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TABLE OF CONTENTS

EDITORIAL

On behalf of the scientific editorial board, I extend my deep appreciation to the contribution made by lecturers and researchers that has led to the successful compilation of this publication. The completion of this volume stemmed from their will, initiative and performance as lecturers and researchers. KIGALI INDEPENDENT UNIVERSITY ULK has always paid regards to promoting education and impacting the complete development of Rwanda through coupling teaching and research. In the same context, the 32nd volume of ULK Scientific Journal is now out with 4 papers which tackle issues of national and regional concern. The authors of articles in this issue suggest scores of recommendations worth consideration to both policy makers and practitioners.

According to economic theory, exchange rate devaluation (the same as depreciation under flexible exchange rate regime) is supposed to generate an improvement in the trade balance in the long run after the short run deterioration. This real exchange rate effect on trade balance is named J-curve. The first paper by **Prof. NDAHIRIWE Kasai** and **IRABARUTA Anicet** is an attempt to investigating whether J-curve exists for Rwanda. The article evaluates the behaviour of Rwanda's trade balance following a depreciation of the real effective exchange rate (the j-curve phenomenon) employing aggregate data for the period 1980 to 2013.

As the second article expounds, agriculture remains the backbone of Rwanda's economy. Additionally, promoting agriculture is imperative to achieve the Millennium Development Goals (MDGs). This has led Lecturer **GATEMBEREZI M. Paul** to carry out a

scientific research on technical efficiency of small holder Irish potato production in Nyabihu District, Rwanda. The author reveals solutions to enhanced food security and poverty reduction in rural areas.

Along the third article, **Mr KAGABIKA Boaz** tackles the study on perception of global warming issues among students of Kigali Independent University ULK in Gisenyi Campus. Taking into consideration the source of information, the study reveals that there is a need for relevant courses on the global warming issues interface that should be included in the curriculum. The researcher believe that formal Environmental Education for sustainability could help young learners to achieve awareness, knowledge, attitude and responsible behaviour about environmental issues, especially climate change issues.

Throughout his article, **Dr RUTERAHAGUSHA Roger** examines the relationship between citizens' participation and success of decentralized services delivery systems in Rwanda, taking Rubavu sector in Rubavu district as a case study. His research built on a belief that citizens can be trusted to shape their own future, participatory development should use local decision making and capacities to steer and define the nature of an intervention.

Dr. SEKIBIBI Ezechiel
Vice Chancellor

ESTIMATING THE RESPONSE OF TRADE BALANCE ON EXCHANGE RATE: DOES THE J-CURVE EXIST FOR RWANDA?

By

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Abstract

This paper evaluates the behaviour of Rwanda's trade balance following a depreciation of the real effective exchange rate (the J-curve phenomenon) employing aggregate data for the period 1980 to 2013. It uses Johansen method (1988), and vector error correction model (VECM) to analyze the long-run relationship among the variables. The empirical results show evidence that there is cointegration between the trade balance and the real effective exchange rate, and domestic and foreign income. Generalized impulse response function is estimated to examine the response to shocks. The generalized impulse response function together with the negative sign of the real effective exchange rate proposes that Marshall–Lerner condition does not hold. Thus, J-curve does not exist for Rwanda.

1. Introduction

So far several empirical analyses have been carried out for the effects of exchange rate changes to trade balance of both developing and developed countries. Economic theory suggests that exchange rate devaluation (the same as depreciation under flexible exchange rate regime) is supposed to generate an improvement in the trade balance in the long-run after a short-run deterioration. This real exchange rate effect on trade balance is named J-curve. It is named so, because these dynamics of the reaction of trade balance to currency depreciation will mark out a j-shaped time path. Magee (1973) described this phenomenon as the J curve effect.

Currency devaluation (depreciation) is expected to primarily affect trade balance of a nation, which is the difference between the value of its exports and that of its imports in the following way: Devaluation reduces the value of a nation's currency in terms of other currencies; thus, following a devaluation, a nation will have to exchange more of its own currency in order to obtain a given amount of foreign currency. As result, the price of imports gets higher and domestic products become more attractive to domestic households. Due to the fact that it takes less foreign currency to buy a given amount of a devalued currency, this result in price reduction of the nation's exports, making them more desirable to foreigners.

Though economic theory confirms the relationship between the exchange rate and the trade balance, empirical results have reported controversial. For instance, findings by Petrović (2009), Jamilov (2011), Tihomir (2004) and Anju and Uma (1999) have confirmed the existence of the J-curve in countries under their

respective studies. By contrast, other researchers do not find any evidence of the J-curve effect. Among many others, one can refer to Tarlok (2004) for India, Ziramba and Chifamba (2014) for South Africa, Ferda (2007) for Turkey and Bahmani and Jehanzeb (2009) for the case of Pakistan. Another study was conducted by Bahmani and Artatrana (2007) for the case of Sweden versus her 17 Major Trading Partners and their findings reported that J-curve effect is present only in five cases.

The paper is aimed at testing the existence of the J-curve for the case of Rwanda. In fact, in its annual report of 2011, the National Bank of Rwanda has stipulated that early in the 1990s, the then Rwandan policy makers have used large devaluations of the Rwandan Francs in order to increase export competitiveness. After 1995, the Rwandan Francs has also depreciated as the report indicates.

Based on the abovementioned currency depreciation that Rwanda has experienced in the past, this study has been motivated to investigate whether the variations of exchange rate have had an effect on the Rwandan trade balance. This study uses cointegration analysis (Johansen's method), Vector Error Correction Model as well as impulse response function. In the analysis, the paper is guided by two main questions: (1) Is there a long-run relationship between the trade balance and the real effective exchange rate? (2) Does the J-curve effect exist for Rwanda?

The remainder of the paper is organized as follow: section two is devoted to literature review; section three develops the specification of the empirical model; section four describes the data; section five reports the findings and conclusions are drawn in section six.

2. Literature review

In the past, numerous empirical studies have been conducted in both developed and developing countries to explore the short-run and long-run relationships between the trade balance and exchange rate. In this section, an overview of some reported evidences is presented.

Most economists believe that the existence of J-curve requires Marshall-Lerner condition to hold, which implies that real devaluation will improve trade balance in the long-run given that the sum of the total values of export and import demand price elasticities exceeds unity. However, most studies on the J-curve effect have come up with mixed results. Some results are consistent with the J-curve phenomenon while others illustrate non existence or new evolution of the J-curve effect. Empirical results by Bahmani-Oskooee (1985) show that trade balance may keep deteriorating no matter whether Marshall-Lerner condition holds.

More recently, Ziramba and Chifamba (2014) assed the behaviour of South Africa's balance of trade following a depreciation of the real effective exchange rate (the J-curve phenomenon) employing aggregate trade data for the period 1975 to 2011. Empirical findings show that though there is cointegration between variables, no evidence for the J-curve phenomenon has been found.

Employing bilateral trade data for the sample spanning from 1989 to 2010, Abd-El-Kader (2013) investigates the J-curve phenomenon between Egypt and her twenty major trading partners. The study finds that the changes of real exchange rate play a role in trade balance. Moreover, the study confirms the

existence of the J-curve in that a depreciation of the Egyptian currency leads to a deterioration of trade balance in short-run before it improves in long-run.

Umoru and Eboreime (2013) have also studied the J-curve hypothesis utilizing the ARDL bounds testing approach for the Nigeria oil sector versus USA and found no evidence for the J-curve on balance of trade. Similar results have been reported by Bahmani and Gelan (2012) who have investigated the J-curve hypothesis for nine African countries namely: Burundi, Egypt, Kenya, Mauritius, Morocco, Nigeria, Sierra Leone, South Africa and Tanzania.

Rustam Jamilov (2011) estimates a bilateral trade model for Azerbaijan vis-a-vis its major trading partner – Europe. In this study, they use The Johansen approach to cointegration and error correction modeling to analyze the total bilateral trade earnings and in particular the trade in the non-oil sector. Their results demonstrate that a real depreciation of the Azerbaijani Manat will cause a temporary decline in the balance of trade in the short-run, but an improvement in the long-run. This study indicates the presence of the J-curve patterns in both scenarios hence its results suggest that Marshall-lerner condition criteria are fulfilled both for the total and for the non-oil sectors.

Moodley (2010) finds no evidence for the J-curve hypothesis on South Africa's bilateral trade with the BRIC countries (Brazil, Russia, India, and China) utilizing the autoregressive distributed lag approach over the period 1994Q1to 2009Q4. According to his results, impact of real exchange rate on trade balance of the countries is not uniform. Real exchange rate impacts negatively the balance of trade For Brazil and India while for Russia and China it is found to have a positive impact.

A study by Pavle Petrović and Mirjana Gligorić (2009) employing Both Johansen's and autoregressive distributed lag approach respectively demonstrates that exchange rate depreciation in Serbia improves trade balance in the long run. Results of this study indicate that, following currency depreciation, trade balance first deteriorates before it later improves.

Thus, the results provide evidence for the existence of the J-curve in Serbia.

3. Model specification

Trade balance is expressed as the difference between the value of total exports and total imports. Following other researchers who performed the study on the J-curve phenomenon, like Bahmani-Oskooee and Brooks (1999),   Lal and Lowinger (2001), Olugbenga (2003), we determine trade balance as the ratio of X to M. A famous reason for this is that, this ratio is not sensitive to the units of measurement as they explained in their study (see for example Bahmani-Oskooee, 1991). Moreover, Boyd *et al.* (2001) showed that the ratio in a logarithmic model fulfils the Marshall-Lerner condition exactly rather than as an approximation. In addition, the use of export to import ratio as dependent variable over trade balance is of the advantage that we can take logs without worrying for the possible negative values of the trade balance in case of trade deficit, as said by Kamoto (2006) and Hsing (2005).

Almost every previous study that has attempted to empirically evaluate the effects of exchange rate, specifically currency depreciation on the trade balance, has directly related a measure of the trade balance to domestic income, foreign income, and a measure of the real exchange rate.

Accordingly, we follow that tradition in the present paper and adopt the model from Olugbenga (2003) as defined by equation (1):

$$\log\left(\frac{X_t}{M_t}\right) = \alpha_0 + \alpha_1 \log RGDP_t + \alpha_2 \log RWGDP_t + \alpha_3 \log REER_t + \alpha_4 Dummy_{1994} + \varepsilon_t$$

$$\log\left(\frac{X_t}{M_t}\right) = \alpha_0 + \alpha_1 \log RGDP_t + \alpha_2 \log RWGDP_t + \alpha_3 \log REER_t + \alpha_4 Dummy_{1994} + \varepsilon_t$$
$$(1)$$

Where:

- $\frac{X_t}{M_t}$ is the ratio of export to import at period t and being the proxy for trade balance (RTB);

- $RGDP_t$ is real Gross domestic product at period t;

- $RWGDP_t$ is real World GDP at period t;

- $REER_t$ is Real Effective Exchange Rate at period t;

- $Dummy_{1994}$ is a shift dummy variable that takes the value of zero for the period before 1994 and one otherwise. The dummy will enter the VAR as an exogenous variable;

- ε_t stands for an error term.

At this level, it is worth mentioning that the study we are following was dealing with bilateral real trade balance, but the current paper uses aggregate data for Rwanda and the rest of the world.

The theory suggests that an increases in real GDP of the rest of the world (domestic country) result in a greater volume of exports

to the rest of the world (domestic country), and vice versa.

So we expect $\alpha_1 < 0$ and $\alpha_2 > 0$. However, the situation may be the other way around if the rise in real GDP is due to an increase in the production of import-substitute goods. Increases in income may result in lower volume of imports in which case $\alpha_1 > 0$ and $\alpha_2 < 0$. As explained in the introduction, the relationship between the real exchange rate changes and the real trade balance is ambiguous. Thus it is expected that, $\alpha_3 < 0$ or >0. The real exchange rate depreciation (an increase in the Real Exchange Rate) may lead to an increase in exports (the "volume effect") due to the relative price effect. However, the higher REER also increases the value of each unit of import (the "import value effect"), which would tend to diminish the trade balance.

Krugman and Obstfeld (2001) argued that in the short run import value effects prevail, whereas the volume effects dominate in the long run. $\alpha_3 > 0$ satisfies the Marshall-Lerner condition. The sign of α_4 is expected to be negative.

Equation (1) illustrates the long-run equilibrium relationship among the variables in the real trade balance model for the country. The next question is the pattern of dynamic adjustments that occur in the short-run to establish these long-run relations in response to various shocks to the system. In order to examine these adjustments, the following vector error correction model (VECM) is estimated for the country:

$$\Delta Z_t = \sum_{i-1}^{k-1} \Gamma_i \Delta Z_{t-1} + \alpha \acute{\beta} Z_{t-1} + \mu + \varepsilon_t \qquad (2)$$

Where:

- $\Delta\Delta$: is the difference operator;
- $Z_t Z_t$: is the vector X_t/M_t, $RGDP_t$, $RWGDP_t$, $REER_t$ and $Dummy_{1994}$;
- $\Gamma_i \Gamma_i$: is the matrix of coefficients for the growth rates of the variables;
- $i\, i$: is the lag order;
- $K K$: is the maximum number of the lag length;
- $\alpha\alpha$: is the matrix of adjustment parameters;
- $\acute{\beta}\acute{\beta}$: is the matrix of cointegrating coefficients (the long run parameters);
- $\mu\mu$: is the vector of deterministic components;
- $\varepsilon_t\varepsilon_t$: is the vector of independently distributed error terms with constant variance.

4. Data sources and variable definitions

In empirical analysis logarithms of real trade balance (*RTB*), real effective exchange rate (*REER*), real gross domestic product (*RGDP*) and real world income (*RWGDP*) are used. These series are at annual frequency for the period from 1980 to 2013. The value in real terms of total export (X) and import (*M*) of goods and services are used to obtain the trade balance, defined as ratio of export over import. Thus an increase in the trade balance variable implies its improvement. Real effective exchange rate is the weighted average of the Rwandan currency relative to a basket

of other major currencies adjusted for the effects of inflation. Real gross domestic product is the GDP at constant price. The data we used in this paper have been collected from the World Bank Development Indicators with the exception of real effective exchange rate which has been collected from the National Bank of Rwanda.

5. Empirical results

First of all, the presence of unit root of each variable has been tested using the augmented Dickey-Fuller (ADF) test (1979). The results have revealed that all the variables are integrated of order one. This being the case, the modelling requires a cointegration analysis in order to avoid an interpretation of a spurious regression. However, the Johansen (1998) cointegration test procedure is preceded by the determination of the optimal lag length in the VAR model. On this matter, the paper has used the Schwartz Information Criterion (SIC), Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC) and Adjusted Likelihood Ratio (ALR) tests. Two lags have been selected as the optimal lag length.

We have also tested the deterministic structure of the model. The results in Appendix 1 show that the model allow for linear deterministic trend in the data with an intercept and trend in the cointegrating equation but with no intercept in the VAR. Table 1 reveals that the trace and max-eigenvalue tests indicate the presence of three cointegrating equations and therefore the existence of a long-run cointegrating relationship between the variables of the model.

Table 1: Cointegration test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.871540	121.5025	63.87610	0.0000
At most 1 *	0.598550	57.88613	42.91525	0.0009
At most 2 *	0.557150	29.59326	25.87211	0.0164
At most 3	0.130726	4.343007	12.51798	0.6921

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.871540	63.61638	32.11832	0.0000
At most 1 *	0.598550	28.29288	25.82321	0.0232
At most 2 *	0.557150	25.25025	19.38704	0.0062
At most 3	0.130726	4.343007	12.51798	0.6921

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Looking at Table 2, the results indicate a positive long-run relationship between the real trade balance and real domestic product (RGDP). This is an indication that in terms of proportion real domestic product affects more the exports than the imports. The results also indicate a positive relationship between real World income and trade balance as we would expect if demand were the driving force in determining exports and imports. Real effective exchange rate is found to have a negative relationship with real trade balance due to (the "import value effect"). Lastly, the coefficient of the dummy variable was found statistically significant. This proposes that the 1994 genocide perpetrated against Tutsi in Rwanda and other war events occurred before, significantly shocked the real trade balance of the country.

Table 2: Long run coefficients for the Rwandan Trade balance

	Dependent variable: Trade balance measured as $log(X_t/M_t)$				
Variable	Log(RGDP)	Log(RWGDP)	Log(REER)	TREND	C
Parameter	0.383878	7.247770	-1.550533	-0.218078	-65.72394
Standard error	(0.16160)	(1.52168)	(0.18296)	(0.04777)	
T-stat	[2.37548]	[4.76301]	[-8.47456]	[-4.56522]	

Nevertheless, we can conclude that these events do not threaten the long-run stability of the real trade balance equation since we find cointegration in the model.   According to the restricted error correction model (see Appendix 2), the adjustment coefficient is equal to -1 which indicates that adjustment toward the equilibrium is quick as it is expected to be completed in one year following a shock.

Moreover, our sample covers a period over which the Rwandan government experienced a number of major events affecting the variables included in the system. Parameter stability over the sample period is therefore of critical importance to guarantee consistency of policy simulations based on the model. Therefore, both the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) stability tests developed by Brown, Durbin and Evan (1975) have been applied to test for parameter stability and the results show no evidence of parameter instability in the model as the graph bellow illustrates it.

Parameter stability test
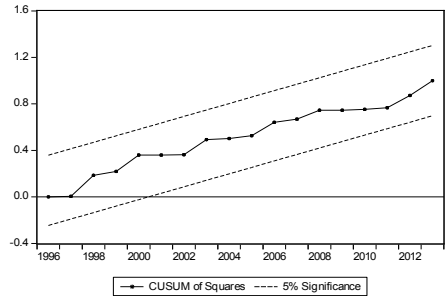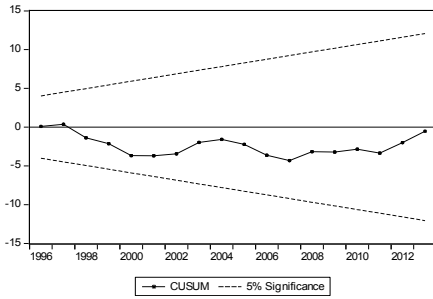
Based on the figure, the CUSUM and CUSUMSQ parameter stability tests confirm that the model is fairly stable over the period of analysis as indicated by the fact that the plot lies within the 5 percent bounds.

Having found evidences on the existence of long run relationship between variables and that the parameters are stable, it is a necessary condition to test whether there is existence of a J-curve phenomenon for the case of Rwanda. Previous papers have tested the phenomenon by generating generalized impulse response functions. In this exercise, generalized impulse responses are aimed at showing the response of the trade balance to permanent one-standard error depreciation in exchange rate. The J-curve effects are confirmed in case currency depreciation leads to a deterioration of the trade balance in the short run but followed by an improvement for long run.

Response to Generalized One S.D. Innovations
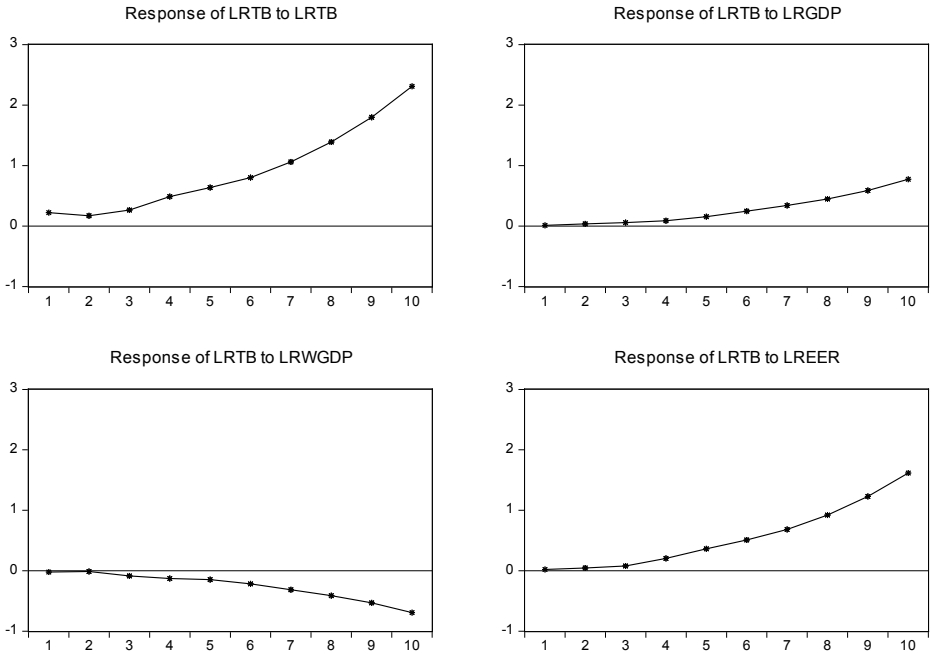
This figure illustrates that the J-Curve phenomenon does not hold for the case of Rwanda. Observing the response of the trade balance to a shock on real effective exchange rate, it can clearly be seen that real depreciation causes an improvement of the trade balance from the very short run to the long run. At this stage, the results are not surprising because the cointegrating equation has reported that the coefficient for the effective exchange rate is negative. Indeed, the J-curve and so the Marshal-Lerner condition would hold in case of a positive coefficient.

6. Conclusion

The objective of this paper was to investigate the J-curve hypothesis for Rwanda using aggregate data for the period 1980 to 2013. Johansen cointegration test, VECM and generalized impulse response functions have been used to reach the objective. The cointegration analysis showed the evidence that there is a long run stable relationship among real trade balance, real effective exchange rate, real domestic income, and real foreign income. The CUSUM and CUSUMSQ parameter stability tests confirmed that the parameters are fairly stable over the period of analysis.

Our long-run results indicate that the real effective exchange rate carries a negative sign and it is statistically significant in the model. This result indicates that the real effective exchange rate play a significant role in the trade balance in the long-run. According to the model, both real domestic product and real World income have positive sign and are statistically significant. The sign of real World income agrees with what theory suggests when the demand side dominates. The generalized impulse responses and the sign of the coefficient of the real effective exchange rate have shown no evidence of the J-curve.

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Appendix 1: Deterministic structure of the model

Date: 10/27/14   Time: 21:18
Sample: 1980 2013
Included observations: 31
Series: LRTB LRGDP LRWGDP LREER
Exogenous series: DUMMY
Warning: Rank Test critical values derived assuming no exogenous series
Lags interval: 1 to 2

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	**Linear**	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	**Intercept Trend**	Intercept Trend
Trace	2	3	2	**3**	4
Max-Eig	2	3	2	**3**	4

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend

Log Likelihood by Rank (rows) and Model (columns)

0	152.8401	152.8401	161.7833	161.7833	165.1678
1	180.7013	181.1801	189.5112	193.5915	194.7625
2	194.1394	198.6025	203.6541	207.7380	208.9084
3	197.0933	206.7054	208.7271	220.3631	220.4247
4	197.3218	209.3732	209.3732	222.5346	222.5346

Akaike Information Criteria by Rank (rows) and Model (columns)

0	-7.796133	-7.796133	-8.115053	-8.115053	-8.075344
1	-9.077506	-9.043876	-9.387822	-9.586550	-9.468545
2	-9.428350	-9.587260	-9.784137	-9.918578	-9.865055
3	-9.102796	-9.529378	-9.595296	**-10.15246***	-10.09192
4	-8.601404	-9.120852	-9.120852	-9.711909	-9.711909

Schwarz Criteria by Rank (rows) and Model (columns)

0	-6.315888	-6.315888	-6.449778	-6.449778	-6.225038
1	-7.227200	-7.147313	-7.352486	-7.504955*	-7.248178
2	-7.207983	-7.274377	-7.378740	-7.420665	-7.274627
3	-6.512367	-6.800176	-6.819837	-7.238225	-7.131427
4	-5.640915	-5.975332	-5.975332	-6.381358	-6.381358

Appendix 2: Coefficients of the short run component of the VECM

Error Correction:	D(LRTB)	D(LRGDP)	D(LRWGDP)	D(LREER)
CointEq1	**-1.029359**	-0.638227	0.000000	0.333869
	(0.22482)	(0.07137)	(0.00000)	(0.07748)
	[-4.57869]	[-8.94233]	[NA]	[4.30889]
D(Log(RTB(-1)))	-1.275322	-0.651695	-0.013628	0.274206
	(0.32533)	(0.11330)	(0.02081)	(0.12182)
	[-3.92003]	[-5.75204]	[-0.65484]	[2.25085]
D(Log(RTB(-2)))	-0.698299	-0.434340	-0.003575	0.113098
	(0.28019)	(0.09758)	(0.01792)	(0.10492)
	[-2.49221]	[-4.45123]	[-0.19945]	[1.07795]
D(Log(RGDP(-1)))	0.803149	0.343498	0.012125	0.388279
	(0.49734)	(0.17320)	(0.03181)	(0.18623)
	[1.61488]	[1.98324]	[0.38112]	[2.08492]
D(Log(RGDP(-2)))	0.025536	-0.047727	0.005240	-0.044848
	(0.47891)	(0.16678)	(0.03063)	(0.17933)
	[0.05332]	[-0.28617]	[0.17106]	[-0.25009]
D(Log(RWGDP(-1)))	7.779085	1.593853	0.221739	-0.327795
	(3.17068)	(1.10419)	(0.20282)	(1.18728)
	[2.45345]	[1.44346]	[1.09327]	[-0.27609]
D(Log(RWGDP(-2)))	0.883688	3.062893	-0.239854	-1.179865
	(3.50007)	(1.21890)	(0.22389)	(1.31062)
	[0.25248]	[2.51283]	[-1.07129]	[-0.90023]
D(Log(REER(-1)))	-1.215929	-0.592091	-0.016202	0.761350
	(0.51540)	(0.17949)	(0.03297)	(0.19299)
	[-2.35921]	[-3.29879]	[-0.49142]	[3.94497]
D(Log(REER(-2)))	-0.957639	-0.933882	-0.002214	0.036871
	(0.61704)	(0.21488)	(0.03947)	(0.23105)
	[-1.55200]	[-4.34599]	[-0.05609]	[0.15958]
C	-1.277576	-0.699991	0.016961	0.291014
	(0.27034)	(0.09415)	(0.01729)	(0.10123)
	[-4.72573]	[-7.43501]	[0.98080]	[2.87472]
DUMMY	1.521185	0.910274	0.017485	-0.415185
	(0.29794)	(0.10376)	(0.01906)	(0.11156)
	[5.10575]	[8.77318]	[0.91743]	[-3.72151]

Note: Standard errors in ( ) and T-statistics in [ ]

TECHNICAL EFFICIENCY OF SMALL HOLDER IRISH POTATO PRODUCTION IN NYABIHU DISTRICT, RWANDA

By

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ABSTRACT

The study on technical efficiency of small holder Potato was carried out in Nyabihu District. The study estimates the technical efficiency obtained from stochastic frontier production approach. The analysis is based on potato growers and it used both primary and secondary data. The data used were obtained directly from respondents selected from a sample of 150 farmers during a survey of April 2010.

Maximum likelihood estimates are obtained from half – normal stochastic production model. The results indicated that 71 % variation in the output of Irish potato production was attributed to technical inefficiency. The mean score technical efficiency among small holder potato farmers was 60.5 % , indicating that it was possible for the farmers to improve their efficiency by 39.5 %.

It is shown that area under potato, seed, and family labor and fertilizers, contributes positively towards the improvement of efficiency. It was also found that, farming experience, house hold size, gender, marital status, farm size and extension services are socio-economic factors that influence the farmers' technical efficiency. However, education, access to credit and firm size brought negative impacts as they affect the efficiency level of farmers. To achieve increased efficiency of production, this study recommends the government to allocate more funds in order to strengthen the extension services and increase agricultural credit services to potato growers.

Keywords: Technical, Efficiency, stochastic frontier, Rwanda.

INTRODUCTION

Agriculture remains the backbone of Rwanda's economy. It contributes 34% of Gross Domestic Product (GDP) and employs around 70% of the Rwandan population that lives in rural areas (RAB,2010). According to vision 2020, Agriculture is a well-known and important economic sector in Rwanda for poverty reduction, and enhanced food security (EICV, 2011). Indeed, promoting agriculture is imperative to achieve the Millennium Development Goals (World Bank, 2008). Today, the population of Rwanda is estimated at about 11 million and is growing at a rate of about 2.5% per year (NIS,2012). The population density has increased from 321 to 416 persons per sq.km between 2002 and 2012, considered the highest in Africa.

The government adopted the Crop Intensification Programme (CIP) through Ministry of Agriculture in 2008 with a goal to increase agricultural productivity of high potential food crops and to provide Rwanda with greater food security and self-sufficiency. The implementation of this program involves various components, including Land Use Consolidation (LUC) as the main pillar, the proximity advisory services to farmers, inputs (seeds and fertilizers) distribution , improving post-harvest technologies (e.g. driers and storage facilities) and access to extension services (MINAGRI, 2011). It is expected that the program will have positive impacts on crop production, food security, and household income.

1.1 Potato production in Rwanda

Potato production plays an important role in the economy of Rwanda in general and in Nyabihu in particular with favorable ecological conditions. It important and second most important food crop in Rwanda after cassava. It's also plays an important role both as food and cash crop in the country. From 1966 to 2010, the cultivated area increased from 9,500 ha to 130,000 ha and production increased from 57,300 MT to 1,300,000 MT. MINAGRI (2010). This crop has become an increasingly important sector in Rwanda in terms of potential for contributing to food security, nutrition, employment and improvement in socio – economic status of rural communities.

The crop is largely produced in highland areas of North –Western Rwanda, in the districts of Nyabihu, Musanze and Rubavu, where all households cultivate it and produce over 60 % of the national production (NISR,2010).

However, Nyabihu District, alone produces between 50 and 60 % of the total annual potato consumption countrywide (MINAGRI, 2011) and Irish potato is one of the most important crops that are grown in that district both for food security and income.

Potatoes are essentially a food security crop especially in urban areas and as a result, the annual consumption is about 125 kg per person, making potato the country's second most important source of calorie intake after cassava. (Nyarwaya et. al, 2002). The production of Irish Potato in the country is estimated to 1,1029,887 MT and 1,113,360MT in 2010 and 2011 respectively. The highest potato production at National level comes from Nyabihu District, followed by Musanze district, with production of 291.5MT or 44.5 % and 178.045 MT or 27.28% respectively. These two Districts comprise 72.3 % of national level production.

(MINAGRI, 2011).

Irish Potato is considered as both food and cash crop in the country in general and Nyabihu District in particular; With 57,000 ha under cultivation, the potato sector is a large and dynamic segment of agriculture. The crop is characterized by a high demand for domestic markets and external especially and in East Africa due to high demand for processed potato chips which have been growing at a rate 10--17% annually.

Figure 1. Potato production trend in Rwanda
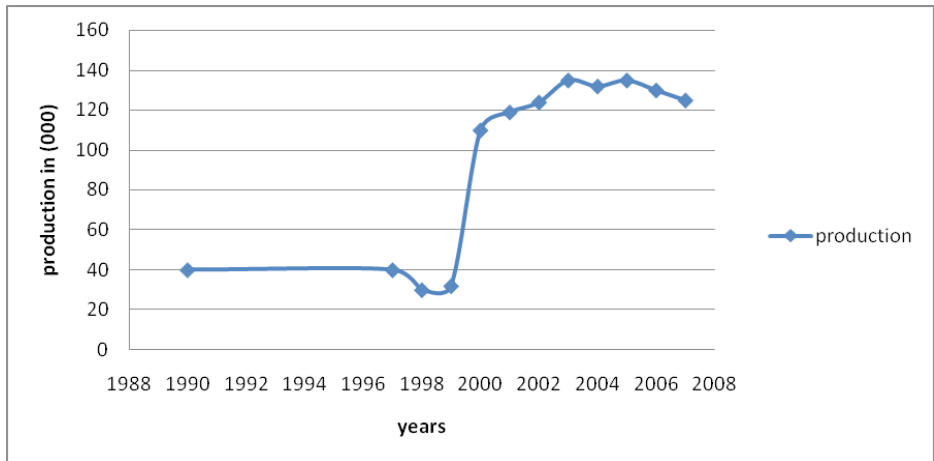
Source: MINAGRI, 2007

 Rwanda is the largest producer of potatoes in the EAC and the sixth largest producer of potatoes in Africa after Egypt, Malawi, South Africa, Algeria, and Morocco (FAO, 2008). However, given the population growth rates, particularly in urban cities, potato remains a preference consumption and high demand for domestic and outside the markets. The challenge for the country   now is to supply food availability which is not keeping pace with population growth.

In order to fill the gap between supply and demand, the Rwandan government imports grains and other food. However, Irish potato still faces a declining trend in yield due to several factors, such as, the scarcity of arable land, reduction of soil fertility and the rapidly increasing demand for food resulting in a high rate of population growth. Potato production is also motivated by domestic consumption and the economy.

Despite the efforts of improving Irish potato production over the years, the problem of low production remains a major challenge .The low production is due to the inefficient use of resources ,inadequate supply of quality seed, low output prices, lack of extension and inadequacy of financial resources. Now the question is, how can potato production in Rwanda, especially in Nyabihu District be increased? One approach that can be used to answer this question is that of the utilization of scarce resources efficiently.

Thus, this study will focus on two questions: first, whether farmers are not technically efficient in potato production and second, which factors determine their level of efficiency? The answers to both questions provide a clue on how we can assist potato growing farmers to be efficient and allocate their resources employed in potato production. Given population growth rates, rapid urbanization consumption and demand for potatoes in Rwanda, potato production is failed to meet the demand in horizon 2020 (Mellor, 2002).

The above constraints are the challenge of meeting food security of Rwanda today which is to produce enough food to feed people around 11 millions , which is not keeping pace with population growth under smallholder constraints of limited inputs and land. Therefore, they can be taught best farming practices in order to increase the production, at least, to 40 tons to 80 tons per hectare,

in some countries like the Netherlands (INES-ICCRD,2014). Thus, there is a need to examine technical efficiency of potato production in Nyabihu District.

The objective of this study is to examine the level of technical efficiency among smallholder potato production and determine the factors that influence technical inefficiencies in the Rwandan district of Nyabihu .

More specifically, the paper intends is:

To estimate the level of technical efficiency of smallholder potato producers in Nyabihu District.

To assess the socio- economic factors that influence technical efficiency among potato producers in Nyabihu District, Rwanda.

2. METHODS AND MATERIALS

Description of study area, Sampling technique, Sources and method of data collection

2.1 Study Area

The Nyabihu district is situated in the Northwest of Rwanda in Western province with 512.5 Km². The population of Nyabihu district is estimated at 280.210 persons while 99 percent leave in rural area with 541 square kilometers of density, (District report 2007). Agriculture is the main activity in the district with potato production as the dominant farming activity followed by maize. The district is one of the major Irish potato growing districts of Rwanda with approximately 8241 ha of land under Irish potato cultivation. Nyabihu district is characterized by reliable rainfall with annual amount of 1400 mm a year. The rainfall is bimodal and

can reach 150mm/month in March and May. The mean maximum temperature is 15ºC and the mean minimum temperature ranges between 10 and 16ºC. The climate is conducive to rich and varied agricultural production where agro-ecological situations are very diverse and include rich soils derived from volcanic ashes.

2.2 Sampling procedure

The sample was selected randomly from three different sectors. In this study, two- stage sampling technique was randomly select. In the first stage, 5 cells (the smallest politico-administrative unit in Rwanda) were randomly selected from each sector giving a total of 15 from the 3 cells. In the second stage, the villages were randomly selected.

From each village, 10 households of farmers were selected randomly from a list provided by of the sector office. A total sample of 50 households was collected from each cell, making 150 households only a total of 148 farmers were interviewed, because 2 farmers did not attend the interview. Moreover, 123 were use in this study because 25 were dropped for lack of adequate missing data in the some sample of household.

2.3 Data preparation and analysis

Data were collected with the use of a structured questionnaire on output levels and input use in Irish potato production, as well as socio-economic characteristics. The data analysis of this study used both descriptive and inferential statistics. Means, standard deviations, percentages and frequencies helped to analyze the socio-economic characteristics of farmers, input and output variables and the distributions of efficiency levels.

A stochastic frontier production function that incorporated inefficiency factors was estimated using Maximum Likelihood Estimation (MLE) technique to obtain farm specific technical efficiencies as well as their determinants.

A Cobb-Douglas stochastic production function was estimated using the single-step. The procedure suggested by Kumbhakar et al. (1991) combines the two-stage procedure into one. Moreover, it produces maximum likelihood estimates of the stochastic production function. The procedure is superior to the two-stage procedure because it does not violate the assumption that the inefficiency effects are independently and identically distributed (Battesse and Coelli, 1995).

2.4. Empirical methods

A stochastic model originally was pioneered by Aigner and Chu (1968) who proposed a composed error term. Battese and Coelli (1995) proposed a stochastic frontier production function, which has firm effects . They are assumed to be distributed as a truncated normal random variable, in which the inefficiency effects are directly influenced by a number of variables.

The major tool of analysis used in this study was the stochastic frontier model by Battese and Coelli (1995). A stochastic model originally was pioneered by Aigner and Chu (1968) who proposed a composed error term.

The stochastic frontier production function model is specified in the implicit form as follows:

$$Yi = f(Xi, b) + (Vi - Ui)$$

Where: Y_i is the output of the $_i$th farm

X_i is a k x$_1$ vector of input quantities of the $_i$th farm

b is a vector of unknown parameters to be estimated

V_i are random variables which are assumed to be normally distributed $N(0, d_v^2)$ and independent of the U_i. It is assumed to account for measurement error and other factors not under the control of the farmer.

U_i are non-negative random variables, called technical inefficiency effects (Aigner *et al.*, 1977).

A Cobb-Douglas Production form of the frontier used for this study is presented as follows:

$$Y_i = f(x_i; \beta) \exp v_i - u_i \tag{1}$$

Where Y_i represents potato output, which is measured in kilograms, x_i represents the quantity of input used in the production, v_i represents random errors assumed to be independent and identically distributed $N(0, \sigma_v^2)$ and u_i represents the technical inefficiency effects assumed to be non-negative truncated of the half-normal distribution

$N(\mu, \sigma_u^2)$. The variance parameters of the model are parameterized as:

$$\sigma_s^2 = \sigma_v^2 + \sigma_u^2 ; \qquad \gamma = \frac{\sigma_u^2}{\sigma_s^2} \quad and \quad 0 \le \gamma \le 1 \tag{2}$$

A Cobb-Douglas Model which was found to be an adequate form of the frontier used for this study is specified as follows:

$$\ln Q_i = \ln \alpha_0 + \alpha_1 \ln AUP + \alpha_2 \ln SEED + \alpha_3 \ln HIRLABOR + \alpha_4 \ln FAMLABOR + \alpha_5 \ln .FERT$$
$$+ \alpha_6 \ln PESTDE + v_i - u_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

LnQ = Potato output in season (Kgs)

Ln *AUP* Area under potato = (ha)

Ln *SEED* = Quantity potato Seed used (Kg)

 Ln (HIRLABOR) Hired labour = (man days)

Ln (FAMLABOR) Family labour = (man days)

Ln *FERT* = chemical fertilizer used (kg)

Ln PESTDE = pesticide fertilizer used (kg)

v = is the random error

μ = inefficiency effect

 αi = are unknown parameters to be estimated

The study employed stochastic frontier production function model of the Cobb- Douglas function in order to estimate the farm level technical efficiency of potato growers in Nyabihu District.

In choosing a model that adequately represents the data, we estimated two functional forms (Cobb-Douglas and Translog). The inefficiency (TIE) model specified for Battese and Coelli (1995) was defined to estimate the influence of some farmer's socio-economic variables on the technical efficiencies of the farmers.

The inefficiency (TIE) model was defined to estimate the influence of some farmer's socio-economic variables on the technical efficiencies of the farmers.

The model is defined by:

$$\mu_i = \alpha_0 + \sum_{i=1}^{8} \alpha_i Z_i + \varepsilon_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4)$$

Where

μ_i = Inefficiency effects

α_i = Intercept term

$Z1$ = Family size of farmers growing potato (Number of household farm members)

Z_2 = Farmer level of Education of a farmer (Year of formal education)

Z_3 = Farming Experience of the farmer in potato (Year of farming)

Z_4 = Farm size of farmer in hectares

Z_5 = Marital status of the farm

Z_6 = Gender of the farmer .Measured as a dummy variable 1 for male,0 otherwise

Z_7 = Credit accessibility.

A dummy 1 if farmer received credit in the survey year, otherwise

Z_8 = Extension contact in the year.

3. RESULTS AND DISCUSSIONS

3.1. Descriptive analysis

The results show that, the family size had an average of 7 persons while 73.1 % were male. The number of households managed by men involved in the potato production was higher than that of females, but 56.9 % of potato farmers did not complete primary education. The average potato farm area in the study area was 0.34 hectares.

The majority of the farmers about 67.4 % have between 1 to 1.5 ha. About 86.2 % had farming experience of growing potato of more than 10 years while 63.4 % of farmers indicated that extension agents were visited. The summary of the production function variables is presented in Table 1 below. The result indicates that the mean output per farmer in potato production was about 16,155 kg.

The analysis of the inputs revealed that the average farm size under potato production ranged from 0.48 ha to 8 ha per farmer of minimum and maximum size of hectares of land respectively. The mean hired labor usage was 79.72 man-days while family labor was 8.16 man-days. This shows that potato farmers depend heavily on hired labor to do most of the farming operations.

Labour constitutes the most important input into smallholder agricultural production in Nyabihu. The average amount of fertilizers used and pesticide applied was 18.16 Kg and 20.46 kg respectively.

The use of pesticides has been observed as a major labor saving device as the labor requirement for weeding always accounts for a high proportion of the total farm cost of labor in potato

production. The average quantity of seeds for sampled farmers planted was 3032.94 kg. The quantity and type of seed planted by potato farmers has a lot of implications for the yield realized.

Table 1. Summary statistics of   output and input variables in
**   Potato production (Kg, ha, man-day)**

Variable	Mean	Std	Minimum	Max	Sample size
Total potato production(Kg)	16.15	30.50	60	250.00	123
Area under potato production (ha)	1.7	0.93	0.48	8	123
Seed quantity(Kg)	3032.94	4596.88	80	3000	123
Hired labor (Man day)	79.72	62.85	0	212	123
Family labor (Man day)	8.16	21.70	0	107	123
Fertilize(Kg)	18.43	10.73	1	37	123
Pesticide (Kg)	20.46	9.65	1	37	123

Source: Author's presentation, 2010

The estimated Maximum Likelihood coefficients showed that each inputs of potato such as firm size, seed quantity and family labor had positive signs and are statistically significant at the 1 % level while fertilizer was statistically at 5 %. This implies that these inputs are playing a major role in potato production.

Table 2 below shows almost that all these values are significant and have a positive effect on Potato production. Therefore, the increment of the variables such as, area under potato production, seed   quantity, family labor, and fertilizer by one per cent will increase output by 0 .18, 0.38, 0.42, and 0.12 % respectively except hired labor which was not significant. In the traditional agricultural production, family labour plays a significant role in farm labour supply.

Table 2. Maximum likelihood estimates of the stochastic frontier production function

Variable	Parameter	Coefficient	Std error	t - value
Constant	α_0	4.08 ***	(.660)	(6.18)
Area under potato (ha)	α_1	.18 ***	(.073)	(2.49)
Seed quantity (Kg)	α_2	.389 ***	(.062)	(6.27)
Hired labor (Man day)	α_3	.001	(.001)	(0.1)
Family labor (Man day)	α_4	.42 ***	(.200)	(2.14)
Fertilize (Kg)	α_5	.12 **	(.081)	(1.56)
Pesticide (Kg)	α_6	- .15 **	(.118)	(- 1.27)
Sigma –squared, $\sigma^2 u + \sigma^2 v$	σ^2	1.68		
Gamma, $\sigma^2 u / \sigma^2$	γ	0.71		
Number of observations		123		
Wald chi2(6)		681.4		
Prob > chi2		0.000		
Log likelihood		- 189.64		
Likelihood-ratio test of sigma=0:				
Chi-square (01)			5.11	

Legend: Asterisks indicate significance at the following levels: ** 5% ,   *** 1%
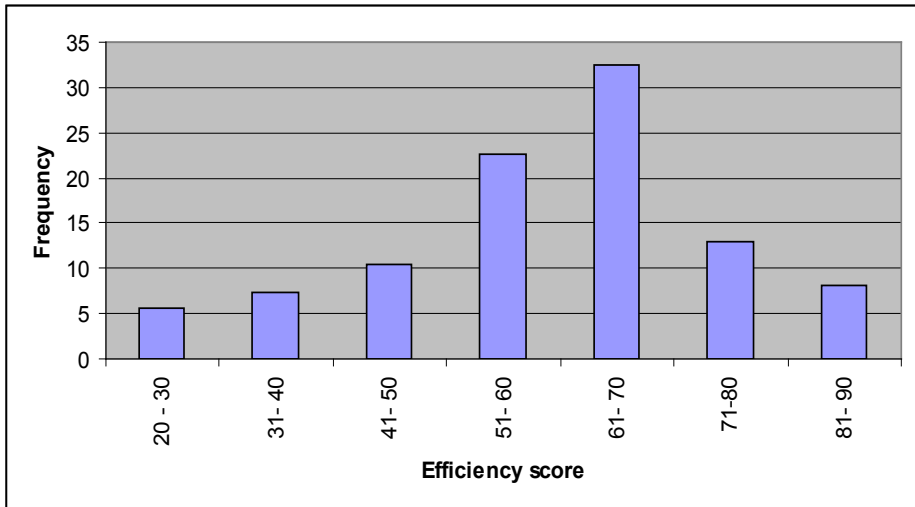
Source: Author's presentation, 2010

Furthermore, pesticide presented a contrary to the expectation sign, the coefficient showed a negative value of - 0.151, which was significant. This indicated that an increment of one percent of pesticide would reduce the output by 0.151 %.

However, the negative sign of pesticide might be due to the reason that farmers are using more pesticide than the recommended level or at a declining marginal productivity level. On the other hand negative values indicated that the input use has reached the maximum level and more use of such input beyond the current level would lead to reduced yields

Figure 1 below shows the frequency distribution of technical efficiency indices for the sampled Irish potato farms. The predicted technical efficiencies range from a minimum of 22.8 %t to a maximum of 88.5%. The mean score of technical efficiency among smallholder potato farmers was 60.5 %. The result shows that it was possible for the farmers to improve their efficiency by about 39.5 %.

Figure 2: Distribution of technical efficiency

Source: Author's presentation, 2010

3.2 Determinants of Technical Inefficiency

Identifying the factors that affect inefficiency and farmers' socio-economic characteristics is a major step that should be taken in raising the efficiency of production activities. This section reports on sources of inefficiency estimated in the model. A negative sign on parameter inefficiencies implies that the variable reduces technical inefficiency while a positive sign increases technical inefficiency.   As expected, the results in table 3 below indicate that, house hold size, gender, marital status, experience and extension services, have a negative sign and therefore reduced technical inefficiency (or increased technical efficiency), while education and firm size have a positive sign which indicates increased inefficiency.

Table 3 Determinants of technical inefficiency and Socio-economic Characteristics

Variable	Parameters	Coefficients	Std error	t - Value
Constant	δ_0	11.59**	.084	138.0
House hold size	δ_1	-.163*	.21	0.74
Education	δ_2	.081	.21	3.69
Sex	δ_3	-1.65***	.44	3.72
Marital status	δ_4	-6.45***	1.93	3.34
Experience	δ_5	-1.34**	.50	2.65
Farm size	δ_6	.68***	.17	4.02
Access credit	δ_7	-.08	.50	0.16
Extension services	δ_8	-.69*	.38	1.81
Lambda (u/v)	λ	1.58		
Sigma-squared (u)	$\sigma^2 u$	1.09		
Sigma-squared (v)	$\sigma^2 v$	0.69		

Source: Source: Field data analysis, 2010

Asterisks indicate significance at the following levels: * 10%, ** 5% , *** 1%

The variables such as gender and marital status were statistically significant at one percent while experience, house hold size and extension services were significant at five and ten percent respectively.

3.2.1 House hold size

Household size positively effects technical efficiency by 10 % level of significance indicating that larger households were more technical than smaller ones. In addition, these households have more labor available, which may influence the supply of household labor for non-farm work (Bizoza et al, 2007).

3.2.2 Education level of household

According to Amos and Kibaara (2007), education plays a significant role in skill acquisition and technology transfer and farmers with higher levels of education. There were likely to be more efficient in the use of inputs than their counterparts with little or no education (Okoruwa et al; 2006). But the results show that the level of education was positively and not significantly related to technical inefficiency. This implies that the level of education of potato farmers means that majority of the farmers did not complete secondary education. Similar study findings were obtained in Nigeria, by Idiong (2007). This implies that there is increased level of technical inefficiency as the level of education increases. This was in contrast with the findings of Ferenji and Heidhues (2007) and Raphael (2008) who confirmed that education of the household had positive and significant influence on the technical efficiency of farmers. This may be attributed to the orientation of most farmers in the district where more than 60 % did not complete their primary education while the few who attempted secondary education did not complete it.

3.3.3 Gender

The coefficient of gender variable was negative (-1.65) at 1% level of significance. The results obtained showed that there are more male farmers involved in potato production their female counterparts. This implies that the gender of the household head was expected to have significant effects on technical efficiency. Farms managed by men were expected to attain higher technical efficiency than those managed by women.

Nearly 80% of men were more likely to have priority access to labor so that operations were done on time which increases

production efficiency in potato production. This is most likely to be due to the fact that men can do more tedious work, which is usually associated with farming compared to females. The same results on gender variable shows male farmers to be more efficient than female. Kibaara (2005) found similar results among maize smallholders in Kenya.

4.3.4 Farm size

The coefficient of farm size was positive and statistically significant at 1% level indicating a direct relationship between farm size and technical efficiency. Land is important in agricultural but a limiting factor of production in Rwanda. Farm sizes were very small averaging 0.83 hectares per household and getting smaller with increasing rural population (Byiringiro, 1996). Rwanda has a high rate of population growth with individual's limited access to land. When the population pressure is high, land subdivision leads to a fall in average farm size (Mpyisi et al., 2003). Large farmers are usually more educated, and have more access to credit, land, and other production inputs as well as adopting agricultural innovations more than small farmers.

4.3.5 Marital status

The estimated coefficient of the variable representing the marital status was positive and significant at 1 %. This implies that marital status was expected to have significant effects on technical efficiency. The results obtained showed that 73.3 % of the respondents were married males who were involved in potato farming. The similar results which were found by Muhammad-Lawal et al. (2009) in Ondo state, Nigeria .This could probably be explained by the fact that the married males had access to land because of cultural prejudice and hence married men were

closer to the frontier. In addition, the married men are heads of households, and had a responsibility to provide more food to the family.

4.3.6 Experience of farmer growing potato

The estimated coefficient for farming experience was negative and significant at 5 % level showing direct relationship between farming experience and technical efficiency. This indicates that efficiency increases with the number of years spent by the household head in potato production. If we consider that, experience is the best teacher, then this implies that the Irish potato farming in the study area was highly dependent on the experience of farmers which may lead to better managerial skills being acquired over time. This corroborates the findings by Amara et al; (1998) and Khai et al; (2008). This result was also supported by Coelli (1996a) who concludes that old farmers are likely to have more farming experience and hence less inefficient.

4.3.7 Extension services   and access to credit

The coefficient for the variable of contact with access to extension services was   expected to have positive influence on technical efficiency of farmers. Similar results were found by Bagamba and Shuhao (2007, 2005) who indicate that extension services are properly disseminated information to the   farmers about better farming practices and agricultural technologies. This implies that extension plays a significant role in improving technical efficiency in potato production. This result is in line with the arguments by Nchare (2007) who indicates that regular contacts with extension workers facilitates practical use of modern techniques and adoption of improved agronomic production practices.

Furthermore, the coefficient of access to credit variable was negative and statistically insignificant. This implies that agricultural credit does not improve technical efficiency. In the study area, access to credit was low with only 11.3% of the farmers able to access credit. However, this study found no statistically significant relationship of access to credit on technical efficiency. Similar findings were obtained in Malawi by Tchale, et al (2007) who indicate that significant effect on credit access may reflect the low levels of farmers' access to credit among smallholder farmers. This is mainly due to collateral requirements and high interest rates associated with seasonal agricultural loans from the Malawi Rural Finance Company. However some farmers indicated willingness to acquire credit but cited stringent requirement imposed by formal credit institutions such as commercial banks and agricultural finance corporations and the perceived risk in case they default re-payment as the main constraints.

4. CONCLUSION AND POLICY RECOMMENDATION

The objective of this study was to examine the technical efficiency of smallholder potato production and determine the factors that influence technical inefficiencies in Nyabihu District-Northwestern Rwanda. The results of the study revealed that technical efficiency for smallholder Irish potato growers was low which suggested the presence of technical inefficiency. Based on the findings of this research, the participants were about 71% variation in output production was attributed to technically inefficient. Firm size, usage of extension services, and education level of the participants were the major factors that affect their level of technical inefficiency.

However, maximum likelihood estimates indicated the coefficients for area under potato production, seed quantity, family labor, and fertilize which are positive and significant. The coefficient on pesticide is negative but insignificant implying that both inputs are possibly being underutilized. This, however, requires, the government to use Integrated pest management (IPM) practices that emphasizes minimal use of pesticides in controlling pests. In addition, if farmers adopt them, there that can be reduction of the use of pesticides and their adverse impacts.

The contribution of the family labor and seed quantity in increasing production are more pertinent. The study also identified that extension services were doing well in the study area. Given the large coefficient estimate on extension services, improvement in these services can play a significant role in improving technical efficiency in potato production. To achieve this, the net extension services should be expanded to reach each every farmer. The government should allocate more funds in strengthening the extension department and expending net of extension service potato growers.

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TERTIARY STUDENTS' PERCEPTIONS TOWARDS GLOBAL WARMING. CASE STUDY OF STUDENTS OF KIGALI INDEPENDENT UNIVERSITY ULK GISENYI CAMPUS

By

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Abstract

This study focuses on perception[3] of global warming issues among students of Kigali Independent University ULK in Gisenyi Campus. It evaluates the perception of a group of 107 from 5 departments. The number of 107 was selected based on random sampling method. A questionnaire comprising three main questions was applied as instrument for data collection. The results revealed that students' perception on definition of global warming was overall high while on causes and consequences it was moderate.

The study also found that there was no significant difference observed between demographic factors as indicated by results from educational level and departments. But gender showed a tendency to significant difference between respondents' perception towards global warming issues. It was found that students are more informed through media than through academic curriculum. This is why the researchers believe that formal curriculum coupled to non-formal is needed to enhance knowledge, attitude and behavior of students towards global warming issues.

Key words: Perception. Tertiary students. Kigali Independent University. Global warming.

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(3) According to Adekunle, I.M et al (2012), Perception is a way of regarding, understanding or interpreting something; a mental impression of a given phenomenon. In this case, perception is about the views of students Kigali Independent University Gisenyi Campus on Global warming issues.

1. Introduction

Global warming is a current issue that Earth Planet is experiencing. Global warming is one of major causes of climate change. When speaking of climate change and global warming there are some significant distinctions and also a number of overlaps that are commonly accepted within the scientific community. There remains some debate about the nature of global warming and its impact on climate change, but most acknowledge that the planet has experienced, and continues to experience, climate change in both significant and minor forms. Otter *et al* (2007) reported: "Since the beginning of humanity, natural and human systems have faced important global environmental change, to which they have responded in different ways, from disappearance to mitigation and adaptation".

According to McMichael *et al* (2003), climate change affects human socio-economic well being in several ways, notably by increasing the distribution and transmission of several vector-borne infectious diseases, including malaria, dengue and leishmaniasis, and diseases related to heat stress, by increasing losses of human lives, livestock and property through severe floods and droughts, and by reducing the availability of water for domestic uses, sanitation levels, as well as losses in food production, biodiversity and ecosystem functions. In addition, WHO (2000), stated that the impact of recent climate change has already caused the loss of 150,000 human lives and about 5 million Disability Adjusted Life Years throughout the world.

2. Background on climate change

The Intergovernmental Panel on Climate Change (IPCC, 2007) reports that since 2003, there exists a phenomenon of global warming due mainly to anthropogenic forcing. This implies the increase in greenhouse gas emissions resulting from human activities in the atmosphere. Scientists have also predicted that global warming would continue over the next century but the magnitude of this warming was not well precized. The magnitude and effects of climate change have been estimated with increasing accuracy and reported from different regions of the world. WHO (2014) reported that heat waves are now a common event in Europe and caused the death of thousands of elderly people in 2003. In the same way Kysely (2010) emphasised that the effects of climate change are predicted to increase in Europe in the coming decades. Moreover Ahern *et al* (2005) highlighted that Asia is increasingly experiencing extensive flooding resulting in high human mortality, injuries, water-borne diseases and mental health problems.

According to Confalonieri *et al* (2007), it is estimated that the health of millions of people throughout the world will be affected due to increases in malnutrition resulting from food shortage; diseases and injuries associated with heat waves, floods, storms, fires and droughts; increases in gastrointestinal diseases and cardio-respiratory disease, and altered distribution and seasonal transmission of vector-borne disease. To Boko (2007), Africa is the continent most vulnerable to the impacts of climate change, due to increases in droughts and floods, the epidemic potential of many infectious diseases and low capacity of nations and communities to adapt to climate change. Regular, predictable rainfall is particularly critical in Africa because many countries

are highly dependent on rain-fed agriculture.

In Rwanda, global warming effects that lead to climate change are also a reality. Data from National Strategy report for climate change (2011) highlight that Rwanda is located in the tropical belt, sits astride two key climatic regions, East Africa and Central Africa each with contrasting controls and drivers on climate.

There is a lack of sufficient climate data in equatorial Africa and these factors make Rwanda troublesome to simulate in climate models. Within the region of East Africa, one climate centre exists currently, the Inter-Governmental Authority on Development (IGAD) Prediction and Climate Applications Centre (ICPAC) in Nairobi, Kenya. There is also pan-African centre, the African Centre of Meteorological Applications for Development (ACMAD) in Niamey, Niger.

Both centres provide meteorological and climate information that covers Rwanda, mainly in the form of observational information and seasonal forecasts. Neither centre provides detailed spatial and sectoral interpretation of the information which remains the responsibility of individual countries. In Rwanda, this function lies with the Rwanda Meteorological Service (RMS). Analysis from existing data shows that over the last 30 years, some parts of Rwanda have experienced unusual irregularities in climate patterns including variability in rainfall frequencies and intensity, persistence of extremes like heavy rainfall in the northern parts and drought in the eastern and southern parts. Figure 1 presents details on the mean annual temperatures.
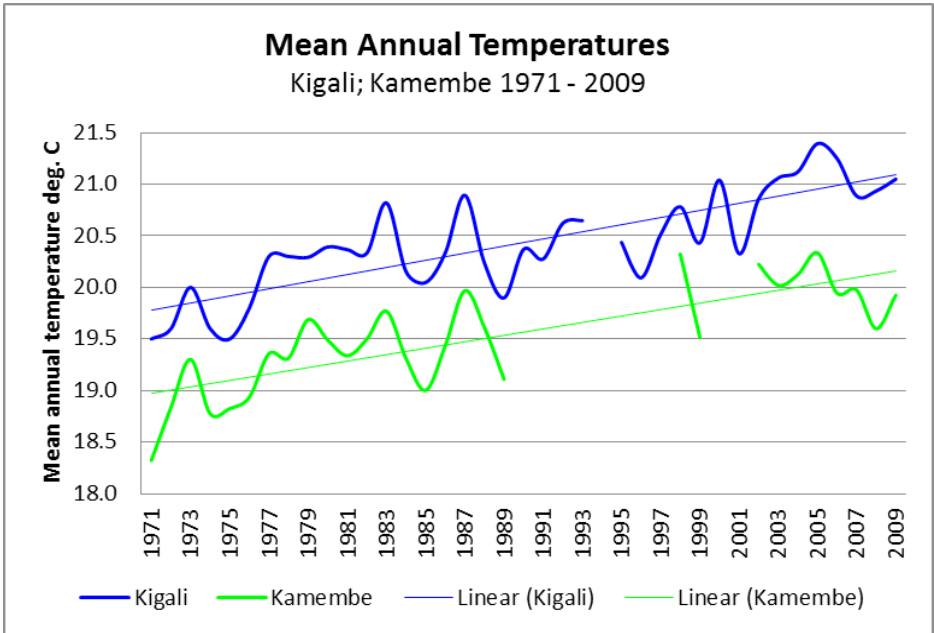
Source: RMS, data from two stations (Kanombe&Kamembe)

Figure 1: Mean annual temperatures from 1971 to 2009

According to SNC document presented to UN Framework Convention on Climate Change Secretariat (UNFCCC) on June 5, 2012, climate projections for Rwanda were done for the period of 2010-2100 using data of the period 1971-2007 as the baseline. These projections are based on the outputs of Global Circulation Models (GCM). Rwandan data appears to be unique in the sense that average data from different stations do not represent the real climatology of the country, due to a net variation in relief altitudes between different stations. The following figure depicts the annual number of rain days at Kigali meteorological station.
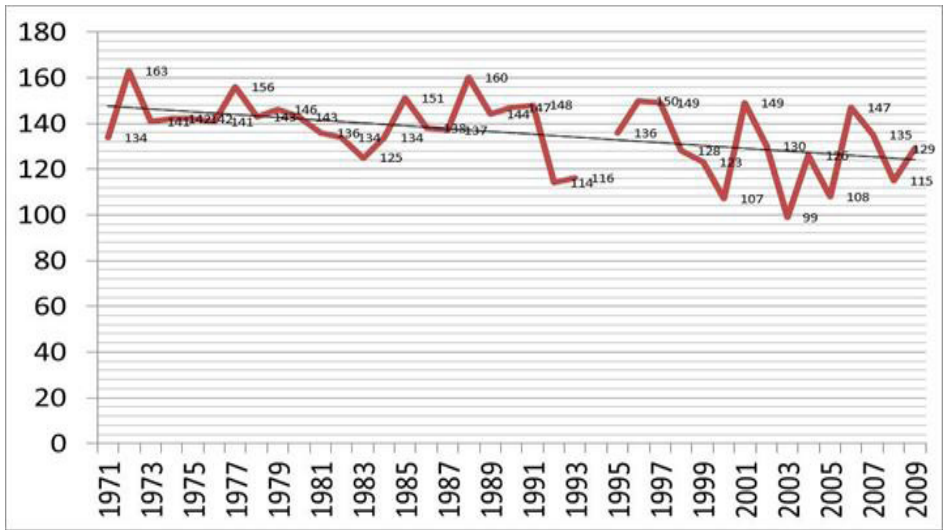
Source: RMS, data from Kigali station (Kanombe)

Figure 2: Annual number of rain days at Kanombe station (1971-2009)

In average, the annual total number of rain days decreased from 134 days to 124 days from 1971 to 2009. According to National strategy for climate change report (2011), the annual average rainfall total decreased from 1029 mm to 920 mm. This infers that during the 1991-2009 periods, there was a decrease of average rainfall of about 100 mm compared to 1971-1990 period. In the same way, data collected from two meteorological stations (Kigali, Kamembe) show that the annual mean of temperatures is increasing. According to Mutabazi (2014), the meteorological station of Kigali Airport station indicates that the average value was 19.8°C in 1971 and 21.0°C in 2009. This implies an increase of 1.2°C in 39 years which is higher than the global warming (~1°C in 150 years).

3. Problem statement

In the knowledge of the researchers little empirical works has been done to analyze students' perceptions of global warming and what exist in the study area show that the perception of students on the issues remains fuzzy. Fatih (2010) analysed secondary school students' perceptions of global warming issues in Turkey. The findings revealed that the definitions of secondary school students do not contain an exact definition of global warming term. Their definitions towards global warming concepts were non relational rather than relational ones. Similarly Grove and Pugh (1999) quoted in Fatih (2010) conducted a study on perceptions of students from different faculties towards global warming.

They found that most of the students think that global warming is caused by weakening of ozone layer; therefore, there will be an increase in the skin cancer cases because of global warming. Besides, a study conducted by Du Plessis *et al* (2012) has also revealed that demographic variables (especially gender) affect respondents' perception towards environmental issues. So the researchers would like to know the perception of students of Kigali Independent University ULK Gisenyi Campus towards global warming issues.

4. Objectives the study

The general objective of the paper is to contribute to disseminating the body of knowledge that exists in the area of environmental issues by examining the perception of students of Kigali Independent University ULK Gisenyi Campus towards global warming issues because some of them could be the leaders of tomorrow. Knowledge and understanding are a way of environmental management.

Specifically, the paper aims to:

☐ Examine the perception of students of Kigali Independent University ULK towards global warming, its causes and its effects

☐ Analyse the demographic factors that influence their perception

5. Research questions

The study intends to answer the following research questions:

(i) Do students of ULK Gisenyi Campus of different levels have different perceptions on causes of global warming issues?

(ii) Do students of ULK Gisenyi Campus of different departments have different perceptions on effects of global warming issues?

(iii) What is the effect of demographic factors on students' perception towards global warming issues?

6. Research methodology

In order to respond to these questions, a survey was conducted on students of ULK Gisenyi Campus. The respondents were selected randomly since the sample size of respondents was from students who attended the public lecture on climate change organized by REMA the day before commemoration of World Environment Day[4], on 4th June, 2014. Thus 120 questionnaires were distributed but 107 only were returned to the researchers. Data collected during the survey were checked before they were entered and analyzed using SPSS, Version 16.

After descriptive analysis of demographic characteristics of the students, a Chi-Square test was used to examine whether or not an association existed between students' demographic information and issues on global warming. A p-value of <0.05 was considered to indicate a statistically significant difference.

(4) World Environment Day is celebrated on 5th of June of each year since the Stockholm conference on human environment organized by UN in 1972.

7. Findings analysis and discussions

This section presents demographic information of respondents and deals with the students' perception about climate change issues. The analysis is based on gender, level of education and departments of respondents to see whether patterns emerge. As stated earlier, the results were analysed based on statistical techniques such as frequencies and measures of crosstabs' association as well as the Chi-Square test (x^2).

7.1 Demographic information of respondents

Demographic characteristics are important in perception analysis on environmental issues. Alibeli and Johnson (2009) stipulate that the concern over the environment is according to students' socio-economic and demographic characteristics.

As indicated in Table 1, respondents encompass 59.8% of female and 40.2% of males from 5 departments and from all grade levels. Majority of study participants are from year 1 (33.6%) and year 4 (36.5%) and from Accounting (42%) and Finance (41%) departments. Participants from Law (4%), development studies (7.4%) and rural development 5.6%) departments represent the lowest percentage.

Table 1. **Demographic information of respondents**

Sex of respondents	Educational level of respondents					
	Year 1	Year 2	Year 3	Year 4	**Total**	**%**
Female	27	10	9	18	64	59.8
Male	9	10	3	21	43	40.2
Total	36	20	12	39	107	100

Educational level of respondents	**Departments**						
	Accounting	Finance	Rural Development	Law	Development studies	Total	%
Year 1	32	4	0	0	0	36	33.6
Year 2	6	2	1	3	8	20	18.7
Year 3	5	6	1	0	0	12	11.2
Year 4	2	32	4	1	0	39	36.5
Total	45(42%)	44(41%)	6(5.6%)	4(4%)	8 (7.4%)	107	100

In fact, even if students of year 1 did not yet choose their departments during the survey, the researcher considered their wish to belong either to Accounting or to Finance. This is why they were classified accordingly in Accounting and Finance departments. As reported earlier, this is due to accident sampling.

7.2 Meaning of global warming

Regarding the components of global warming definition, respondents were requested to choose one of items listed in Table 2 according to their sex in order to explore their understanding on issue under study.

So, details are herein depicted.

As shown by findings from Table 2, 35.9% of females against 30.2% of males provided correct responses of Global warming

when they defined it as the increase of temperature of the earth. However 39.1% of females against 16.3% of males defined global warming as change of seasons and 12.5% of females against 27.9% believe that global warming is the destruction of ozone layer while all the items were considered as definition of global warming by 12.5% of females against 25.6% of males.

Table 2: Perception between demographic characteristics of respondents and meaning of global warming

1. Sex of respondents	Meaning of global warming					x^2 value
	Change of seasons	Increase of world average temperature	Destruction of ozone layer	All the above	**Total**	P= 0.05 df=3
	n= 32	n=36	n= 20	n=19	n=107	
	%	%	%	%	%	
Female	39.1	35.9	12.5	12.5	100	
Male	16.3	30.2	27.9	25.6	100	
% of Total	29.9	33.6	18.7	17.8	100	0.01
2. Educational level of respondents						
Year 1	33.3	38.9	11.1	16.7	100	x^2 value
Year 2	20	50	20	10	100	P= 0.05
Year 3	50	8.3	8.3	33.3	100	df=9
Year 4	25.6	28.2	28.2	17.9	100	
% of total	29.9	33.6	18.7	17.8	100	0.15
3. Departments of respondents						
Accounting	42.2	33.3	6.7	17.8	100	x^2 value
Finance	25	25	29.5	20.5	100	P= 0.05
Rural development	16.7	50	16.7	16.7	100	df=12
Law	0	25	75	0	100	
Development Studies	12.5	75	0	12.5	100	
Total	29.9	33.6	18.7	17.8	100.0	0.01

Then, data were analysed using the Pearson Chi-square. The empirical p-value computed gave a level of significance of 0.01 therefore less than theoretical (p 0.05) at degree of freedom (df=3). This confirms that there exists a significant difference in the perception on global warming's definition students' respondents based on their gender.

Therefore, this implies female students of ULK Gisenyi know more than male students about the meaning of global warming in this study. This goes in the same sense of results got by many scholars like McCright who conducted a study in the United States and found that women had a better understanding of the impact of climate change than men and Dankelman (2002) concluded that these gendered differences may be attributed to the relatively higher social responsibility of women than men in their communities, which increases their understanding of the causes and consequences of climate change.

This pattern of female awareness and their potential contribution to reducing climate change and mitigating impacts is contrary to the common perception that African females are unaware of environmental issues and helpless to deal with them. In this study, this opinion is illustrated in Table 3 below where the data showed a higher proportion of male students (86%) than female students (76.6%) to be aware of causes on global warming.

Regarding educational level of respondents, most study participants were from year 4 (39), followed by students of year 1(36), and year 3 (12) while the smallest groups were from year 2 (8).

Regarding educational level of respondents, most study participants were from year 4 (39), followed by students of year 1(36), and year 3 (12) while the smallest groups were from year 2 (8).

Indeed, knowledge about definition of global warming, in overall presents a low the rate because 33.6% of respondents gave correct definition. Concerning knowledge by educational level, students from year 2 got a high score (50%). They were followed by students year 1 (38.9%) and students of year 4 (28.2%). In last position come students of year 3 with a rate of 8.3%. Chi-square test did not reveal statistically significant association of good perception of global warming definition according to level of education (p-value computed = 0.15> 0.05; df=9).

This implies that in this study, educational level did not influence the understanding of definition of global warming. Concerning perception by departments, the respondents who gave good answer are coming from department of development studies (75%). They were followed by students from rural development department (50%). This would be due to fact that students of development studies and rural development have in their curriculum, the components of environment.

Students from accounting are listed the last but one with a rate of 33.3%. Finally, students from law and finance departments come in last rank with a score of 25%. Chi-Square test revealed that there is significant association between students from different departments on global warming definition (p-value computed was 0.01< 0.05; df=12).

Similarly, a study conducted by Nigatu *et al* (2014) found that there was one statistically significant association, between students' awareness of climate change and their perceived departmental role in preventing the public health consequences of climate change.

Students who knew about climate change were more likely to perceive preventing climate change health impacts as one of their departments' objectives than students who did not know about climate change.

In fact, people used to confuse climate change and global warming and they think both concepts can be used interchangeablebly. Then they confuse climate to weather or to season. All those concepts are linked and overlapped but each one has its specific meaning. According to UNFCCC (1994), climate change is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. In other words, climate change includes major changes in temperature, precipitation or wind patterns among other effects that occur over several decades or longer (at least 30 years of observation).

Contrary to climate change, EPA (2014) stresses that global warming itself represents only one aspect of climate change. It refers to the recent and ongoing rise in global average temperature near Earth's surface and it is mostly due to increasing of greenhouse gases concentrations in the atmosphere. Then, the words "**climate**" and "**weather**" are sometimes used interchangeably, but they are in fact different, though related, phenomenon.

According to Mitchell and Aalst (2008), weather refers to short-term, atmospheric conditions while climate to long-term ones. Weather is measured by temperature, humidity, wind speed, atmospheric pressure, cloudiness, and precipitation. Weather conditions change quickly, for example it may be sunny and dry in the morning; rainy and cool in the afternoon.

But climate is the average, or typical, weather conditions of a given area observed over a long period of time, usually 30 years or more. Climate is slower to change, but the implications of change are far reaching. Season is a traditional division of the year based on distinctive weather conditions. In temperate regions, there are four seasons, spring, summer, autumn, and winter, while in tropical zone there are often only two, a dry season and a rainy season. For instance, in Rwanda there are two seasons which occur in four times per year (small rainy season from September to December, small dry season from January to February, great rainy from March to Mid-June and great dry season from Mid-June to September).

7.2 Causes of global warming

Since long time, some climatologists have argued that the observed warming is only the result of natural phenomena (such as changes in solar activity and that of the Earth's orbit). According to 4th IPCC report (2007), it is in 1979, during the First World Climate Conference, that the issue of impact of human activity on climate was raised for the first time on the international stage. Today, many scientists agree that global warming is attributed to the release of specific gases by the action of mankind.

Specific gases called green house gases (GHG) such as dioxide of carbon (CO_2) capture more heat than others and these gases that have been released in larger numbers since the Industrial Revolution. These gases are released in a number of industrial processes from the operation of automobiles to the operation of many varieties of power plants.

Students were requested to designate whether the statement concerning the causes of global warming is true or false. Details of their responses are depicted in Table 3 below.

Table 3: Respondents' perception on causes of global warming based on demographic factors

	Global warming has natural and manmade causes			
1. Sex of respondents	True	False	Total	x^2 value
	n= 86	n=21	n= 107	P= 0.05
	%	%	%	df=1
Female	76.6	23.4	100	
Male	86	14	100	
% of Total	80.4	19.6	100	0.22
2. Educational level of respondents				
Year 1	83.3	16.7	100	x^2 value
Year 2	75	25	100	P= 0.05
Year 3	91.7	8.3	100	df=3
Year 4	76.9	23.1	100	
% of total	80.4	19.6	100	0.60
3. Departments of respondents				
Accounting	77.8	22.2	100	x^2 value
Finance	81.8	18.2	100	P= 0.05
Rural development	100	0	100	df=4
Law	50	50	100	
Development Studies	87.5	12.5	100	
Total	80.4	19.6	100	0.36

According to results from Table 3, the majority of respondents from all gender (80.4%), educational level (80.4%) and departments (80.4%) agree that global warming has both natural and manmade causes. From the percentages displayed in this table, it is seen that male students have the tendency to agree with the statement (86% of male compared to 76.6% female).

 Concerning educational level, respondents who recognized that global warming has both natural and manmade causes are surprisingly students of Year 3 (91.7%). They are followed by students of Year 1 (83.3%). Students from Year 4 and Year 2, come in last position (76.9% and 75% respectively) although among them there are students from Year 2 of development studies and rural development who are supposed to know more because they have a course of environment management in their curriculum.

Then, the Chi-Square test results showed that there is no significant difference in opinion within respondents by gender, educational level and departments. This infers that those demographic features do not influence the knowledge of global warming's causes of participants in this research.

Perception and knowledge could be due to personal information of respondents.

According to UNESCO (1977), mass media which is the one part of non-formal education play a key role in creating widespread environmental awareness and concern. In several countries many extracurricular or informal environmental education have been carried out. These include school clubs, excursions; study tours, field studies, lectures on environmental topics, for the sake of increasing environmental consciousness. Besides to this mass media, radio, television, films and the press could have played a very important role in many countries for the dissemination of environmental information.

In Rwanda it is generally agreed that the root cause of environmental degradation is the high population density. This implies that the phenomena of climate change are related to population growth. Actually, increase of population entails the multiplication of activities in order to seek how to survive, such as deforestation (cutting and burning forests) for agriculture, increased use of vehicles and industrialization provoke atmospheric pollution.

NISR (2012) highlighted that understanding population growth and surrounding topics are an important starting point when thinking about Rwanda and the state of its environment. According to World Resource Institute (WRI), (2011) quoted in National strategy for climate change report (2011), Rwanda has one of the lowest GHG emissions per capita in the world, estimated at 0.6 tCO2e/person compared to a global average of 6.7 tCO2e/person, including land use change, in 2005.

But Green House Gases (GHG) emissions have shown an upward trend, from 2,896 Gigagrammes (Gg) in 2003 to 5,793 Gg in 2006 and are likely to continue to rise. Congruent with NISR (2012), the amount of C02 emissions is in permanent evolution because it shifted respectively from 740, 790, 840 up to 890 Tons per capita and per year respectively in 2008, 2009, 2010 and 2011.

7.3 Global warming's consequences

According to Net Science of Nature (2014), global warming is a phenomenon that is a type of climate change. Because the effects of global warming can contribute to further warming it has the potential to create very long-term and dramatic climate change. In the same way the 4th IPCC report (2007) highlighted that among consequences of global warming on which scientists agree is a

rise of sea level due to its warming and its addition of extra water from the melting of continental icecap.

Then the report emphasized that absolute humidity of the air should increase and consequently precipitation also should increase. So, students were requested to state which of the following items are consequences of global warming.

Table 4: Respondents' perception on consequences of global warming based on demographic characteristics

	Consequences of global warming					
1. Sex of respondents	Climate change	Rising of sea level	Destruction of ecosystems	All above	**Total**	x^2 value P= 0.05 df=3
	n= 46	n=14	n= 24	n=23	n=107	
	%	%	%	%	%	
Female	53.1	12.5	17.2	17.2	100	
Male	27.9	14	30.2	27.9	100	
% of Total	43	13.1	22.4	21.5	100	0.06
2. Educational level of respondents						
Year 1	44.4	16.7	19.4	19.4	100	x^2 value P= 0.05 df=9
Year 2	45	10	30	15	100	
Year 3	41.7	8.3	16.7	33.3	100	
Year 4	41	12.8	23.1	23.1	100	
% of total	43	13.1	22.4	21.5	100	0.96
3. Departments of respondents						
Accounting	46.7	13.3	17.8	22.2	100	x^2 value P= 0.05 df=12
Finance	40.9	15.9	18.2	25	100	
Rural development	50	0	33.3	16.7	100	
Law	0	25	75	0	100	
Development Studies	50	0	37.5	12.5	100	
Total	43	13.1	22.4	21.5	100	0.37

Table 4 results show that overall; more than 40% of the gender, educational level and department factors agree that global warming leads to climate change.

And as always seen in Table 4 other responses are scattered in rising of sea (13.1%), destruction of ecosystems (22.4%) and all above (21.5%). Actually all items listed below are consequences of global warming.

No demographic factors seemed to be significant in any way from the Chi-Square analysis, except only within the gender factor which shows a slight significant difference of opinion between male and female (see p-value computed of 0.06).

In Rwanda as stated earlier, the impacts of global warming entail climate change which affects in its turn people differently depending on the areas and types of activities. The vulnerability to climate change is in large part defined by its exposure to the various impacts with droughts, floods, landslides, changes in rainfall regime, thunderstorms and rising of temperature as the main drivers. According to SNC (2012), this disturbance confuses farmers on planting dates. As a result, they cultivate late with the risk of an early onset of the dry season, before the harvest. Thus, it is observed lower yields, intensification of crop diseases, and reduction of irrigation water.

Floods recently observed in the Northwest of the country caused loss of food production and displacement of human lives, leaving people homeless and without food. The observed floods in the marshes of the Nyabarongo and Akanyaru rivers during the months of April-May destroy crops. Drought is the mostly encountered shock in many parts of the country especially in the South-Eastern part of the country where it appears as the major

factor of vulnerability.

In terms of health, SNC (2012) reported that Malaria continues to affect the health and the national development. Despite a significant reduction in malaria mortality and morbidity since 2007, malaria remains the second leading cause of mortality and is responsible for 23.27% of all deaths registered in the country, of which 11.5% were due to severe malaria. Theoretically, ecology of mosquito could not go beyond 1,500 meters of altitude but today people of Musanze (situated at more than 3000 m of altitude) and Gicumbi (2,300 m) are experiencing malaria, problem which did not exist there almost 30 years ago.

Regarding impact on natural ecosystems, students from development studies (37.5%) were the first to point out the issue. They were followed by students from rural development (30%). According to SNC (2012), in Rwanda, natural ecosystems such as supramontane forest areas in the North and West provinces constitute the most threatened areas. Ecosystems bordering the region in question are averagely endangered (plantations).

Among biotic noxious agents, folivoracious and subcortical insects prevail in the planar and collinear areas as it was the case of Bugesera in the years 1998-2002, due to the increasing temperature and low humidity of soil, favorable for the growth of noxious insects in this region.

Many people continue to consider these disasters as myths and legends, like the flood story of Noah period is considered. So, as future cadres, students must understand the global warming issues and its causes, the likelihood and severity of the impacts, how the risks may affect people individually and collectively.

Conclusion

The results from all the tables (2-4) between global warming issues and demographic factors show that the perception and knowledge of respondents are in average at low level. In addition, the Chi-Square test results show that there is no significant difference in opinion within respondents by gender, educational level and departments except only within the gender factor where it is observed a significant difference between male and female and slightly mixed within respondents by departments concerning the meaning of global warming (see Table 2).

This infers that many more students had gained information on climate change issues from electronic mass media than from the formal education. This implies that there is a need for relevant courses on the global warming issues interface that should be included in the curriculum. The researchers believe that formal Environmental Education for sustainability could help young learners to achieve awareness, knowledge, attitude and responsible behaviour about environmental issues, especially climate change issues. Anderson (2012) stated that given the world's limited natural resources, rising population and the climate change challenge, sustainable development cannot be attained without education that equips learners with the skills needed to live healthy, safe and productive lives in the 21st century, while also safeguarding the ability of future generations to meet their own needs.

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CITIZENS' PARTICIPATION AND SUCCESS OF DECENTRALIZED SERVICES DELIVERY SYSTEMS IN RWANDA: A CASE STUDY OF RUBAVU SECTOR

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ABSTRACT

This study examines the relationship between citizens' participation and success of decentralized services delivery systems in Rwanda, using Rubavu Sector in Rubavu District as a case study. The researcher used both a case study and survey research design. A questionnaire (self-administered) was used as the main method of data collection. Nevertheless, informal interview data collection method was also used to supplement and validate data that were generated through the questionnaire.

The study findings made four main revelations. First, citizens in Rubavu Sector participate in various decentralized services delivery systems in areas of Health, education, drinking water and sanitation, justice, agricultural extension, seeds and roads. Second, citizens in Rubavu Sector use two modes of participation, namely; direct participation at lower level, and representation (by elected Representatives) at the Sector Level.

Third, to participate in decentralized services delivery systems, citizens in Rubavu Sector follow several procedures including, appearing for public hearing, attending meetings in person and airing out their views freely, deciding on priorities through voting (and use of majority vote rule to make significant decisions), and use of representatives to air out their views at the Sector Level. Fourth, citizens' participation in Rubavu Sector greatly promotes to the success of decentralized services delivery systems. It should, however, be noted that notwithstanding the foregoing, the study revealed as well that several measures are required to make citizens' participation more vibrant in enhancing the success of decentralized services delivery systems, in Rubavu Sector, in particular, and Rwanda in general.

The researcher, therefore, recommends as follows. First, Local Governments should increase the level of sensitization to make citizens more aware of the importance of decentralized services delivery systems so that they can participate actively. Second, Local Governments should endeavor to implement the lower level decisions/views, more so when and if they are genuine and reasonable. Third, leaders of the Local Governments should be more transparent and more accountable to the citizens at the grassroots. Fourth, citizens themselves at the local level should endeavor to get more information about the decentralized services delivery systems that benefit them.

Fifth, Central Government should work hand-in-hand with Local Governments and citizens to strengthen accountability and transparency. Sixth, Central Government should work hand-in-hand with Local Governments to reactivate local people to initiate, implement and monitor decisions and plans that concern them. Finally, Central Government should enhance responsiveness of public administration to the local environment/people.

1. Introduction

Participation is involvement by a local population and, at times, additional stakeholders in the creation, content and conduct of a program or policy designed to change their lives. Built on a belief that citizens can be trusted to shape their own future, participatory development should use local decision making and capacities to steer and define the nature of an intervention.

Participation, particularly and explicitly participation of the poorest and most vulnerable participants is a human right and an inherent and indivisible component of pro-poor development strategies and empowerment.

Participation of the main stakeholders increases the accuracy of information and relevance to the realities of peoples' lives and policy decision and implementation processes.

1.1 Background of the study

The experience of the war and genocide in 1994 made it clear that poor governance was at the root of Rwanda's tragic history. Since then, the government was characterized by concentration of powers in the hands of few individuals at the central government level. This has been confirmed by the Ministry of Local Government and Social Affairs (2000), arguing that "The current political, economic and social situation of Rwanda is a direct consequence of the recent political and administrative history of the country the apex of which was the cataclysmic genocide of 1994, a genocide planned and effectively executed by the communities and agents of the state". Those individuals had all the power in their hands and could decide whatever they wanted without the population's participation in terms of governance and in all decisions related to the development of the country.

Related to this was the inappropriate highly centralized dictatorial governance of the colonial and post-independence administration of the country excluded the population from participating in the determination of their political, economic and social wellbeing (Ministry of Local Government and Social Affairs, 2000).

Given the foregoing, with the increased demand for embracing of Structural Adjustment Programmes in the 1990s, Rwanda embarked on enactment of the decentralization Policy which, was finally enacted in 2000. To Rwanda's Government, Decentralization was viewed, and is still viewed as important because it gives opportunities to the local citizens, especially at the grass roots level, to participate in matters of their concerns like identifying their own problems and propose solutions to them.

According to Luhring (1975), in order to improve the economic performance in rural areas, many African governments have launched programs of administrative decentralization. Despite this, many of them have not successfully achieved their objectives because of poor implementation process.

For Kiros (1985), if projects undertaken in any locality aim at improving the welfare of the local people, then their involvement at every stage of local projects is not only vital but imperative for the success of that project. To be genuine and effective, local participation, whether on economic, political or social orientation, has to be based on three basic principles, namely; participation in information, power, and services delivery systems. Administrative decentralization if sufficiently implemented can reduce poverty. This can be done only when the local citizens are involved in identifying, management and implementation of projects that are essential to them.

It is impossible to enjoy a durable development if the local citizens have no role in planning for their development processes. As it has been mentioned above, the local citizens had been excluded from all process of development related to their wellbeing. However, the government tried to implement some projects in terms of development regardless of the participation of the people concerned by the same projects. Even if something good could happen due to the kind of these projects, it could not be sustainable because the beneficiaries and future managers who are the local people had not been motivated and so they were not initiators of the projects concerning their livelihood.

Now that Rwanda took on decentralization, in particular services delivery systems, the researcher wanted to establish the relationship between citizens' participation and the success of decentralized services delivery systems in Rwanda.

1.2 Statement of the problem

Rwanda is one of the developing African countries that embraced decentralization of services delivery systems in 2000. Prior to this period, the government of Rwanda was characterized and dominated by over centralization of almost all services delivery systems, which, consequently, and inevitably, led to, among others, inadequate participation of the majority of the population in the making of decisions that concern(ed) their livelihood; and passivity, lack of initiative and dependency syndrome on the part of the majority of population, caused especially by over centralization and exclusion from participation (Ministry of Local Government and Social Affairs, 2000).

In an attempt to mitigate the foregoing and other anomalies that characterized over centralization of government and services,

the government of Rwanda, in 2000, introduced the National Decentralization Policy and decentralization of services delivery systems in particular. This, among others, was meant to ensure and solicit for adequate participation of the majority of the population in decision-making, especially in matters that concern their livelihood; and to bring about a proactive, innovative and a self-reliant population which could be achieved through vibrant participation of citizens in most, if not all, decentralized services in general, and decentralized services delivery systems, in particular.

The foregoing stanced the researcher with several queries: what kinds of decentralized services delivery systems do citizens participate in, in Rwanda? What modes of participation do citizens use in decentralized services delivery systems in Rwanda? What procedures are followed by citizens when they participate in decentralized services delivery systems in Rwanda? Does citizens' participation promote the success of such decentralized services delivery systems? Unfortunately, the researcher could not get the empirical answers to the foregoing queries, and therefore had to do research to get actual facts on ground, using a case study of Rubavu Sector, Rubavu District, in the Western Province of Rwanda.

1.3 Research questions

To achieve the foregoing objectives, the researcher used the following research questions.

a) What are the various decentralized services delivery systems in which citizens participate in Rubavu Sector?

b) What are the various modes of participation used by citizens in decentralized services delivery systems in Rubavu Sector?

c) What procedures do citizens follow when participating in decentralized services delivery systems in Rubavu Sector?

d) In what ways, if any, does citizens' participation promote the success of decentralized services delivery systems in Rubavu Sector?

1.4 Purpose and objectives of the study

1.4.1 Purpose of the study

The study sought to examine the relationship between citizens' participation and success of decentralized services delivery systems in Rwanda, using Rubavu Sector as a case study.

1.4.2 Objectives of the study

The study was guided by the following objectives.

a) To establish the kinds of decentralized services delivery systems in which citizens participate in at Rubavu Sector.

b) To identify the modes of participation used by citizens in the decentralized services delivery systems in Rubavu Sector.

c) To analyze the procedures followed by citizens to participate in the decentralized services delivery systems, and,

d) To establish whether, or not, citizens' participation promotes the success of decentralized services delivery systems in Rubavu Sector.

1.5 Significance of the study

a) The findings of this study will generate useful information that may contribute to finding solutions to the success of decentralized services delivery systems as the best policy for development in Rwanda and beyond.

b) This research will promote awareness for carrying out a comprehensive research on various parameters of citizens' participation and success of decentralized services delivery systems.

c) The study will also provide to policy makers, local government practitioners and other stakeholders with recommendations which can be used to achieve a better society and improve livelihoods while local people are initiated in decision-making.

1.6 Conceptual framework

Figure1. Conceptual Framework

Intervening Variables
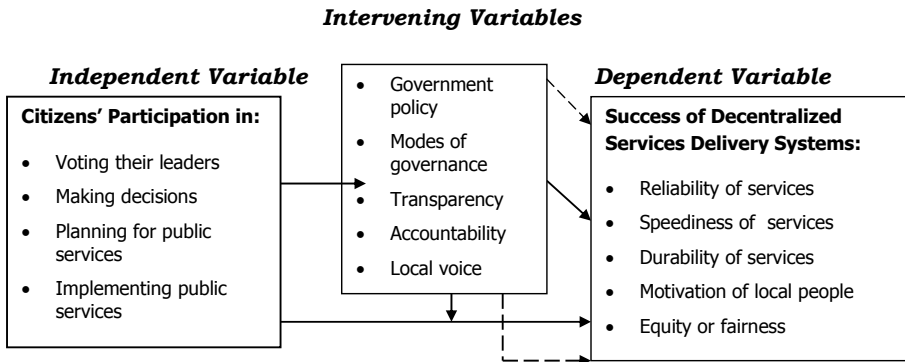
Source: Researcher generated Diagram

KEY

⟶　　**Positive Relationship**

------►　　**Negative Relationship**

In the above Conceptual Framework, citizens' participation is hypothesized to influence the success of decentralized services delivery systems. This can be reached when the intervening variables are favorable.

Citizens' participation could influence the success of decentralized services delivery systems only when the intervening variables intervene positively otherwise there will be a negative influence. It is said that citizens' participation influence positively the success of decentralized services delivery systems when characteristics of citizens' participation.

The researcher wants to establish whether the conceptual framework fits in what happens in Rubavu Sector in view of citizens' participation and the success of decentralized services delivery systems.

1.7 Theoretical framework

This study was modeled on the Theory of "The Plan is the People's Plan" advanced by the Republic of Zambia (1971) in its Second National Development Plan. The theory was used by Chambers (2007: 86). The Theory postulated that when the people are the initiators and planners of an activity or a project, they will have a decision-making role, which may be theirs exclusively, or joint with others, on a specific issues of a policy or project. Thus, they will count more and more on services delivery systems which they are sure that is for them and the best will be its results for their livelihood.

The only meaningful way to let people feel responsible of all decentralized services delivery systems and enjoy its results for long is the participatory approach where people themselves participate in planning and management of policies and projects related to their livelihood.

As adapted in this study, the "Participation in Planning" Theory holds that, decentralization of services delivery systems influences the internal efficiency of the local people by choosing their priority needs and making decisions concerning the development of their area. The study was to prove whether or not, the foregoing Theoretical framework fits in what happens in Rubavu Sector in view of citizens' participation and the success of decentralized services delivery systems.

2. REVIEW OF RELATED LITERATURE

2.1 Citizens' participation

The term citizen participation in terms of development is defined by DFID (2000) as enabling people to realize their rights to participate in, and access information relating to, the decision-making processes which affect their lives.

The term citizens' participation is a multidisciplinary one, and it falls into four major areas of democratic theory, namely, political behaviour, community development, citizen action and government initiated citizen action (Checkoway & Til, 1978:60). Consequently, there are variations in terminology and definitions. For instance, terms like popular participation, community involvement, public participation and citizen participation are often used.

2.2 Decentralization of services delivery systems and citizens' participation

Decentralization of services delivery systems has, not only an administrative value, but also a civic dimension, since it increases the opportunities for citizens to take interest in public affairs; it makes them get accustomed to using freedom. The mere fact of opting for decentralization of services delivery systems shall not by itself ensure that the population effectively participates in its development which is the ultimate goal of a good policy of decentralization and good governance. It is important to set up mechanisms reassuring the participation of the population (Boeninger, 1992).

In his definition, Kauzya (2008) stressed that decentralization is no new item on the agenda of policymakers, but is now taking place in a different, arguably more favorable context in political terms.

However, "the decentralization policies that are underway in a number of less developed countries are conceived, on the one hand, under the constraints imposed by conditions of multilateral or bilateral donors, and on the other, to tackle political conflict linked to national resource management and redistribution, or else with the objective in mind of increasing people's participation in managing of services delivery systems interventions or local affairs (FAO, 1997).

Political decentralization is best conceived within these two frameworks so that the power and authority to decide is not limited to electing leaders or representatives but includes the full range transfer of decision-making from central government to local governments/authorities/communities (Kauzya, 2008).

The involvement of citizens in development planning and implementation enables the formulation of realistic plans that are in line with local circumstances and conditions. Administratively, decentralization is considered as a key strategy that provides solutions to overloaded and over-centralized agencies (Boeninger, 1992).

The decongestion of the workload at the centre promotes cost-effectiveness and greater coordination and efficiency in public resource utilization, service delivery and local development. For instance, by giving local institutions the power to make some decisions without constantly referring to the top levels, delays are minimized and responsiveness in development or project

management is enhanced since decisions are flexible and adjusted to respond to circumstances on the ground. In addition, decentralization is regarded as a means of facilitating the even distribution of resources and minimizing development regional inequalities (Omiya, 2000).

For instance, as an economic intervention, the decentralization process entails establishing or decentralizing small-scale projects close to the grassroots. In the worst of cases, the objectives of decentralization have not been achieved because of the seizure of decentralization measures by local elites, or their co-option of individuals to whom increased power has been devolved under new decentralization laws, but the reasons for falling short of envisaged outcomes are varied and complex.

2.3 Success of decentralized services delivery systems

Political factors are of intrinsic importance to decentralized service delivery for several reasons. It is widely accepted that political commitment on the part of federal or state governments is a sine qua non of effective democratic decentralization, and especially forms of decentralization that are specifically geared to the interests of the poor (Crook, 2001; Blair, 2000).

Cahn and Camper (1968) suggest there are three rationales for citizen participation. First, they suggest that merely knowing that one can participate promotes dignity and self-sufficiency within the individual. Second, it taps the energies and resources of individual citizens within the community. Finally, citizen participation provides a source of special insight, information, knowledge, and experience, which contributes to the soundness of community solutions. The result is an emphasis on problem solving to eliminate deficiencies in the community.

In its National Decentralization Policy (2000), the Government of Rwanda acknowledges that local communities have better experience and knowledge about their environment. They can therefore better identify their development needs and potentials. The Decentralization Policy has been specifically designed to empower local governance structures with appropriate autonomy to bring public administration closer to the people, and to make local governance accountable to the electorate.

The capacity of citizens to participate in planning, implementing, monitoring and evaluating sustainable poverty reduction and socio-economic development with their collective and individual potentials must therefore be reinforced.

Decentralized governance is effectively strengthened and rendered more accountable when citizens' participation is encouraged, facilitated and institutionalized. Communities, neighborhoods and individuals can play a crucial role in ensuring that local government responds to their needs by participating in the planning, implementation and monitoring of activities and projects affecting their lives and eventually impacting the level of human development they maintain (UNDP, 1999).

3. Methodology

3.1 Introduction

The present chapter presents the methodology that was used in the study. Specifically it entails the research design, target population, sample size, sampling techniques, data collection methods, data analysis, data quality control and concludes with the research procedure

3.2 Research design

A case study and survey research designs were used. A case study was used for two main reasons: First, it gave the researcher an opportunity to do an in-depth analysis of Rubavu Sector which could make it possible to understand the issues under investigation deeper and better. Second, since the researcher could not study the entire country of Rwanda due to limitations of funds and time, a case study which zeroed to Rubavu Sector was viewed and used as a better substitute. The survey design was used within the case study to ensure that as many citizens as possible were incorporated in the sample to make it more representative and generalizable to the entire target population.

3.3 Scope of the study

The study was done in Rubavu Sector which is located in the Western Province, in Rubavu District. The study was conducted between December 2008 and April 2009. It mainly focused on establishing and analyzing the relationship between citizens' participation and success of decentralized services delivery systems in Rwanda, particularly in Rubavu sector.

3.4 Target Population

The study targeted the entire population of Rubavu Sector. In the "Rubavu Sector, January 2009 Annual Report", the Sector had a population of 23456 with about 6689 households and it is composed of seven cells and 35 villages. The entire population of Rubavu Sector was therefore targeted.

3.5 Sample size

All the seven cells in Rubavu Sector were selected. From seven cells, 372 households as respondents were randomly selected and that is the total numbers of the sample size. The researcher was guided by Amin's book (see appendix A) to determine the sample size; hence, from 6689 households in Rubavu Sector, the researcher selected 372 households as representative sample of the whole population. In addition, the researcher added one Executive Secretary of Rubavu Sector, Seven Coordinators of Cells, and Seven Executive Secretaries of Cells for the interview, hence, making a total sample size of 387 respondents. Table II shows the sample selected from each of the seven Cells in Rubavu Sector.

Table 1: Sample size drawn from each of the Seven Cells in Rubavu Sector.

Cells	Number of households in each cell	Number of household sample selected from each cell
Bulinda	913	53
Buhaza	462	53
Byahi	1050	54
Gikombe	957	53
Murambi	1703	53
Murara	766	53
Rukoko	838	53
Total	**6689**	**372**

Source: Data from the Field, February 2014

3.6 Sampling Techniques

A random sampling technique was used to select the category of respondents to be included in the sample. Random sampling technique was mainly used to ensure that each member of the target population had an equal and independent chance of being included in the sample. Therefore, generalizations were used basing on information generated from the randomly selected respondents.

3.7 Methods of Data Collection

The study used three methods of data collection, namely: self-administered questionnaires, informal interview and document review. The selection of these tools was guided by the nature of data to be collected, the time available as well as by the objectives of the study. The overall aim of this study is to examine the relationship between citizens' participation and success of decentralized services delivery systems in Rwanda, particularly in Rubavu Sector. The researcher was mainly concerned with views, opinions, perceptions, feelings and attitudes. Such information could be best collected through the use of questionnaires and informal interview techniques (Bell, 1993; Touliatos & Compton, 1988) cited by Oso and Onen (2008).

3.8 Data Analysis

Primary data were collected from the respondents in sampled households and secondary data were generated through documentary review. Data were organized in a more meaningful and interpretive way to answer to the study objectives and research questions. After being collected from the field, data were organized and sorted using percentages, tables and tabulation - by putting similar findings in one category and dissimilar in another; this was possible with the use of coding.

3.9 Quality Control

To ensure validity of the questionnaires and interview guides, the researcher presented them to 10 academic experts including the supervisor. Nine of these approved the validity of the research instruments.

Content Validity Index (CVI) = (Number of judges declared item valid)/(total number of items)

9/10=0.9

According to Amin (2005), for the instrument to be accepted as valid, the Average Index should be 0.7 or above, which confirms ours to be valid because it is 0.9 which is beyond 0.7.

To establish the reliability of the questionnaire, the researcher gave out 10 questionnaires to 10 respondents for pre-testing purposes, which they filled and were collected by the researcher. One week after, the same questionnaire was again given to the same 10 respondents; and the responses were basically the same. This helped to reveal to the researcher that the questionnaire instrument was reliable.

4.   Findings

Table 1: Decentralized services of which people participate in.

Services	Frequency	Percentage
Health	300	80.65
Education	369	99.19
Drinking water and sanitation	345	92.74
Justice	320	86.02
Agricultural extension	364	97.85
Seeds	368	98.92
Roads	362	97.31

Source: Data from the Field, February 2014

The study findings made it clear that citizens in Rubavu Sector participate in various decentralized services delivery systems in areas of Health, education, drinking water and sanitation, justice, agricultural extension, seeds and roads.

Looking at the results in the table above it is remarkably shown that the majority of respondents beyond 80% confirmed their permanent participation in all those mentioned decentralized services.

Table 2: Type of modes in which people participate in service delivery

Type of mode	Frequency	Percentage
Direct participation at lower level	372	100
Representation (by elected Representatives) at the Sector Level	372	100

Source: Data from the Field, February 2014

People in Rubavu Sector use two modes of participation, namely; direct participation at lower level, and representation (by elected Representatives) at the Sector Level that was confirmed by all respondents.

Concerning the mode of direct participation, depending on the nature of the service people in a public assembly gather at the cell level and contribute in giving there ideas on and how the issue must be addressed. If it is a matter of projects for their development again they the ones to choose which according to their will and their priority.

For the representation, when the issue is to be addressed at the sector it then the elected representatives have to go to the sector for discussing with other representatives from different other cells on issues regarding the development of the sector.

To participate in decentralized services delivery systems, citizens in Rubavu Sector follow several procedures including, appearing for public hearing, attending meetings in person and airing out their views freely, deciding on priorities through voting (and use of majority vote rule to make significant decisions), and use of representatives to air out their views at the Sector Level.

Citizens' participation in Rubavu Sector greatly promotes to the success of decentralized services delivery systems. It should, however, be noted that notwithstanding the foregoing, the study revealed as well that several measures are required to make citizens' participation more vibrant in enhancing the success of decentralized services delivery systems, in Rubavu Sector, in particular, and Rwanda in general.

On whether the foregoing procedures promote citizens' participation, 93.01% of respondents argued that the procedures indeed favour their participation as showed in table1.

Table 3: Whether or not, procedures promote citizens' participation in Rubavu Sector.

Question	Response	Frequency	Percentage
Do those procedures favour/promote	Yes	346	93.01
	No	26	6.98
	Total	**372**	**100**

Source: Data from the Field, February 2014

The study revealed that 93.01% of the respondents confirmed that the procedures favour their participation. Why? Because of the following:

a) Those procedures favour because people at grassroots decide on what to be done in matters concerning their lives.

b) They favour because the results that will come from development projects shall match with local people needs.

c) They favour because local people feel responsible in their development process.

d) They favour because the local people are involved in planning and shall also be involved in the management of their own services.

Some of the respondents (6.9%), however, answered negatively by saying that the procedures don't favour citizens' participation in Rubavu Sector. Why? Because of the following:

a) They don't favour because local people are not wise enough in order to decide on very important projects like education, health care, modern infrastructures, etc. This is mainly because majority of them is primary school levels who are not articulated enough.

b) They hinder/inhibit because local people get bored when some decisions taken by them are not implemented.

c) They don't favour because some local people don't trust their local leaders.

d) They hinder because People are reluctant to participate in community activity when they do not have enough information to act responsibly.

5. Discussion of findings

The present sub-section explores findings in comparison to the existing related literature discussed.

5.1 Decentralized services respondents participate in, at Rubavu Sector

According to Boeninger (1992), the involvement of citizens in development planning and implementation enables the formulation of realistic plans that are in line with local circumstances and conditions. Administratively, decentralization is considered as a key strategy that provides solutions to overloaded and over-centralized agencies. As it has been highlighted by Ministry of Local Government and Social Affairs (2000), the overall objective of the decentralization policy is to ensure political, economic, social, managerial/administrative and technical empowerment of local populations to fight poverty by participation in planning and management of their development process.

Services delivery systems in which citizens ought to participate, according to UNDP (1999), are often equated with public goods like health, education, drinking water and sanitation and are the most common forms of services provided by local governments. The findings from the field were in conformity with the literature in the following words: Respondents after confirming that the services delivery systems are now decentralized in Rubavu Sector at more than 80% in all services. The following are the decentralized services delivery systems they participate in: Health, education, drinking water and sanitation, justice, agricultural extension, seeds and roads. This is in agreement with what UNDP (1999) noted, as highlighted above.

5.2 Modes of citizens' participation

According to UNDP (1999), some examples of modes of citizens' participation are mentioned from different countries: in Pakistan squatter settlements normalization, the mode of participation used was "Squatter settlement participation in planning, improving and managing their own services". In Jordan education, the mode used was "The Local Parental Council and the committees of Educational Development". In Brazil municipal health, the mode used was "Open community level forums with management".

Likewise, the citizens' participation in the case of Rubavu sector is also guided by two modes of participation, including: Direct participation at the cell level and through representatives at the sector level where the sector council members are the representatives of the citizens interests in decision making process. At this level, the most pertinent issue is that all respondents themselves have given a common answer that their participation in decentralized services delivery systems starts at lower level. It is at the cell level where they directly participate in planning, managing and controlling the development affairs i.e. identifying and prioritizing needs.

5.3 Procedures of citizens' participation

Nsibambi (2000) noted that in assessing community participation, some of the local issues are: procedures and actors at the various stages of the programmes. Participation in consulting, identification, selection, implementation, management of utilities are some of the aspects highlighted.

According to the Republic of Rwanda (2006), in order for decentralized service delivery to happen, local governments will incorporate participatory approaches to promote bottom-up planning where communities can decide what their development needs and priorities are.

Findings from Rubavu Sector about citizens' participation procedures are in conformity with the foregoing authors because respondents revealed the following procedures to participate in Rubavu Sector decentralized services delivery systems: First, is public hearing. Here citizens have to address their views in regular meetings. At the cell level, citizens give freely their ideas and select services they find very relevant to meet their needs according to the nature of their region.

Second, while in meetings citizens are given chances to freely give out their views but in an organized manner. They should follow the instructions given by the chairpersons of such meetings and should follow the agenda adopted at the beginning of the meeting.Third, to decide on priorities and/or to vote, they follow the majority only i.e. an issue is only voted or declared a priority if it receives majority voter support. Fourth, at Sector level, representatives decide and participate on behalf of the rest of the citizens. What is decided on by representatives is bound to be accepted by the citizens as their decision.

5.4 Successful services delivery systems

The decongestion of the workload at the centre promotes cost-effectiveness and greater coordination and efficiency in public resource utilization, service delivery and local development. For instance, by giving local institutions the power to make some

decisions without constantly referring to the top levels, delays are minimized and responsiveness in development or project management is enhanced since decisions are flexible and adjusted to respond to circumstances on the ground. In addition, decentralization is regarded as a means of facilitating the even distribution of resources and minimizing development regional inequalities (Omiya, 2000).

By looking at what was said by UNDP (1999), he argued that decentralized governance is effectively strengthened and rendered more accountable when citizens' participation is encouraged, facilitated and institutionalized.

However, if we compare this to the answers given by Rubavu citizens, it is remarkable that the decentralization of services delivery systems in Rubavu Sector is successful. How? In the following words:

a) Ownership (reduction in redundancy)
b) Representation in decision making (by the Sector Council Members)
c) Mobilization of resources
d) Attendance in regular meetings
e) Accountability
f) Reporting corrupted local government agents
g) Workshop and trainings

Here, the reason is that the beneficiaries are involved in the planning of their services which makes those services of good quality and reliable. This match with what UNDP (1999), said, "Communities, neighborhoods and individuals can play a crucial role in ensuring that local government responds to their needs by participating in the planning, implementation and monitoring of activities and projects affecting their lives and eventually impacting the level of human development they maintain".

6. Conclusions

From the findings, the researcher makes the following conclusions.

a) Citizens in Rubavu Sector participate in various decentralized services delivery systems which, among others, include; Health, education, drinking water and sanitation, justice, agricultural extension, seeds and roads (services delivery systems).

b) In Rubavu Sector, citizens use two modes of participation namely: direct participation and representation. Direct participation is used at Lower/Cell Level while representation is used at Sector Level.

c) In Rubavu Sector, citizens use the following procedures to participate in decentralized services delivery systems: first, is pubic hearing; second, while in meetings, citizens are given chances to freely give out their views but in an organized manner; third, to decide on priorities and/or to vote, they follow the majority rule; fourth, at sector level, representatives decide and participate on behalf of the rest of the citizens.

d) Citizens' participation in Rubavu Sector has increased the success of decentralized services delivery systems in Rubavu Sector. How? Through ownership and continuous support of the decentralized services delivery systems, representation in decision making (by the Sector Council Members), mobilization of resources, attendance in

regular meetings, accountability, reporting corrupted local government agents, and participating in Workshop and trainings.

7. Recommendations

The researcher, therefore, recommends as follows. First, Local Governments should increase the level of sensitization to make citizens more aware of the importance of decentralized services delivery systems so that they can participate actively. Second, Local Governments should endeavor to implement the lower level decisions/views, more so when and if they are genuine and reasonable.

Third, leaders of the Local Governments should be more transparent and more accountable to the citizens at the grassroots. Fourth, citizens themselves at the local level should endeavor to get more information about the decentralized services delivery systems that benefit them. Fifth, Central Government should work hand-in-hand with Local Governments and citizens to strengthen accountability and transparency. Sixth, Central Government should work hand-in-hand with Local Governments to reactivate local people to initiate, implement and monitor decisions and plans that concern them. Finally, Central Government should enhance responsiveness of public administration to the local environment/people.

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