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Trade Policy Implications on Food Security in Rice and Maize in Kenya and the Philippines

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The research is a study on trade policy implications on food security in rice and maize in Kenya and the Philippines. It covers, globalization as embodied by the East African Community and ASEAN region, trade and agricultural trade policies, agricultural development and factors of production regarding rice and maize. The purpose of the study is to determine implication of trade and trade policy model on food security, state of production and consumption on rice and maize. We also try to determine if there is no significant correlation between the factors of production concerning rice and maize. The study is a contribution to a body of knowledge on trade policies on food security. Another significance of this research include the link of trade policies to food security which is - basic in economic development; aiding farmers or producers and traders of rice and maize in investment decision. The theoretical framework, based on regional bloc theory, was used to develop the conceptual framework. The study used document analysis research design, questionnaires and interviewing key respondents. The study used Chi-square and multiple regression to test hypotheses. The findings of the study indicate that agricultural development in terms of rice and maize has been increasing despite problems associated with land, labor and capital as factors of production. It also indicates that trade policies and agricultural trade policies affect food security. The study found out those trade policy reforms of 1980s, 1990s and 2000s reduced domestic production of rice and maize and increased importation. Further findings show that there is no significant difference between food self sufficiency and food self reliance. Some policies were proposed and others recommended, a framework proposed and a trade policy model recommended.

JEL Classifications: Q18, F13, F50

Keywords: Trade Policy Implications: Food Security on Rice And Maize: Kenya And The Philippines.

INTRODUCTION

Many studies have investigated the effect of globalization or liberalized trade on food security. Our intention was to link trade and food security in Kenya and the Philippines. The two countries were chosen because a related research on the effects of globalization policies on food security on rice in the Philippines had been carried out. Maize in Kenya and rice in the Philippines are the focus of the study because they are considered staple food items. Information concerning globalization, agricultural development and factors of production in terms of rice and maize in both countries is important. Food security comprises self-sufficiency (domestic production or domestic trade on food) and self-reliance (domestic production and the net imports or international trade on food). Kent (2002 as cited in Chandra, & Lontoh, 2010) likened food security to wealth sourced from the international market. A country can pursue self-reliance policy to supplement domestic food supplies and when imports are cheaper. Kenya has been pursuing self-sufficiency in maize, wheat, rice, milk and meat in vain. Within the Southeast Asian region, the governments pursue self- reliance strategy because rice is a sensitive commodity and has no close substitute (Timmer, 1997 as cited in Chandra, & Lontoh, 2010).

Hypothesis was tested to determine if there is no significant difference between food self -sufficiency and food self- reliance on rice and maize. The purpose of the test was to establish whether food security is determined by self-reliance or self-sufficiency. Another hypothesis was tested to determine the significant relationship between factors of production; land, labor and capital in predicting production of rice and maize. The reason for the test was to determine whether increases or decreases in one variable or factor significantly relate to increases or decreases in the other variables or factors. Investigating food security per see has important theoretical implications. The practical implication relate to trade policies, prices and availability of food. This paper highlights a proposed framework for food security in Kenya and the Philippines as shown in Figure 1. The role of food security in agro-based economies is important as shown in Figure 2. Domestic agriculture, pillar of economic growth of developing countries, determines the growth potential of the non-agricultural sector as a source of food and raw materials for industries. The study was geared towards building a trade model on food security for a developing country. The paper provides documented information regarding the trade policies as a basis of policy review, modification, or enactment of new ones.

To address the research problem the study we attempted to provide answers to the following questions:

1. What is the state of production and consumption of rice and maize in Kenya and the Philippines from the year 2000 to 2013?
2. What problems in the factors of production of rice and maize in both countries are encountered?
3. Based on the findings of the study, what trade policy implications on food security can be identified?
4. Based on the findings of the study, what framework on food security can be prepared and proposed for a developing country?
5. Based on the findings of the study, what trade policy model on food security can be built and recommended?

LITERATURE REVIEW

The study is anchored on the Regional Bloc Theory (Global Scepticism), which postulates

strongly that there is no single world market. The growing internationalisation of trade and investment is really the growth of regional economic blocs and beneficial mainly to countries within the blocs (e.g. European Union, East Africa Community and the ASEAN, etc).

Many studies show that importation of food improves food security and prices (Chopra, Galbraith, & Darnton,2002). Some studies focus on the implications of trade agreements on food security (Aksoy & Beghin, 2005; Stevens, 2000; as cited in Chandra, & Lontoh,2010). International food trade affects a country's' food security (Matthews, 2003 as cited in Chandra, & Lontoh,2010).

A research done by Sawaya, Martins, & Martins, (2003) showed that the Brazilian government liberalized the market for soybean and vegetable oils leading to increased international trade in Brazil. A study carried out by Vepa (2004 found out that globalization in India increased imports of many food items. Regmi, Ballenger, and Putnam (2004) conducted a research on liberalization of trade in the Mediterranean region. Results indicate that trade increased the demand for specific kinds of food like olive oil, pasta, and cheese despite trade barriers and transportation costs. A study carried out by Kinabo (2004) indicated that trade liberalization has facilitated the availability of fruits and vegetables in Tanzania. Meijerink, Roza, and Berkum (2009) carried out a study on how Kenya, Tanzania, Uganda, and Ethiopia reacted to high international food prices in 2008. The results indicate that policies of free trade, liberalized agricultural markets, domestic taxes, and subsidies on outputs and inputs did not encourage farmers to increase production. Gilbert, Scollay, & Bora, (2001) conducted a research and found out that AFTA generated less impact on agricultural trade. A research done by Pasadilla (2006) showed that AFTA was not designed to boost intraregional agricultural trade. Building up of rice reserves, export restrictions, and liberalized importation of rice are trade policies used by net rice exporting countries like Thailand and Vietnam according to a study conducted by the Asian Development Bank 2008). Eugenio, Marcelle, and Robinson (2000) researched on the trade aspect of food security. A study on the impact of trade policy reforms was conducted under the auspices of the Philippine Institute for Development Studies. The results show that there was an increase in imports, lower domestic prices, and diversification of export products. Development Studies. The results show that there was an increase in imports, lower domestic prices, and diversification of export products A research by Omiti, Waiyaki, and Fritz, (2007) on trade policy found out that there had been significant reductions in both tariff and non-tariff barriers and progress on trade policy in Kenya. These were attributed to liberalizing the domestic economy. It emerged from their study that Kenya needed appropriate institutional framework, skills, and resources to make and effectively implement the right trade policies. This paper was concerned with trade policy implications on food security on rice and maize in Kenya and the Philippines.

The current study and the previous studies are related on the basis of the impact of trade agreements and liberalization on food security. Models of the study (Figures 1 and 2) and quantification of parameters of food security (in Tables 1, 2, 5, and 6) make the current study an improvement over the existing ones.

METHODS

The study employed document analysis, which is a systematic collection and objective evaluation of past data in order to test hypotheses concerning causes, effects, or trends of past events that may help to explain present events and anticipate future events as argued by Gay (1996). The purpose of the documentary review was to collect, verify documented data (reports

and policy documents), and test hypotheses. We considered the research design an appropriate research method because important data for the study was in written form. We gathered data using questionnaires and interviews from the Ministries of Trade and Agriculture in Nairobi, Kenya and the Department of Agriculture and National Food Authority in Manila, Philippines. The interview was done to validate the written data. Busha and Harter (1980) argue that both quantitative and qualitative (secondary and the primary sources) variables can be used in the collection of past information.

The study used chi-square to test the hypothesis: "1. there is no significant difference between food self-sufficiency and food self-reliance on rice and maize" and 2. "there is no significant relationship between factors of production; land, labor and capital in predicting production of rice and maize" in Kenya and the Philippines. Multiple regression analysis aided by the usage of statistical package for social science (SPSS) was used to determine. The two hypotheses were tested at $\alpha = 0.05$ level of significance. The study used narrative method and researchers' designed tables and SPSS based tables to present data.

RESULTS AND DISCUSSION

In analysing the content of the questionnaires and interviews, the following themes were evident: globalization policies, trade and agricultural trade policies, agricultural development, and factors of production regarding rice and maize in Kenya and the Philippines.

Globalization Policies as Embodied by the East African Community and ASEAN region

Association of South-East Asian Nations (ASEAN), East African Community (EAC) and the Central American Free Trade Agreement (CAFTA) have embraced liberalization. Trade and food security has been a major concern of these trading blocs. Favourable conditions for issuing export and import credits, availability of export and import subsidies, and removal of monopoly of marketing boards are globalization policies which have improved food security on rice and maize in the Philippines. Despite the liberalization, these economic integrations protect sensitive products like rice, wheat, and maize. Their regional policy frameworks cover tariffs, rules of origin (ROO), harmonized customs laws, and recognition of partner state quality marks. Frameworks also address simplification of customs documentation, procedures/regulations, and standards.

EAC common internal tariff and common external tariff (CIT & CET) and Common Effective Preferential Tariff (CEPT) scheme for the ASEAN-AFTA are the main trade policies used to realize harmonized tariff. The research findings show that the EAC-CIT and CET) have little impact on food self sufficiency and reliance on rice and maize in Kenya. This is because both rice and maize are treated as sensitive products and in most cases not subjected to EAC-CIT and CET). The CEPT scheme under the ASEAN Free Trade Area (CEPT-AFTA) has led to positive impact on food-reliance on rice and maize in the Philippines.

Trade and Agricultural Trade Policies

Tariff is the major and non-tariff is the minor trade policy instrument used. Findings from the study indicate that East African Community agricultural trade policies were formulated in 2010 and were being implemented in 2012**.** However the elimination of tariff and non-tariff barriers, creating a regional market, and cooperation in the field of agriculture is already a success.

The research findings show that food self-sufficiency on rice in the Philippines remained relatively constant despite strategic plan of action, for 2005-2010, on ASEAN cooperation

in food, agriculture, and forestry. However, Philippines food-reliance on rice has registered an increase. The ASEAN Common Agricultural Policy (ACAP) involves protection on plant and animal. This has not led to favourable food self sufficiency and reliance on rice and maize in the Philippines.

Agricultural Development in Terms of Production of Rice and Maize in Kenya and the Philippines

The fluctuation in the production of rice and maize in Kenya and the Philippines is caused by weather conditions (typhoons, drought, pest outbreaks, and rising temperatures), quality of seeds, fertilizer application, expansion in irrigated land. It is also affected by better preparation of land, timely planting, and efficient weeding. However, typhoon is not experienced in Kenya.

The widening gap between domestic production and consumption of rice and maize in Kenya and the Philippines is due to liberalization leading to growing dependency upon imports. On average a Kenyan consumes seven kilos of rice but expected to rise to 15 kgs by 2015 and 98 kgs of maize per year. A Filipino, excluding domestic animals, consumes 120 kgs of rice and 40 kg of maize per year.

The quantitative summary regarding rice and maize is shown in Tables 1 and 2.

Kenya and the Philippines experienced fluctuating net deficits in rice from 2000-2013. Production, consumption, deficits, and importation of rice in metric tonnes are less in Kenya than in the Philippines. Rice is a major staple food in the Philippines than it is in Kenya. It is also due to the differences in demand requirements of population between the two countries. The gap between domestic production and consumption of rice in metric tonnes in Kenya is lower than domestic production against consumption in the Philippines.

Kenya experienced fluctuating net maize deficits except in 2001 and 2006. The Philippines experienced fluctuating net deficits in maize from 2000-2013. Production, consumption, and deficits of maize in metric tonnes are less in Kenya than in the Philippines. It is due to the differences in demand requirements of population between the two countries. Except in the years 2000, 2001, 2002, and 2007, importation of maize is more in Kenya than in the Philippines. Maize is a major staple food in Kenya than in the Philippines. As a result, Kenya is a net importer of maize even in good production years.

Factors of Production in Kenya and the Philippines

Factors of production are crucial determinants of food security and knowing the problems associated with the factors is important. Land, labor, and capital were assigned numerical values for the purpose of testing hypothesis.

Land: Problems associated with land include land tenure systems, land fragmentation, soil fertility, scarcity, and loss to industrial and/or residential developments. The study found out that there is need to limit land fragmentation a consolidate land, discourage ownership of idle land, and prepare land while water is available

Labor: Traditionally, most farmers depend on family labor during peak season to reduce cost. The young and energetic people have migrated to the urban centres making labor unavailable and expensive. The low use of labor and low technical knowhow partially explains the low production of rice and maize. Farmers rarely attend seminars or training workshops and these are crucial in production of rice and maize.

Capital: There is low use of mechanization and adoption of agricultural technologies due to finances. Farmers have poor access to credit due to lack of collaterals as a result of non ownership of land. The findings show that there is need to develop good crop management, subsidize

Table 1.
Production, Consumption, Deficit/Surplus, Imports and Exports of Rice in Metric Tones in Kenya and the Philippines Between 2000-2013

KENYA						PHILIPPINES				
RICE						RICE				
	Production	Consumption	Deficit /Surplus	Imports	Exports	Production	Consumption	Deficit /Surplus	Imports	Exports
Year	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT
2000	52,349	272,000	-219,651	105,692	0	8,135,000	8,750,000	-615,000	1,410,000	0
2001	45,000	238,600	-193,600	137,566	0	8,450,000	9,040,000	-590,000	810,903	1
2002	45,000	247,560	-202,560	137,419	0	8,450,000	9,550,000	-1,100,000	1,500,000	0
2003	40,592	258,600	-218,008	191,415	0	9,200,000	10,250,000	-1,050,000	1,290,000	0
2004	49,295	270,200	-220,905	223,182	0	9,425,000	10,400,000	-975,000	1,500,000	0
2005	62,677	279,800	-217,123	227,724	0	9,821,000	10,722,000	-901,000	1,622,000	0
2006	64,840	286,000	-221,160	142,218	0	9,775,000	12,000,000	-2,225,000	1,800,340	8
2007	47,256	293,722	-246,466	258,003	0	10,479,000	13,499,000	-3,488,521	2,570,000	25
2008	63,248	314,000	-307,752	262,206	0	10,755,000	13,650,000	-2,895,000	2,600,630	510
2009	37,198	340,000	-302,802	296,164	0	9,772,000	13,125,000	-335,3000	1,575,000	749
2010	73,000	380,000	-307,000	305,000	0	10,539,000	12,800.000	-2,,261,000	2,378,000	0
2011	64,000	390,000	-326,000	310,000	0	10,639,000	12,850,000	-2,211,000	1,500,000	0
2012	81,000	415,000	-334,000	375,000	6000	18,052,422	12,850,000	5,202,422`	1,400,000	0
2013	76,000	475,000	-399,000	410,000	10,000	11,640,000	12,850,000	-1,210,000	2,000,000	0

Source: National Cereals and Produce Board (NCPB) Kenya
Bureau of Agricultural Statistics (BAS) Philippines
FAOSTAT website: http://faostat.fao.org/ 2012 & 2013
Internet sources: www.indexmundi.com/agriculture/coutry
http://data.mongabay.com/commodities/category/2-Trade/8-Crops+and+Livestock+Products/27-Rice%2C+paddy/91-Export+Quantity/171-Philippines
http://data.mongabay.com/commodities/category/2-Trade/8-Crops+and+Livestock+Products/27-Rice%2C+paddy/91-Export+Quantity/171-Kenya

Table 2.
Production, Consumption and Deficit/Surplus of Maize in Kenya and Philippines Between 2000-2013

KENYA						PHILIPPINES				
MAIZE						MAIZE				
	Production	Consumption	Deficit/ Surplus	Imports	Exports	Production	Consumption	Deficit/ Surplus	Imports	Exports
Year	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT	Metric tonnes MT
2000	2,160,000	2,713,500	- 553,500	409,416	0	4,511,100	4,900,000	-388,900	447,938	0
2001	2,790,000	2,713,500	76,500	23,000	0	4,525,010	4,700,000	-174,990	172,729	61
2002	2,408,600	2,713,500	- 304,900	33,000	30,059	4,319,260	4,650,000	-330,740	278,246	0
2003	2,710,850	2,802,150	- 91,300	105,791	8,165	4,615,630	4,950,000	-334,370	99,797	0
2004	2,607,140	2,890,800	- 283,660	274,000	14,538	5,413,390	5,150,000	263,390	157,000	0
2005	2,905,560	2,979,450	- 73,890	127,379	10,405	5,352,160	5,800,000	-447,840	70,972	0
2006	3,247,200	2,979,450	267,750	156,949	16,578	6,082,110	6,550,000	-467,890	109,246	193
2007	2,928,790	2,979,450	- 50,660	144,072	48,328	6,736,940	7,500,000	-763,060	152,307	831
2008	2,367,240	2,979,450	- 612,210	258,801	20,947	6,928,220	7,300,000	-371,780	432,000	8
2009	2,439,000	2,979,450	- 540,450	1,200,000	4,000	7,034,030	6,500,000	534,030	303,149	0
2010	3,222,000	3,500,000	-278,000	350,000	9,000	6,376,800	7,200,000	-823,200	62,000	0
2011	2,700,000	3,200,000	-500,000	500,000	10,000	6,971,221	7,300,000	-328,779	150,000	0
2012	3,600,000	3,800,000	-200,000	158,525	10,850	7,406,834	7,400,000	6,834	66,193	0
2013	2,800,000	3,800,000	-1,000.000	800,000	5000	7,150,000	7,600,000	-450,000	300	0

Source: National Cereals and Produce Board (NCPB) Kenya
Bureau of Agricultural Statistics (BAS) Philippines
FAOSTAT website: http://faostat.fao.org/ 2012 & 2013
Internet sources: www.indexmundi.com/agriculture/coutry
http://data.mongabay.com/commodities/category/2-Trade/8- Crops+and+Livestock+Products/27-maize%2C-Export+Quantity/171-Philippines
http://data.mongabay.com/commodities/category/2-Trade/8-Crops+and+Livestock+Products/27-maize%2C+/91-Export+Quantity/171-Kenya

Table 3.

The Chi-Square $x^2 = \frac{(O-E)^2}{E}$ Calculation for Rice in Kenya and the Philippines Between 2000-2013

KENYA					PHILIPPINES			
RICE					RICE			
	Production	Production + (imports-Export			Production	Production + (imports-Export		
Year n	Observed or actual Frequency (O)	Expected frequency (E)	$\frac{O-E}{E}$	$\frac{O-E^2}{E}$	Observed or actual Frequency (O)	Expected frequency (E)	$\frac{O-E}{E}$	$\frac{O-E^2}{E}$
2000	52,349	158,041	-0.669	0.4476	8,135,000	9,545,000	-0.148	0.0123
2001	45,000	182,566	-0.754	0.5685	8,450,000	9,850,803	-0.142	0.0202
2002	45,000	182,419	-0.753	0.5670	8,450,000	9,950,000	-0.151	0.0228
2003	40,592	232,007	-0.825	0.6806	9,200,000	10,490,000	-0.123	0.0151
2004	49,295	272,477	-0.819	0.6708	9,425,000	10,925,000	-0.137	0.0188
2005	62,677	290,401	-0.784	0.6147	9,821,000	11,443,000	-0.139	0.0193
2006	64,840	207,058	-0.687	0.4720	9,775,000	11,575,332	-0.141	0.0199
2007	47,256	305,259	-0.845	0.7140	10,479,000	13,048,975	-0.179	0.0320
2008	63,248	325,454	-0.806	0.6496	10,755,000	13,335,120	-0.115	0.0104
2009	37,198	333,362	-0.888	0.7885	9,772,000	11,347,000	-0.124	0.0154
2010	73,000	378,000	-0.807	0.6512	10,539,000	12,917,000	-0.184	0.0339
2011	64,000	374,000	-0.829	0.6872	10,639,000	12,139.000	-0.124	0.0154
2012	81,000	450,000	-0.82	0.6724	18,052,422	19,452,422	-0.072	0.005
2013	76,000	476,000	-0.84	0.706	11,640,000	13,640,000	-0.015	0.0002
	Chi-squire	$x^2 = \frac{(O-E)^2}{E}$		8.8901	Chi-squire	$x^2 = \frac{(O-E)^2}{E}$		0.2407

Source: Production, Imports and Exports are generated from table 1

Calculation of $x^2 = \frac{(O-E)^2}{E}$ is based on Production, Imports and Exports.

The degrees of freedom is defined as n – 1. From 2000-2013 there are 14 number of observation hence (14- I) =13.

Table 4.

The ChiSquare $x^2 = \frac{(O-E)^2}{E}$ ***Calculation for Maize in Kenya and the Philippines Between 2000-2013***

KENYA					PHILIPPINES			
MAIZE					MAIZE			
	Production	Production +(imports-Export			Production	Production +(imports-Export		
Year n-1	Observed or actual Frequency (O)	Expected frequency (E)	$\frac{O-E}{E}$	$\frac{O-E^2}{E}$	Observed or actual Frequency (O)	Expected frequency (E)	$\frac{O-E}{E}$	$\frac{O-E^2}{E}$
2000	2,160,000	2,569,416	-0.159	0.0253	4,511,100	4,959,038	-0.090	0.0081
2001	2,790,000	2,813,000	-0.008	0.0000	4,525,010	4,697,678	-0.037	0.0014
2002	2,408,600	2,411,541	-0.001	0.0000	4,319,260	4,597,506	-0.061	0.0037
2003	2,710,850	2,808,476	-0.035	0.0012	4,615,630	4,715,427	-0.021	0.0004
2004	2,607,140	2,866,602	-0.091	0.0083	5,413,390	5,570,390	-0.028	0.0007
2005	2,905,560	3,022,534	-0.039	0.0015	5,352,160	5,423,132	-0.013	0.0001
2006	3,247,200	3,387,571	-0.041	0.0017	6,082,110	6,191,163	-0.018	0.0003
2007	2,928,790	3,024,534	-0.032	0.0010	6,736,940	6,888,416	-0.022	0.0005
2008	2,367,240	2,605,094	-0.091	0.0083	6,928,220	7,360,212	-0.059	0.0035
2009	2,439,000	3,635,000	-0.329	0.1082	7,034,030	7,337,179	-0.0413	0.0017
2010	3,222,000	3,563,000	-0.096	0.0092	6,376,800	6,438,800	-0.010	0.0001
2011	2,700,000	3,190,000	-0.154	0.0237	6,971,221	7,121,221	-0.0210	0.0004
2012	3,600,000	3,747,675	-0.039	1.521	7,406,834	7,473,027	-0.001	0.000001
2013	2,800,000	3,595,000	-.0.221	0.049	7,150,000	7,150,300	-0.00041	0.0001681
Chi-squire		$x^2 = \frac{(O-E)^2}{E}$		**1.7584**	Chi-squire	$x^2 = \frac{(O-E)^2}{E}$		**0.021069**

Source: Production, Imports and Exports are generated from table 2

Calculation of $x^2 = \frac{(O-E)^2}{E}$ is based on Production, Imports and Exports.

The degrees of freedom is defined as n – 1. From 2000-2013 there are 14 number of observation hence (14- I) =13.

fertilizer and certified quality seeds, and promote mechanization of farms. This will overcome the low yield in rain-fed upland and irrigated lowland. Our aim was to test hypothesis on the significant correlation of factors of production in predicting production of rice and maize in Kenya and the Philippines as shown in Tables 5 and 6.

Hypothesis Testing

Null hypothesis No. 1: There is no significant difference between food self-sufficiency and food self- reliance on rice and maize.

We tested the hypothesis regarding rice and maize in each country by using chi square ($x^2 = \frac{(O-E)^2}{E}$) and its calculation is shown in Tables 3 and 4**.** The calculated chi square regarding rice is 8.8901(Kenya) and 0.2407 (Philippines). The calculated chi square regarding maize is 1.7584 (Kenya) and 0.021069 (Philippines). At the level of significance (alpha 0.05) the value of chi square of 13 degrees of freedom is 22.362**.** The calculated chi-square values for rice and maize in both countries (Tables 3 and 4) are less than 22.362 hence the null hypothesis was accepted.

The differences between observed data/ frequency (domestic production) and expected data/frequency (domestic production plus imports minus exports) are due to chance alone and not caused by certain factors. Observed frequencies are almost similar to expected frequencies. There is no real difference between food self-reliance and food self-sufficiency. Therefore, for food security, the governments of Kenya and the Philippines can pursue the policy on food self-reliance or food sufficiency depending on local and international conditions. The two countries have the option to supplement their deficiencies in domestic production by importing food if food sufficiency policy is pursued. The domestic and international trade policies are important for food security regarding rice and maize in the two countries hence should be drafted well.

Null hypothesis no. 2: "There is no significant relationship between factors of production—land, labor, and capital—in predicting production of rice and maize". It is mathematically expressed as H0: $\beta_1 = \beta_2 = \beta_3 = 0$,

At $\alpha = 0.05$ level of significance, the study determined if the regression model is useful for predicting production of rice and maize in Kenya and the Philippines. If the significant (2-Tailed) value is greater than 0.05 then there is statistically no significant correlation and if less than or equal to 0.05 then, statistically, there is significant correlation between the variables. In the former, it means that increases or decreases in one variable do not significantly relate to increases or decreases in the other variables. For the later, it means that increases or decreases in one variable do significantly relate to increases or decreases in the other variables.

The null hypothesis is normally rejected if p-value ≤ 0.05 and accepted when p-value is greater.

The coefficient (t-statistics) of land, labor, and capital regarding rice are 3.494 (Kenya) and 1.557 (Philippines). Their 2-tailed p-values (significant values) are 0.004 (Kenya) and 0.145 (Philippines). P-value is less than 0.05 for Kenya but more than 0.05 for the Philippines. Intercept coefficient (t-statistics) are 2.313 (Kenya) and -1.112 (Philippines). Their 2-tailed p-value (0.039) is less than 0.05 (Kenya) and (0.288) is more than 0.05 (Philippines). They are significantly different (Kenya) and not significantly different (Philippines) from 0. This is because their 2-tailed p-values are less than 0.05 (Kenya) and more than 0.05 (Philippines). The researchers conclude that, statistically, there is significant correlation (Kenya) and no correlation (Philippines) between the variables. For Kenya, there is significant correlation between a change (either increase or decrease) in any one factor with changes (either increase or decrease) in the other factors of production. For the

Table 5.
Units of Factors of Production for Rice in Kenya and the Philippines Between 2000-2013

KENYA					PHILIPPINES			
RICE					RICE			
	Production	Land	Units of labor (2.6 workers per hectare)	Units of Capital (31.3 kg of fertilizer per hectare)	Production	Land	Units of Labor (1.2 workers per hectare)	Units of Capital (73.1 kg of fertilizer per hectare)
Year	y	Hectares xi	Number of workers xii	Kilograms of Fertilizer xiii	y	Hectares xi	Number of workers xii	Kilograms of Fertilizer xiii
2000	52,349	13,882	36,093	434,507	8,135,000	4,038,085	4,845,702	295,184,014
2001	45,000	13,200	34,320	413,160	8,450,000	4,065441	4,878,529	297,183,737
2002	45,000	13,000	33,800	406,900	8,450,000	4,046318	4,855,582	295,785,846
2003	40,592	10,781	28,031	337,445	9,200,000	4,006421	4,807,705	292,869,375
2004	49,295	13,223	34,380	413,880	9,425,000	4,126,645	4,951,974	301,657,750
2005	62,677	15,940	41,444	498,922	9,821,000	4,070,421	4,884,505	297,547,775
2006	64,840	23,106	60,076	723,218	9,775,000	4,159,970	4,991,964	304,093,807
2007	47,256	16,459	42,793	515,167	10,479,000	4,272,889	5,127,467	312,348,186
2008	63,248	16,734	43,508	523,774	10,755,000	4,459,977	5,351,972	326,024,319
2009	37,198	21,829	56,755	683,248	9,772,000	4,532,310	5,438,772	331,311,861
2010	73,000	20,181	52,471	631,665	10,539,000	4,354,161	5,224,993	318,289,169
2011	64,000	22,000	57,200	688,600	10,639,000	4,536,642	5,443,970	331,628,530
2012	81,000	25,000	65,000	782,500	18,052,422	4,698,000	5,637,600	343,423,800
2013	76,000	28,000	72,800	876,400	11,640,000	4,670,000	5,604,000	341,377,000

Source: Production is generated from table 1
FAOSTAT data of 2012 & 2013: Units of labor and capital
FAOSTAT data of 2012 & 2013: Land in hectares
Calculation of number of workers and kilograms of fertilizer are based on units of labor and capital

Table 6.
Units of Factors of Production for Maize in Kenya and Philippines Between 2000-2013

KENYA					PHILIPPINES			
MAIZE					MAIZE			
	Production	Land	Labor (2.6 workers per hectare)	Capital (31.3 kg of fertilizer per hectare)	Production	Land	Labor (1.2 workers per hectare)	Capital (73.1 kg of fertilizer per hectare)
Year	y	Hectares xi	Number of worker xii	Kilograms of Fertilizer xiii	y	Hectares xi	Number of workers xii	Kilograms of Fertilizer xiii
2000	2,160,000	1,500,000	3,900,000	46,950,000	4,511,100	2,510,342	3,012,410	183,506,000
2001	2,790,000	1,640,000	4,264,000	51,332,000	4,525,010	2,486,588	2,983,906	181,769,583
2002	2,408,600	1,592,320	4,140,032	49,839,616	4,319,260	2,395,456	2,874,547	175,107,834
2003	2,710,850	1,670,910	4,344,366	52,299,483	4,615,630	2,409,828	2,891,794	176,158,427
2004	2,607,140	1,351,330	3,513,458	42,296,629	5,413,390	2,528,135	3,033,762	184,806,669
2005	2,905,560	1,771,120	4,604,912	55,436,056	5,352,160	2,441,788	2,930,146	178,494,703
2006	3,247,200	1,888,190	4,909,294	59,100,347	6,082,110	2,570,673	3,084,808	187,916,196
2007	2,928,790	1,615,300	4,199,780	50,558,890	6,736,940	2,648,319	3,177,983	193,592,119
2008	2,367,240	1,700,000	4,420,000	53,210,000	6,928,220	2,661,021	3,193,225	194,520,635
2009	2,439,000	1,884,370	4,899,362	58,980,781	7,034,030	2,683,890	3,220,668	196,192,359
2010	3,222,000	2,008,350	5,221,710	62,861,355	6,376,800	2,499,040	2,998,848	182,679,824
2011	2,700,000	1,800,000	4,680,000	56,340,000	6,971,221	2,544,612	3,053,534	186,011,137
2012	3,600,000	2,266,000	5,891,600	70,925,800	7,406,834	2,557,000	3,068,400	189,916,700
2013	2,800,000	1,800,000	4,680,000	56,340,000	7,150,000	2,370,000	2,844,000	173,247,000

Source: Production is generated from table 2
FAOSTAT data of 2013: Units of labor and capital
FAOSTAT data of 2013: Land in hectares
Calculation of number of workers and kilograms of fertilizer are based on units of labor and capital

Philippines, there is no significant correlation between a change (either increase or decrease) in any one factor with changes (either increase or decrease) in the other factors of production. This implies that units of labor are more than units of land. There are excess units of labor per unit of land involved in the production of rice. This means there will be no significant changes in the required units of labor if more land is cultivated. It also implies that additional units of fertilizer do not require additional units of land and labor. With application of more fertilizer, the current land under cultivation has not reached the level of diminishing returns to necessitate additional units of land to be converted to agriculture.

The coefficient (t-statistics) of land, labor, and capital regarding maize are 2.145 for Kenya. In the Philippines the coefficient (t-statistics) is -1.073 for land and labor, and 1.324 for capital. Their 2-tailed p-values (significant values) are (0.058) for Kenya and for the Philippines, it is 0.306 for land and labor while it is 0.212 for capital. P-values in Kenya and the Philippines are greater than 0.05. Intercept coefficient (t-statistics) are 1.146 (Kenya) and -1.235 (Philippines). Their 2-tailed p-value (0.278 for Kenya and 0.243 for the Philippines) are more than 0.05. They are not significantly different from 0 because their 2-tailed p-values are more than 0.05. We conclude that there is no significant correlation between the variables in both countries. For Kenya and the Philippines, there is no significant correlation between a change (either increase or decrease) in any one with changes (increase or decrease) in the other factors of production.

The null hypothesis is normally rejected if p-value ≤ 0.05 and accepted when p-value is greater. The 2-tailed p-values of regression model regarding rice are 0.004 (Kenya) and 0.145 (Philippines). The Kenyan p-value is less and the Philippines p-value is more than 0.05 at $\alpha = 0.05$ level of significance. Because of this, the null hypothesis was rejected for Kenya and accepted for the Philippines. The 2-tailed p-values of regression model regarding maize in Kenya and the Philippines are 0.720 and 0.073 respectively. The p-values are greater than 0.05 at $\alpha = 0.05$ level of significance. Because of this, the null hypothesis was accepted.

The values of coefficients of multiple determinations (R) are 0.710 (Kenya) and 0.410 (Philippines) regarding rice as shown in Table 6.3. The regression equation is moderately useful for making predictions in the production of maize in Kenya. It is lowly useful for making predictions in the Philippines. Coefficient of multiple determinations (R^2) show that about 50.4% (Kenya) and 16.8% (Philippines) of the variation in food security on rice is explained by land in hectares, labor (number of workers) and capital (kilograms of fertilizer). About 49.6% (Kenya) and 83.2% (Philippines) of the variation in food security on rice is explained by other factors like weather, pest, and diseases. These factors were not covered by the study.

The values of coefficients of multiple determinations (R) are 0.241(Kenya) and 0.615 (Philippines) regarding maize as shown in Table 6.3. The regression equation is lowly useful for making predictions in production of maize in Kenya. It is moderately useful for making predictions in the Philippines. Coefficient of multiple determinations (R^2) show that about 5.8% (Kenya) and 37.9% (Philippines) of the variation in food security on rice is explained by land in hectares, labor (number of workers) and capital (kilograms of fertilizer). About 94.2% (Kenya) and 62.1% (Philippines) of the variation in food security on maize is explained by other factors like weather, pest, and diseases. These factors were not covered by the study.

Table 6.1.
The SPSS Version 15.0 Multiple Regression (Coefficients) Results for Rice and Maize in Kenya and the Philippines

		Kenya			Philippines						
		Unstandardized Coefficients		Std Coefficients	Unstandardized		Std Coefficients	Kenya		Philippines	
		B	Std. Error	Beta	Coefficients	Std Error	Beta	t	Sig	t	Sig
Rice	Constant	23320.208	10082.7		-22582725.66	20308160.538		2.313	0.039	-1.112	0.288
	Land	1.875	0.537	0.710	7.364	4.728	0.410	3.494	0.004	1.557	0.145
	Labor	0.721	0.206	0.710	6.137	3.940	0.410	3.494	0.004	1.557	0.145
	Capital	0.060	.017	0.710	0.101	0.065	0.410	3.494	0.004	1.557	0.145
maize	Constant	546094.115	593376.729		8584578.356	6952003.409		1.146	0.278	-1.235	0.243
	Land	1.276	0.337	0.738	-26.994	25.153	-2.339	2.145	0.058	-1.073	0.306
	Labor	0.491	0.129	0.738	-22.496	20.961	-2.339	2.145	0.058	-1.073	0.306
	Capital	0.041	0.011	0.738	0.448	0.338	2.885	2.144	0.058	1.324	0.212

Dependent Variable: Production of rice in Kenya and the Philippines

Table 6.2.

The SPSS Version 15.0 Multiple Regression (ANOVA) Results for Rice and Maize in Kenya and the Philippines

	Kenya					Philippines				
	Sum of Squares	df	Mean Square	F	Sig.	Sum of Squares	df	Mean Square	F	Sig.
Regression (Rice)	1260266586.659	1	1260266586.659	12.208	0.004	43878062956318.870	1	43878062956318.870	2.426	0.145
Regression (maize)	459170490661.355	2	229585245330.678	0.338	0.720	6339535292573.710	2	3169767646286.857	3.352	0.073

Predictors: Land, labor, and Capital

Table 6.3.
The SPSS Version 15.0 Multiple Regression (R) Results for Rice and Maize in Kenya and the Philippines

	Kenya				Philippines			
	Coefficient (R) which is between 0.9 to 1 shows very high correlation ,0.7 to 0.9 high correlation ,0.5 to 0.7 moderate correlation, 0.3 to 0.5 low correlation and 0 to 0.3 shows little correlation.							
		R Square	Adjusted R Square	Std. Error of the Estimate	R	R Square	Adjusted R Square	Std. Error of the Estimate
Rice	0.710	0.504	0.463	10160.4257	0.410(a)	0.168	0.099	4253199.3544067
Maize	0.241	0.058	-0.113	824403.25130	0.615	0.379	0.266	972428.80318

Predictors: Land, labor, and Capital

Qualitative Analysis of Trade and Other Related Policies Based on the Findings of the Study

Kenya's trade policy reforms in the 1980s, 1990s, and 2000s reduced domestic production of rice and maize hence declining food self-sufficiency and increasing food reliance. Liberalization, import substitution strategies, tariff reduction programs, and removing restriction on import licensing became ineffective regarding food self-reliance. These lead to decreased domestic production and increased importation of rice and maize. The establishment of National Export Credit Guarantee Corporation did not lead to automatic increase in domestic production and importation of rice and maize. The findings from the study showed that domestic industries were exposed to sudden international competition. In times of food crisis, the government of Kenya temporarily "zero rates" (eliminate) ad-valorem tariffs and non-tariff barriers to ease importation of all agricultural goods, maize, wheat, and rice. Under normal conditions the tariff rate ranges between 35% and 70%. For instance, in January 2009, Kenya's food crisis deepened due to allegations of corruption over the issuance of import licenses, diversion of maize imports to Sudan, and lack of transparency over the sale of subsidized National Cereals and Produce Board (NCPB) grain. The import duty on maize was finally lifted on January 28, 2009; allowing importers to buy maize from the international market duty free (Ariga,J.,Jayne, T. S ,&Njukia, S 2010).

Philippine trade policy was initially biased against agriculture. Import substitution policies were the main policy program between 1960s -1980. Up to the 1970s, the effective protection rates (EPR) for major agricultural commodities were negative. The Philippines Tariff Reform Program (TRP) of 1980-2011 was meant to reduce excessive or obsolete tariffs and cushion the domestic rice farmers against the effects of trade liberalization. Import Liberalization Program (ILP) and the First Tariff Reform Program (TRP-I) commenced in 1981 due to the influence of the Structural Adjustment Program (SAP) prescribed by the World Bank. The aim of ILP was to remove non-tariff restrictions on regulated items like rice and maize. The issuance of Executive Order number 189 on July 18th 1994 marked the beginning of TRP III. In 1995 the EPR for agriculture exceeded that of industry for the first time. Executive Order 313 (effective May 7th 1996) provided interim tariff protection to sensitive agricultural products like rice and maize. The findings from the study indicate that tariff reforms, elimination of import restrictions, realignment of indirect taxes and rationalization of export promotion, though it sidelined the agricultural sector were effective and increased food security on rice but minimal effect on maize. Regulation on rice and maize has fluctuated from tariff to non-tariff policies in the Philippines. The government not only manages domestic rice distribution but monopolizes rice importation and exportation through National Food Authority (tax free). In 2003 the Agriculture and Fisheries Modernization Act (AFMA) was enacted. It was meant to exempt from tariffs and import duties, until 2015, enterprises engaged in agriculture, agricultural, and fisheries inputs (chemicals, seeds, machinery, and equipment). These led to increased production of agricultural products including rice and maize. Gathered response shows that Kenya and the Philippines agricultural trade policies have affected food security on rice and maize.

Proposed Framework that can be Used to Develop and Sustain Food Security on Rice and Maize in Kenya and the Philippines

We designed the framework based on the concepts of Dixon, Gibbon, & Gulliver, (2001) and SENSOR project, launched in 2005, and headed by Dr Katharina Helming of European

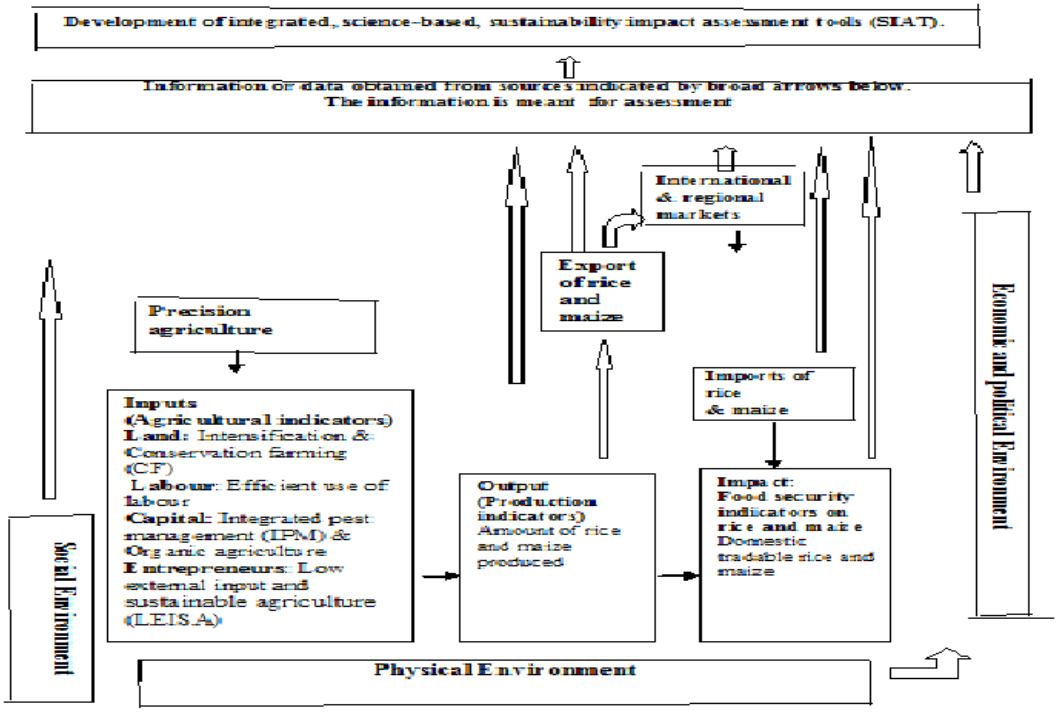

***Figure 1*. Proposed framework of the study**

Union. The aim of the SENSOR project was to develop science-based Sustainability Impact Assessment Tools (SIAT), including databases and spatial reference frameworks. Our proposed framework is intended to assist in analysing how rice and maize can be developed and sustained. It requires that the user analyses information on agricultural inputs, outputs, exports, imports, the market, the socio-economic, and physical environments. The SIAT tools consider the trade-offs between social, physical, and economic environments as indicated in the proposed framework of the study.

We argue that there is need to develop new and an effective framework. This would aid in the development of sustainable agriculture in staple foods like rice and maize. In Kenya and the Philippines, agriculture, forestry, rural development, tourism, peoples' settlement, transportation, and infrastructure compete for land use. The two countries should develop individual science-based Sustainability Impact Assessment Tools (SIAT) because their policies are different. SIAT would be used in Kenya and the Philippines to make decisions on policies related to multiple land use. It would be used to assess potential impact of implementing policies, for example, to assess the potential impact of liberalised economies. Possible contribution of different agricultural practices in achieving the goals set by the Kyoto Protocol could be analysed using SIAT. Precision agriculture involves the use of sophisticated technologies to vary input applications and production practices. This happens according to seasonal conditions, features of soil, and land potential. Intensification improves productivity of land. Conservation farming (CF) involves minimal ploughing of soil and harrowing. These will enhance fertility of soil, reduce soil erosion, and improve water infiltration. Cost of farming related to labor and equipment will decline. This leads to reduction in cost of conserving of land resources and cost per unit output. Integrated

pest management (IPM) is an ecosystem-based strategy to control pests or their damage. This is done through biological control, pest monitoring, and habitat manipulation, modification of cultural practices, and use of resistant varieties. It is difficult for Kenya and the Philippines to adopt and implement IPM technologies. Entrepreneurs should employ the principle of low external input and sustainable agriculture (LEISA). It takes into account farmers' knowledge and multiple management practices to minimize the need for purchased inputs. The management practices include agro-forestry, IPM, intercropping, crop-livestock integration and micro-climate management. Organic agriculture employs agronomic, biological, and mechanical methods to control pests and maintain soil fertility with little use of chemical fertilizer for crop and livestock production.

CONCLUSION

The agricultural development in terms of rice and maize in Kenya and the Philippines has been improving despite problems associated with land, labor, and capital as factors of production. The trade liberalization and market-oriented economic reforms started in early 1980s intensified in the 1990s and continued in the 2000s and have affected food security in many countries including Kenya and the Philippines. The government of Kenya and the Philippines carried out reforms in global trade and entered into Free Trade Agreement within East African community and ASEAN respectively. Globalization policies have been ineffective in developing countries and if allowed would lead to decrease in food self-sufficiency. The trade blocs like East African community and ASEAN Free Trade Agreement were formed to neutralize the negative effects of globalization policies but within the framework of World Trade Organization (WTO). They have maintained high tariff rates on highly sensitive agricultural products like rice and maize. The EAC-CIT and CET have little impact on food-self sufficiency and reliance on rice and maize in Kenya. The CEPT scheme under the ASEAN Free Trade Area (CEPT-AFTA) has led to positive impact on food reliance on rice and maize in the Philippines. East African Community agricultural trade policies were recently formulated and currently being implemented. There is no real difference between food self-sufficiency and food self-reliance frequencies. Kenya and the Philippines can pursue the policy of food self-reliance or food sufficiency. For Kenya, a change (increase or decrease) in any one factor of production regarding rice is correlated with changes in the other factors but in the Philippines it is not correlated with changes in the other factors. However, regarding maize in the two countries, a change in one factor is not correlated with changes in the other factors of production. The variation in food security on rice and maize is largely explained by other factors like weather, pest, and diseases.

RECOMMENDATIONS

Trade policy on green lane and trade regulatory institutions linking origin and end markets for intraregional trade in staple foods had been proposed for consideration by EAC experts to be an EAC Food Security Policy. There is need to reduce trade and food security policy discrepancies, minimize the adverse effects of liberalization on food security and improve food security nationally and regionally. The government of Kenya and the Philippines should put in place relevant national food security schemes. A research done by Omiti, Waiyaki, and Fritz, (2007) showed that trade policy processes are influenced by international and domestic factors. It also indicates that appropriate institutional framework, skills, and resources are

needed to make and effectively implement the right trade policies. They should coordinate and work well with relevant non-state stakeholders. The two governments should implement their national food security policies in line with the spirit of East African Community (EAC) and ASEAN region. They should also support East Africa Community and East Asia Emergency Rice Reserves in the context of Strategic Plan of Action for Food Security.

There is need for harmonization of standards within the East African Community to include more goods and harmonize internal taxes such as VAT (value added tax) and excise to avoid difficulties in trade. The ASEAN member countries need to uphold transparency and have uniform custom to traders in the region. They should also have common elements in their Green Lane systems. The trade and agricultural trade policies need to be formulated to establish appropriate incentives for agricultural development.

There is need to research on other factors which affect food security in Kenya and the Philippines. They include weather, pest, and diseases, preparation of land, timely planting, and efficient weeding.

The research was conducted in Kenya and the Philippines and we suggest that a similar study can be conducted in other countries. We suggest research into other food crops other than rice and maize. For reliability, the same study can be replicated using the same research instruments and methodology.

Kipkorir and Khanser's Hexagon Trade Policy Model on Food Security in a Developing Country

The trade policy model is composed of three levels, namely global, regional, and domestic. At every level, there are trade policies and market outlets. The global and regional levels receive exports as surplus from the domestic level. The

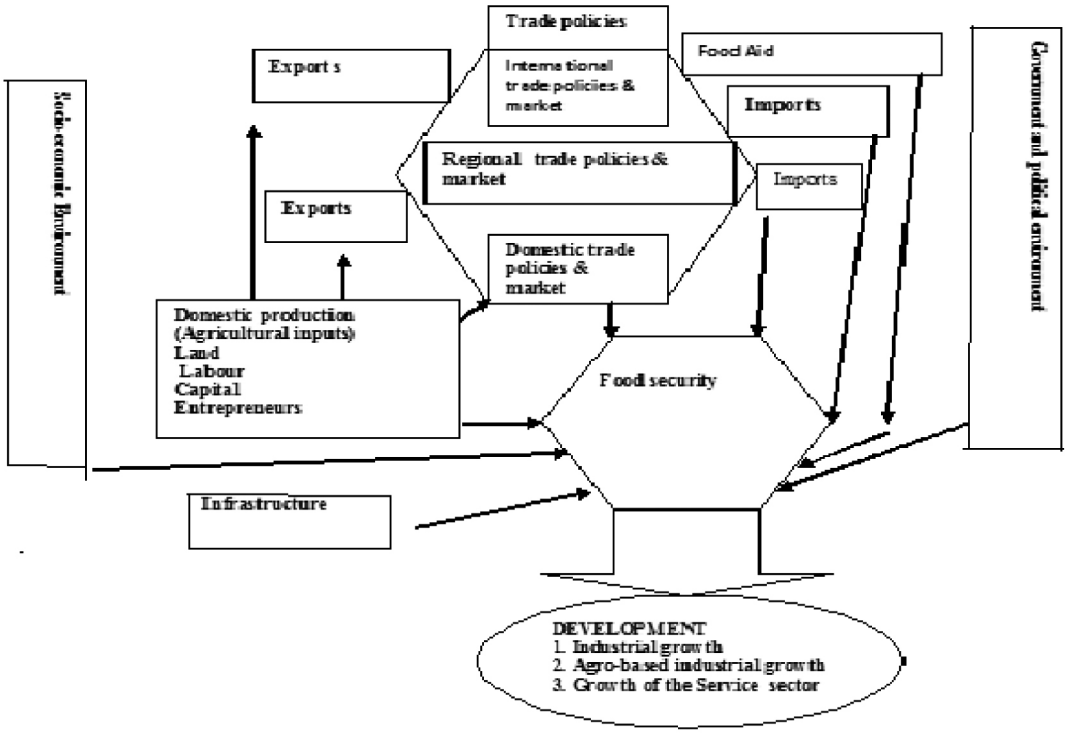

Figure 2. **Recommended trade policy model.**

global and regional levels in turn provide food aid and imports to balance the domestic exports and deficits if any. These will constitute food security, which in turn facilitates economic development especially industrial growth, agro-based industrial growth, and growth of the service sector.

The top face of the hexagon constitute trade policies and extends down the middle of the hexagon as global, regional, and domestic trade policies in that order. On the left side of the hexagon the faces of the hexagon represent exports to global and regional markets from the domestic production. On the right side of the hexagon the faces represent imports from global and regional markets to the domestic market. At the bottom of the hexagon the face represents the domestic sector**.** The domestic production, food aid, and imports directly affect food security as shown by arrows pointing unto the corners of the hexagon (direct influence on food security). The socio-economic, infrastructure, and government/political constitute external factors which indirectly affect food security. They are represented by arrows pointing unto the faces of the hexagon (indirect influence on food security). This is why it is called hexagon trade policy model. The food security situation can be balanced through food-sufficiency (influenced by the domestic policies and market conditions) and reliance (influenced by global, regional policies, and market conditions). Agricultural production is not possible without land, labor, capital, and entrepreneur as shown in the model. Domestic policies or reforms should be geared towards productivity of these factors of production. Indeed, there is no one single solution to the problems of food security in short and long run. A developing country like Kenya and Philippines will have to employ various options which do not sacrifice environmental sustainability. Trade liberalisation has made it easier and cheaper to import food and non-food products since early 1980s.

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