the previous price of tea was shown to be a significant factor influencing tea supply in Kenya. There was a positive and significant relationship between the current quantities of tea supplied and the previous tea prices. This implies that as the previous price of the tea increased and so was the quantity of tea supplied. This is in accordance with the economic theory and similar to our apriori expectation. This study sync well with the study conducted by Odada (1975) who explored the supply of Kenya pyrethrum whereby farmers' responsiveness was associated with higher prices. Similarly, Were et al (2002) carried out a similar study in which they determined the factors that influence the levels of tea supply in Kenya. The authors found that, tea supply response was influenced by the tea prices available in the market. This implies that previous prices act as a motivating factor triggering more supply.

From the study results, previous input prices were shown to have negative influence to the quantity of tea produced in Kenya. Our study revealed that at 10% significance level, the increase in the previous cost of purchasing farm inputs led to a consequent decline in the quantity of tea supplied. This finding was confirmed by Miano (2009) who also investigated the determinants of tea export supply in Kenya. The study suggested that the previous input price was very important in the enhancement of the tea industry in Kenya especially in the production.

The study results also indicated a positive relationship of wage rate against our a priori expectation. However, under some conditions or circumstances, the workers working in tea estates under KTDA or individual on small farms may be motivated and this may trigger the productivity of the crop. Motivation, from the literature, has been termed as one of the immeasurable factors which lead to more output. This was in line with Kabubo (1991) who suggested that the wage rate contributed supply response of wheat in Kenya.

Finally, the study showed that real exchange rate had a significant and negative relationship with tea supply in Kenya. Similarly, Binswanger (1989) who conducted study examining the policy response of agriculture concurs with our study findings by concluding that exchange rate affects agriculture production because when the local currency is devalued, it encourages export and discourages import and therefore, agricultural production improves.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary the study results in relation to the objectives, literature review and main variables in our study. Also it makes conclusions based on the established relationship between tea supply in Kenya and factors that determine the quantity supplied thus making necessary recommendations are drawn. Suggestions for further areas of study are captured as a way of filling the gaps identified in the study.

5.2 Summary of the Study Findings

This study was conducted with the main objective of evaluating factors influencing tea supply response in Kenya. The study conducted trend analysis and explored the nature and pattern of the study variables. The study utilized secondary data obtained from various statistical abstracts for the period 1990-2014. It employed Nerlovian Model with Ordinary Least Square (OLS) as an estimation technique in modeling the relationship among the study variables upon conducting varied tests and considering the nature of the data. The study variables used were the quantity of tea supplied, the price of tea, input price, price of milk, real exchange rate, wage rate and a dummy representing weather pattern.

The first difference of the tea prices was found to be statistically significant at 1% significance level while the first difference of the input prices and the first difference of the wage were found to be statistically significant at 5% in determining the current quantity of tea supplied in Kenya. On the other hand, the first difference of the prices of milk and the weather patterns were found to be statistically insignificant.

Further, we had a positive and negative impact of the various study variables on the general tea supply. For instance, a unit change in input prices and real exchange rates led to a decline in tea supply by 0.5094 and 0.0132 million metric tonnes other factors kept constant whereas unit increase in tea prices and wage rate led to an increase in tea supply by 0.2141 and 5.0254 million metric tonnes respectively holding other factors constant.

5.3 Conclusion from the Study Findings

From the literature, it was shown that tea is one among other major cash crops in Kenya which contributes greatly in the country's economic growth. To stabilize the production and supply of this crop, the study found out that some of the established factors contributed negatively into the quantity supplied. In conclusion, there is a need to address input prices and real exchange rates which was found to reduce the quantity of the current tea supply in Kenya. The rest of the factors as indicated in model (4.2) need to be considered for stabilization purpose of tea supply in Kenya.

5.4 Policy Recommendations

From the study findings, the factors which influence tea supply response in Kenya have been extensively analyzed. Therefore, we suggest the need for the government through the KTDA and the Ministry of Agriculture to identify other external tea markets to enable more sales and high incomes for the farmers. This may encourage farmers to produce more tea as there would be an assurance of a ready market and good incomes.

Secondly, the KTDA needs to consider giving out loans to farmers at reasonable interest rates to lead to credit affordability and at times, government should subsidize the inputs required to increase the yield of tea. This may enable more farmers to acquire those essential inputs like fertilizers which would be used to boost yields. In addition, the government through its Ministry of Agriculture (MOA) should engage as many field extension officers who could advise farmers on how to grow the crop and efficient utilization of inputs for higher output. On the other hand, there is a need to revise the exchange rates which discourages total tea output especially when trading with outside markets. This could stabilize the prices offered to the consumers and thus income which is likely to encourage them to produce more of this crop.

Finally, the positive effect experienced due to changes in the wage rate need to be given attention. To control this effect, KTDA need to revise their wage rates to a reasonable rate to be in line with the current economic situation to .enable farmers to cater for their day to day needs. This would lead to an increased morale among farmers who may not only spend more time but also increase the number of tea plantations.

5.5 Areas for Further Research

This study has focused on tea supply response in Kenya whereby price and non- price factors have been considered in an effort of exploring the main factors that trigger the direction of this crop. However, as a developing country with social, economic and political challenges, the influence of political and political related factors in Kenya has not been considered. Therefore, more studies are recommended to give a green light on their contribution to tea supply in Kenya. Finally, there are other models apart from the Nerlovian Model employed in this study, therefore future studies utilizing other models like Cobb Douglas production models among others is required.

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APPENDIX

ANNEX I: DATA USED IN THE ANALYSIS

Years	TS	TP	PM	IP	W	DR	DW
1990	149.6	35	4.9	30.33	1	1	
1991	163.6	38	5.2	31.8	1.5	1	0.5
1992	150.5	29	6.5	34.87	1.5	0	0
1993	146.4	92	7.8	45.96	2	1	0.5
1994	150.5	87	12.5	33.94	2	0	0
1995	221.3	65	14.5	32.7	2.5	1	0.5
1996	217.2	79	12.5	34.76	3	1	0.5
1997	191.6	106	14.5	57.51	3	0	0
1998	223.3	133	15.49	65.8	3	1	0
1999	222.7	125	14.94	77.62	3	0	0
2000	173	152	15	80.85	3	1	0
2001	258.6	113.89	13.87	101.44	3.5	1	0.5
2002	256.5	116.38	13.87	92.8	3.5	0	0
2003	292.9	117.73	14	94.7	4	0	0.5
2004	324.3	126.96	16	111.1	5	1	1
2005	328.2	118.24	16	128.6	5	1	0
2006	310.4	145.41	18	123.9	5	1	0
2007	369.3	118.74	20	130.7	5	0	0
2008	345.6	150	22	128.4	5.5	1	0.5
2009	314.1	156.2	24	129.5	6	1	0.5
2010	398.5	214.22	26	127.1	5.5	0	-0.5
2011	377	219.33	26	125.6	5	1	-0.5
2012	369.2	223	28	130.2	5	1	0
2013	432.2	231.5	29	134.55	6.1	1	1.1
2014	444.8	238.33	29	141.88	6.8	1	0.7