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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 35th 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.

The paper by Dr OKOKO OSAMBO, Dr RUTUNGWA Eugène, RWAMUCYO Arnaud and NSENGUMUREMYI Jean Guillaume states that profitability, tangibility, Size, age, liquidity and growth were statistical significant factors of capital structure of Rwandan commercial Banks in long run but Effective tax rate was found to have no statistical significant long run impact on Banks' capital structure in Rwanda.

The second paper whose title is "Influence of Subject Areas on Environmental Knowledge of Secondary Schools' Students in City of Kigali" was written by Boaz. M. KAGABIKA and Prof. F.L. ORACH-MEZA. It aimed at exploring what Rwandan students of secondary schools know about environment because environmental knowledge can be one of determinants of their future behaviours and actions towards addressing environmental issues. Additionally, from a sample of 250 students from 3 Districts of Kigali City (Nyarugenge, Gasabo

and Kicukiro); it was found that in general; environmental knowledge of students was still low. So the researchers recommended initiating specific programme of Environmental Education within secondary schools in order to have a greater consideration of students on environmental values.

The last paper but not least by Mr. NDIYAYE UWIMANA Innocent was themed "Promoting regional peace and security by governing instruments of conflict: a case of Rwanda"

This study stressed on one hand that the Government of Rwanda in its drive against the proliferation of SALW has recorded impressive achievements. Strategies adopted have been responding positively and global as well as regional instruments were the most significant guiding principles in trying to clamp down on the proliferation of SALW.

With sound National Action Plan and subsequent measures crafted, Rwanda has become a striking example in curbing the proliferation of SALW in a region marred by political violence. On the other hand, it expressed some weaknesses in uprooting SALWs by clearly showing that even though achievements have been recorded, challenges remain.

Hence regional cooperation on information sharing has to be strengthened. There is need for improved border management mechanisms by boosting cross-border cooperation. Effective strategies should be used to control various unauthorized entry/exit routes in the region by recognizing and enlisting the support as well as cooperation of bordering communities.

Dr. Sekibibi Ezechiel

Vice Chancellor of ULK

FACTORS DETERMINING BANKS' CAPITAL STRUCTURE:

EVIDENCE FROM SELECTED COMMERCIAL BANKS IN RWANDA

By:

Dr OKOKO OSAMBO , Dr RUTUNGWA Eugène, RWAMUCYO Arnaud and NSENGUMUREMYI Jean Guillaume

ABSTRACT

This study examined the factors determining the capital structure of commercial banks in Rwanda by using data of four sampled banks over the period of ten years (2006-2015). Since the data is secondary in nature, the quantitative approach to research was considered. Statistical and Vector Autoregression Model (VAR) were performed. Seeing that the selected variables are stationary at I(1) and cointegrated, we tested the stability of long run equilibrium relationship using Vector Error Correction Model (VECM).

The results indicated that the coefficient (speed of adjustment) carries the correct sign- negative and it is statistically significant at 5%, with the value of 0.94. Consequently, we found that Profitability, Tangibility, Size, Age, Liquidity and Growth were statistical significant factors of capital structure of Rwandan commercial Banks in long run but Effective tax rate was found to have no statistical significant long run impact on Banks' capital structure in Rwanda. Regarding to the consistency of capital structure theories, the results provide evidence in support of the Pecking order and Tradeoff theories of capital structure in Rwandan commercial Banks.

Keywords: Capital Structure, Commercial Banks, Tradeoff Theory, Pecking Order Theory, Signaling Theory, Time Market theory, Vector of Error Correction Model (VECM).

1. INTRODUCTION

Capital structure of Banks describes the way in which a Bank raises capital needed to establish and expand its business activities. It is a mixture of various types of equity and debt a Bank maintains resulting from its financing decisions. Exceptionally crucial is for someone to know how a Bank chooses its optimal mix of debt and equity capital. As one of the most important decisions made by financial managers, capital structure is at the center of many other decisions in the area of corporate finance. One of the many objectives of a corporate financial manager is to ensure low cost of capital and thus maximize the wealth of shareholders. Hence, capital structure is one of the effective tools to manage the cost of capital.

An optimal capital structure is reached at a point where the cost of the capital is minimal. But, what are the potential determinants of such optimal capital structure? This is the key question that has been answered by this research in the case of commercial Banks in Rwanda.

Research on factors determining the capital structure was initially directed mainly to firms in some countries. In the United States, the effect of asset structure, non-debt tax shields, growth, uniqueness, industry classification, firm size, earnings volatility and profitability on firm's choice of debt-equity mix was tested. Researchers (Rajan and Zingales ,1995) have attempted to find out whether the capital structure choices in other countries are made based on factors that similar to those capital structure influencing ones in U.S firms. In his research, Koert te Nijenhuis (2013) indicated that firm size and liquidity are the most important factors in determining leverage of Dutch companies.

Previous researches have mostly focused on non-financial firms, not many on that of financial institutions in general and on Banks specifically. This research tried to examine the factors determining the capital structure of Rwandan commercial Banks by using its internal factors. Rwanda differs from other developing countries previously studied in such a way it has a capital market that is seen to be at its initial stage with only seven registered companies namely: Bank of Kigali Ltd, Bralirwa Ltd, Crystal Telecom Ltd, Equity Group Holdings Ltd, KCB Ltd, Uchumi Supermarket Ltd and Nation Mediam Group Ltd which does not make things easier for firms to raise funds and choose the best mix of debt and equity sources.

Currently, there is no clear understanding on how commercial Banks in Rwanda choose their capital structure and what factors influence their corporate financing behavior. In their researches, Niyonzima S. (2014) and Rurangwa J. (2015) recommended further studies to examine the determinants of firms'capital structure in the context of Rwandan Banking industry.

Nevertheless, understanding the factors determining the capital structure is as important for Banks as for non-Banks firms. Thus, we are fascinated to conduct this study because of the following motives:

1. There is no clear evidence about the potential factors determining the capital structure of commercial Banks operating in Rwanda.

2. There is no clear evidence whether the financing decisions made by commercial Banks in Rwanda provide empirical support for the existing capital structure relevancy theories.

3. There is a lack of agreement about what would qualify as factors determining capital structure and lack of literature in the case of Rwanda.

Therefore, the purpose of this paper is to fill the stated gap by identifying the factors that determine capital structure decision and providing additional facts to the theories of capital structure relevancy evidencing commercial Banks in Rwanda.

Based on the main research objective of analyzing the factors determining the capital structure of Commercial Banks in Rwanda and on the primary research question posed of what are the factors that determine the capital structure of commercial Banks operating in Rwanda, the following alternative hypotheses were examined:

- $\mathbf{H}_{a1}$: There is a significant relationship between profitability and Bank leverage,
- $\mathbf{H}_{a2}$: There is a significant relationship between tangibility and Bank leverage,
- $\mathbf{H}_{a3}$: There is a significant relationship between size and Bank leverage,
- $\mathbf{H}_{a4}$: There is a significant relationship between age and Bank leverage,
- $\mathbf{H}_{a5}$: There is a significant relationship between liquidity and Bank leverage,
- $\mathbf{H}_{a6}$: There is a significant relationship between growth and Bank leverage,
- $\mathbf{H}_{a7}$: There is a significant relationship between effective tax rate and Bank leverage,

Against the null hypothesis (H_o) that there is no significant relationship between Bank leverage and various identified capital structure factors.

The rest of the paper is organized as follows: Section 1 provides a general overview of the research work and the objective of the study. Section 2 reviews the major literature on capital structure theories and determining factors. Section 3 presents the methodology employed in the study. Section 4 presents and discusses the empirical results of the study. Conclusion and recommendations are offered in section 5.

2. LITERATURE REVIEW

2.1 Theoretical Literature Review on Capital Structure

There are various theories that describe how capital structure of a firm is formed. These theories of capital structure are discussed through the following summary:

2.1.1. Trade-Off Theory of Capital Structure

Tradeoff theory looks at how businesses balance the pros and cons of different forms of financing and assumes that firms trade off the benefits and costs of debt and equity financing and find an "optimal" capital structure after accounting for market imperfections such as taxes, bankruptcy costs and agency costs (Popescu L. and Visinescu S.,2009) .

For example, when the tax code allows interest payments to be deductible expenses in computing corporate income tax, a taxpaying corporation that pays an extra dollar of interest receives a partially offsetting "interest tax shield" in the form of lower taxes paid. Thus, financing with debt instead of equity

increases the total after-tax return to investors and therefore increases corporate value, implying that companies should maximize debt financing over equity.

However, too much debt raises the probability of financial distress (Simon Kwan, 2009). Tradeoff theory says that firms will borrow to the point that the marginal value of the tax shield equals the expected marginal cost of financial distress, implying moderate debt ratios for nonfinancial businesses. The theory among other things predicts a positive relationship between tax and leverage and is based on a trade-off between tax savings and distress costs of debt.

The trade-off theory has contributed a lot in finance. It yields an intuitively pleasing interior optimum for firms and gives a rationale for cross-sectional variation in corporate debt ratios i.e. firms with different types of assets will have different bankruptcy and agency costs and different optimal debt ratios. However, the theory has limitations i.e. debt ratios as produced by this theory are significantly higher than observed. Secondly, in many industries, the most profitable firms often have the lowest debt ratios, which is the opposite of what the trade off theory predicts (Lakshmi & Myers, 1999). The results of empirical research in trade-off theory are mixed.
Fama and French (2002) concluded that the many shared predictions of the trade-off theory tended to do well in their tests, however, when shared predictions were confirmed, attributing theory was unclear. Frank and Goyal (2003) identified one inconsistency regarding the trade-off theory (i.e., the negative linkage between leverage and profitability). Tucker and Stoja (2011) suggested that the trade-off theory could explain certain aspects of UK companies' capital structure policies.

2.1.2 Pecking Order Theory

Pecking order theory emphasizes the information asymmetry between managers and outside investors. A company that issues equity may signal that it has positive net-present-value projects, meaning that capital raised by issuing stock can be invested in projects that exceed the company's hurdle rate of return. But the market may read stock issuance as a signal that the company is overvalued and its share price too high. This leads to an equilibrium in which a company can issue shares, but only at a marked-down price. Thus, companies whose assets are undervalued at the marked down share price may choose not to issue equity, even if it means giving up potentially profitable projects. By contrast, debt, which is senior to equity, is less exposed to errors in firm valuation, minimizing the information advantage of managers. With debt, bondholders are less concerned about the level of profitability of the borrower, focusing instead on whether the company's cash flow will be adequate to service its debt obligations.

Pecking order theory says that businesses prefer internal capital to external financing and if necessary, prefer debt to equity because of lower information costs associated with debt issues. But if external financing is needed, businesses will issue the least risky securities, that is, securities least likely to be marked down by investors because of information asymmetry, working down from senior debt to junior debt, to convertible securities or preferred stock, and finally to equity.

Pecking order theory suggests a negative impact on leverage (Nguyen and Kayani 2013, p.15). It implies that a less profitable firm with a weak internal cash flow when having profitable investment opportunities would be more likely to use external

fund given its limited retentions. The pecking order theory predicts that: a) controlling for investment opportunities, firms with more profitable assets in place have less book and market leverage; b) firms with more tangible assets in place have less book and market leverage; c) given the profitability of assets in place, firms with more investments have more leverage. (Pan J., 2012).

2.1.3 Signaling Theory

Financial decisions are signals sent to investors by managers in order to compensate information asymmetry. These signals are regarded as the main core of financial relationships (Javad A. et al., 2012).

In signaling theory, capital structure serves as a signal of private information.The main prediction of this theory is that the market reaction on debt issues (more generally, on leverage increasing transactions such as issuing convertible debt, repurchasing shares, and debt for equity swaps) is positive. Contrary, Anton Miglo (2012) confirmed that the market reaction on equity issues (or leverage-decreasing transactions) is negative. According to Barry, Zhao and Ani (2004), the signaling theory implies a positive relationship between the firm's cash flow and debt structure.

Taking the argument from the signaling theory perspective, Ravid and Sarig (1991) posited that, firms signal their financial independence by the optimal combination of dividends and debt capital. Their study forecasted that firms which are performing well in terms of their financial performance and are highly leveraged pay higher dividends than those with less debt in their capital structure.

With the signaling theory, financial institutions and lenders have adverse selection regarding investment prospects. Managers of financial institutions then attempt to pass on to lenders their good expectations of future feat through various signals, which can be higher leverage or accumulated assets. Lenders judge the truth of these signals and then decide to save with such institutions who will intend give them out as loans to their customers. If high leverage can work as financing signal for financial institutions, financial firms should have a higher leverage level which is connected with contemporaneous investment. (Kwashie, 2014). According to Zhao and Ani (2004) for corporate firms which can use leverage as signal to facilitate their financing, potential lenders for farm businesses more prefer to issue loans to farms with larger size, good historical record of income as well as high profitability. They mentioned that old farmers are more following the signaling theory.

2.1.4 Market Timing Theory

Market timing theory refers to the practice that firms issues equities when the shares are believed to be overvalued and inversely, implement repurchase when shares are undervalued. There are two versions. The first is the dynamic version assuming rational economic agents (i.e. managers and investors). Korajczyk et al. (1991) finds that with the existence of adverse selection costs, firms tend to issue equities following a positive information release so that information asymmetry between investors and managers is reduced, resulting in increasing stock price. Hence, firm could create its own timing opportunity. The extent of adverse selection varies across firms, across time (Choe et al.,1993) and negatively related to market-to-book ("M/B") ratio. The second version assumes irrational economic agents, leading to a time-varying mispricing of the

firm's stock (Baker and Wurgler, 2002).

It is the case when managers believe that they can time the market as was evidenced in the survey by Graham and Harvey (2001), so issue equities when they believe shares are at high price and repurchase when believing shares are at low price. Accordingly, variation in M/B ratio comes from managers' perception of misevaluation. Hence, both versions of market timing theory are expected to explain the potential relation between M/B and capital structure.
The two market timing versions of dynamic asymmetric information and mispricing cannot be distinguished. Above all, after taking into account results of various researches, Baker and Wurgler (2002) concludes that there is no optimal capital structure, but capital structure only evolves as the cumulative outcome of past attempts to time the equity market. With the sample of all publicly-traded Banks, the market timing theory is expected to help explain any changes in Banks' preference of equity financing and thus their capital structures as well. Rajan and Zingales (1995) have used the hypothesis related to market timing in their studies where market-to-book (MB) ratio has been considered to measure growth opportunity.

Hovakimian (2004) hold up the fact of existence of market timing. However, all of them have disagreed with the Wurgler and Baker (2002) on the unremitting force going on capital formation via market timing. By finishing his studies; Alti (2006) portrayed that US corporations have dynamically rebalanced the leverage to be located in the most advantageous assortment. Therefore, the impacts of market timing are transitory. Market timing elucidation of data questioned by Alti (2006) provided confirmation that even if market timing exists, it doesn't encompass long-run impact on corporation's power and that

businesses do keenly rebalance their leverage fractions toward several target point.

Most of the evidences support market timing theory in a sense that managers wait for the market conditions to get better, that stocks' position in the market gets better before the new issuance and before issuing new stocks firms try to make their performance better. The market timing theory is considered to determine the various phenomena about whatever researchers have discussed regarding capital structure.

The reality is that studies in this area still lack theoretical models. Consequently, different opinions have been explained by different authors while interpreting market timing. Market timing theory requires new theoretical models.

2.2 *Previous Empirical Study on Capital Structure*

It is normal that a company's capital structure is determined by the set of securities issued by the company to finance its projects and activities. According to Seetharaman et al. (2003), some significant factors which may have a direct impact on capital structure are: personal tax, corporate tax, government and other regulations, bankruptcy, agency cost, corporate governance, signaling, ownership structure, macroeconomic variables, floatation and other direct costs.

Overesch and Voeller (2010) have analyzed the tax effects of both personal capital income and corporate profit taxation on capital structure choices. They have collected detailed tax rates for the corporate profit tax, dividend tax and taxes on interest income, and then calculated the tax benefit of using debt relative to equity financing. The results identify a positive effect of the relative tax benefit of debt on the companies' capital structure,

suggesting that differences in the tax levels of the return on equity relative to the tax on the return on debt do in fact play a significant role.

Bankruptcy concerns the issues of default costs on debt, which may be direct (e.g., filing costs) or indirect (e.g., lost executive time and market share). Bankruptcy cost is one of the centre pieces of the trade-off theory. Agency costs are hidden effects arising from conflicts between stakeholder groups. Several studies have provided theories and empirical evidence supporting a complementary perspective on capital structure based on corporate governance and corporate ownership structure. According to Torre and Pindado (2011), capital structure is partly determined by the incentives and the goals of those who are in control of the firm.

Gleason and Jiraporn (2007) also demonstrated how capital structure is influenced by the strength of shareholder rights. Their empirical evidence shows an inverse relation between leverage and shareholder rights, suggesting that firms adopt higher debt ratios where shareholder rights are more restricted. This is consistent with the agency theory, which predicts that leverage helps alleviate agency problems. Government regulations have a strong influence on firm behaviour. Disclosure regulations, for instance, may have a big impact on capital structure, as they can decrease or increase information asymmetry according to the market in which firms operate. On a related issue, macroeconomic variables can also impact capital structure. When interest rates are low, firms have incentives to finance with debt so as to minimize the weighted average cost of capital to presumably maximize firm value.

On the other hand, when economic conditions are volatile, there is a higher risk of default; hence firms are influenced to reduce their debt ratio. Floatation and other direct costs refer to issuance expenses when a firm sells securities to the public. If such expenses are substantial, there may be an incentive to finance firm's projects with debt, shaping as a result a different capital structure.

Works, like the one by Gropp and Heider (2010), indicated that, in case of Banks that have a pad of own capital above the minimum value established by the Basel agreements, explanation variables, such as Size, Profitability, Growth opportunity, Guarantees, Payment of dividends and Assets risk, as well as control variables, such as actual growth domestic product (GDP) growth and market return, are equally relevant in the definition of capital structure of Banks. In his study, Papagiani (2013) found that size of a bank, profitability, the ratio liquid assets to Deposits &short term funding and the ratio net loans to total assets, tangibility and inflation are significant.

Using data from 61 Banks from 10 Asian countries, Nguyen and Kayani (2013) confirmed that Profit and tax rate are statistically significant in explaining leverage ratios for Banks in less developed countries. Collateral can only explain leverage ratios of banks in advanced countries, and it is an inverse relation. In East Asia, Thiam Wen (2009) used balance panel data to analyze the determinants of Bank capital ratio for seven countries in East Asia in 2004-2007. The regression results of the model showed that credit risk, liquidity, leverage, Bank profitability, and the return on assets influence significantly the decision of determining the capital structure of Banks but Bank Management quality and regulatory pressure showed a significant negative impact.

The Bank size was insignificant. For North American Banks, The dynamic regression model suggested with panel data confirmed the significance power of profitability, the assets risk, deposits and growth opportunity on Bank leveraging (Michele and Fishlow, 2012). In nigeria, Aremu M. A. et al. (2013) found that the main determinant factors which contribute to the Bank leverage level of the Banking industry in Nigeria between the years 2006 to 2010 were mainly Bank size, dividend payout, profitability, tangible assets, growth, business risk and tax charge.

In Ethiopia, Weldemikael (2012) 's findings on determinants of banks' capital structure showed that profitability, size, tangibility and liquidity of the Banks are important determinants of capital structure of Banks in Ethiopia but growth and risk of Banks are found to have no statistical significant impact on the capital structure of Banks in Ethiopia. In addition, the results of his analysis indicated that pecking order theory is pertinent theory in Ethiopian Banking industry. In the same country, Kibrom Mehari (2010) found that profitability, size, age and tax-shield variables are the significant firm level determinants of capital structure in Ethiopian commercial Banks.

In the region, with the objective of finding out the determinants of capital structure of commercial Banks in Kenya, Nyamora (2012) found that overall leverage of Banks is negatively related to operating assets, and long-term debt structure is positively and statistically related to operating assets.

According to him, short-term debt of Banks is negatively related to Banks' profitability, risk and asset structure and positively related to size, growth and corporate tax. On the other hand, the long-term debt of the Banks is positively related to Banks'

asset structure and profitability and inversely related to Bank risk, growth, size and corporate tax.

In Rwanda, various researches, largely university dissertations have been conducted on firms' capital structure. These studies are at 70% focusing on characteristics of firms' capital structure and on introductory descriptive issues of capital structure rather than on factors determining Banks' capital structure. Illustrations of these studies are: Rurangwa (2015) who examined the effect of capital structure on energy production and Niyonzima (2014) who analysed the capital structure and firms' financial performance. Hence, showing the gaps on research of this topic in Rwanda, the present study intends to contribute closing this gap.

2.3 Variables Selected

The characteristics of a Bank, which are termed here as Bank specific factors (internal), affect the capital structure. This section presents internal factors that affect the capital structure of a Bank adopted first from the study of Kibrom (2010), Oduol (2011) Booth et al.(2001),Nguyen and Kayani (2013), Koert and Aremu et al.(2013), Papagianni and Mahishid (2013), Michele and Fishlow (2012),and then with reference to the relevant capital structure theories stated earlier.

2.3.1 Leverage Ratio as Dependent Variable

As mentioned before, the capital structure of a company consists of equity and debt to finance assets, operations and future growth of a company. To finance, companies can choose for equity or debt. In this research the focus was to investigate how different factors influence on the amount of leverage of a Bank. Therefore, the dependent variable is leverage ratio which

is measured by dividing a corporation's total liabilities by its total assets. This ratio tells the percentage of total assets that were financed by creditors, liabilities, debt.

It shows a company's ability to pay off its liabilities with its assets. In other words, this shows how many assets the company must sell in order to pay off all of its liabilities. Companies with higher levels of liabilities compared with assets are considered highly leveraged and more risky for lenders.

The leverage ratio is a measure of capital structure (Aremu, et al., 2013,) and is shown in decimal format. As with many solvency ratios, a lower ratio is more favorable than a higher ratio. A lower ratio usually implies a more stable business with the potential of longevity because a company with lower ratio also has lower overall debt. Each industry has its own benchmarks for debt, but 0.5 is reasonable ratio (Bent Vale, 2011). Considering this, the dependent variable of leverage ratio in our research is referred to as total debts over total assets (Weldemikael, 2012; Nyamora, 2012; Bah and Dumontier, 2001).

2.3.2 Independent Variables

Starting from related theories and previous empirical researches, potential variables have explanatory power on capital structure of Banks. The relevant factors are selected based on past empirical studies on determinants of capital structure of firms in general and of Banks specifically, including Profitability, Tangibility, Size, Age, Liquidity, Bank Growth and Effective tax rates.

2.3.2.1 Profitability

For the Static trade-off theory, the higher the profitability of the firm, the more are the reasons it will have to issue debt,

reducing its tax burden. On the other hand, Pecking order theory assumes that larger earnings lead to the increase of the main source of capital firms choose to cover their financial deficit: retained earnings. A positive correlation between profitability and leverage is implied.

In a signaling framework, profitable firms are assumed to use debt as a signal of the firm's quality; this theory also predicts a positive relationship. Therefore, the Static trade-off theory expects a positive relationship between profitability and leverage, whereas the pecking order theory expects exactly the opposite. Firms are assumed to prefer internal financing to external financing in a pecking order framework. This preference leads firms to use retained earnings first as investment funds and move to external financing only when retained earnings are insufficient. When facing the choice between bonds and equity, firms will prefer debt issue to equity issue. In this case, profitable firms are expected to have less debt.

However, most empirical studies confirm the negative correlation between profitability and leverage (Titman and Wessels, 1988), while the positive relationship is rarely supported by empirical studies. Net operating income over total assets was used as a proxy for profitability (Kibrom Mehari, 2010).

2.3.2.2 Tangibility of Fixed Assets

The trade-off theory predicts a positive relation between tangibility and debt levels. As the value of intangible assets disappears in the cases of bankruptcies, the presence of tangible assets is expected to be important in external borrowing as it is easy to collateralize them. Tangible assets often reduce the costs of financial distress because they tend to have higher liquidation value (Titman and Wessels, 1988; Harris and Raviv, 1991).

Pecking order theory of Myers and Majluf (1984) conclude that issuing debt secured by property, avoids the costs associated with issuing shares. This suggests that firms with more collateralized assets (fixed assets) will be able to issue more debt at an attractive rate as debt may be more readily available. Hence, firms with high level of fixed assets would have higher level of debt. Tangibility is defined as the value of fixed assets divided by total assets (Papagianni, 2013; Aremu et al., 2013; and Weldemikael, 2012).

2.3.2.3 Size

According to trade-off theory, firm size could be an inverse proxy for the probability of the bankruptcy costs. Larger firms are likely to be more diversified and fail less often. They can lower costs in the occasion of bankruptcy. Larger firms are more likely to have higher debt capacity and are expected to borrow more to maximize the tax benefit from debt because of diversification (Titman and Wessels, 1988). Therefore, size has generally a positive effect on leverage. Connell (1999) produced evidence that as the value of a company decreases, bankruptcy costs increase. Small companies prefer short term borrowings like bank loans than issue of debt and equity that are associated with higher fixed charges hence costly. The natural logarithm of total asset is used as a proxy for Size (Aremu et al., 2013; Nyamora, 2012; Papagianni, 2013 and Weldemikael, 2012).

2.3.2.4 Age

Age of the firm is a standard measure of reputation in capital structure models. As a firm continues longer in business, it establishes itself as an ongoing business and therefore increases its capacity to take more on debt. Age of the financial institutions

have been regarded by most researchers like Kwashie (2014) and Usman (2013) as significant because it determines the extent to which a firm which has excess cash flow would still prefer to use debt in its operational activities. Hence age is positively related to debt. On the contrary, findings by Michaelas et al.(1999) and Petersen & Rayon (1994) are parallel with pecking order theory that states the usage of debt financing decreases with age of firms.

2.3.2.5 Liquidity

Banks with higher liquidity ratios or more liquidity assets were prefer to use these assets to finance their investments and discourage to raise external funds. Thus, the findings from Oduol Owino (2011) support the fundamental theory that demonstrates a negative relationship between liquidity and leverage. As the level of liquidity increases, the leverage level reduces. Firms maintain high liquidity levels to protect their human capital and reduce chances of financial distress.

In addition, the theoretical analysis of pecking order theory states that high liquidity firms use internal resources instead of external to finance their projects. Firms are likely to create liquid reserves from retained earnings. If liquid assets are sufficient to finance the investments, firms will have no need to raise external funds. Hence, liquidity is expected to be negatively related to leverage. Here, current ratio calculated as current assets over current liabilities is preferred as a proxy of liquidity.

2.3.2.6 Bank Growth (Growth opportunity)

According to tradeoff theory growth opportunities could not be used for collateral, although it adds to a firm value. Beside that growth opportunity does not contribute to further tax

deduction (Titman and Wessels, 1988). The empirical findings of Titman and Wessels (1988), and Najjar and Petrov (2011) showed a negative sign and confirmed that growing firms are expected to have less debt ratio, which was consistent with tradeoff theory. Therefore, it is expected that there is a negative relationship between growth and leverage ratio.

2.3.2.7 Effective Tax Rates (ETR)

Effective tax rate is believed to be important factor that affects the amount of debt that a firm has to have in its capital structure (Barclay and Smith, 1999). Literature on the influence of effective tax rate on leverage recorded a mix results. The findings of Sogorb-Mira & Lopez Gracia (2003) and Homaifer, Zietz and Benkato (1994) indicated a positive relationship between effective tax rate and debt levels. The more profitable a firm is, the more is the amount of tax it would have to pay on its interest payments. Therefore, by taking more debt in their capital structure, firms benefit from the 'interest tax-shield' that debt provides. Thus, Trade-off theory predicts that the higher the tax amount a firm has to pay, the greater is the debt it will have in its capital structure (Ramlall, 2009, Klapper and Konstantinos, 2008).

On the other hand, Gupta & Newberry (1997), Kim & Sorensen (1986) and Titman and Wessels (1988) found in their researches a negative relationship between ETR and leverage. The amount of tax expenses divided by pretax profit was used as a proxy for effective tax rate (Marie, Aaro and Kadri, 2011).

3. METHODOLOGY

3.1 Population and Sample

The target population of this study refers to all commercial Banks registered by National Bank of Rwanda before 2006 and only six commercial Banks were considered to constitute the population. For this study, ten years data (2006- 2015) were considered. Therefore, Banks which were established after 2006 and started to provide financial statements in the succeeding years were not included in this study because this study incorporated only Banks that have financial statements for the year, 2006, and onwards. Due to data scarcity and time limitation, we could not examine the whole population but only focused on a small sample of four commercial Banks that represents 67 percent of the entire population. Using purposive sampling known as judgmental, selective or subjective sampling (Dolores C. Tongco, 2007),and the availability and quality of data for the time period from 2006-2015, the selected commercial Banks were Investment and Mortgage (I&M) Bank Rwanda, Ecobank Rwanda, Bank of Kigali, and Cogebanque Rwanda.

3.2 Data Collection

Secondary data were drawn from the audited financial statements of the sampled commercial Banks for ten years and analyzed by using Vector Autoregression (VAR) Model. This method was employed to determine whether there exists a relationship between the explanatory variables (Profitability, Tangibility, Size, Age, Liquidity, Growth, Effective tax rate) and the dependant variable (leverage). Data was analysed using Eviews version 8 as unstructured after importing them from excel and the obtained outputs were analyzed to investigate which variables are important to determine banks'capital structure.

The selection of the variables was primarily guided by the results of the previous empirical studies and the availability of data. The dependent and independent variables are defined so that they are consistent with those of Ahamad and Wan (2015) in Malaysia, Aremu et al.(2013) in Nigeria, Kibrom (2010) and Weldemikael (2012) in Ethiopia, *Sogorb-Mira* and *López-Gracia* (*2003*), Daskalakis and Psillaki (2008) and Mahshid(2013) in Iran.

3.3 Model Specification with Expected Signs

As per the literature review done, the findings of Kibrom (2010), Oduol Owino (2011), Booth (2001), Nguyen and Kayani (2013), Koert and Aremu (2013), Papagianni and Mahishid (2013), Reint and Florian (2009) , Michele and Fishlow (2012), revealed that there is a significant relationship between leverage and bank specific variables namely: Profitability, Tangibility, Size, Age, Liquidity, Growth, Effective tax rates .

This study is proposed to estimate the model defined as follows:

Leverage **=** F **(**Profitability, Tangibility, Size, Age, Liquidity, Growth, Effective tax rate**)**

Therefore the Bank Specific Specified Model is:

Leverage = $\beta 0 + \beta 1$ (Prof) + $\beta 2$ (Tang) + $\beta 3$ (Size) + $\beta 4$ (Age) + $\beta 5$ (Liquidity) + $\beta 6$ (Growth) + $\beta 7$ (Effective tax rate) + ε.

This is simplified as:

DAR =$\beta 0$ +$\beta 1$ (PR) +$\beta 2$ (TN) +$\beta 3$ (SZ) +$\beta 4$ (AG) +$\beta 5$ (LQ) +$\beta 6$ (GR) +$\beta 7$ (ETR) + ε

Where β_0 is the Coefficient of Intercept (Constant), β_{1-7} are coefficients of explanatory variables and ε is the error term, which represents measurement errors in the independent variables, and any other explanatory variables that have been omitted, as well as in the measurement of the independent variables.

The predicted sign of the independent variables with the dependent variables, according to the theories of capital structure is shown in the Table 1.

Table 1: Coefficients of Variables and their Theoretical Predicted Signs

Variables	Predicted Signs	Key Prediction Origin
Profitability (PR)	**(-/+)**	Both signaling and TOT predict positive relation, and negative relation is predicted by pecking order theory (Xiaoyan,2008)
Tangibility (TN)	**(+)**	Both TOT and POT predict a positive relationship (Titman &Wessels 1988, Koert ,2013)
Bank Size (SZ)	**(+)**	POT, TOT and signaling theories predict a positive relationship (Titman and Wessels,1988, Zhao and Ani,2004)
Age (AG)	**(-/+)**	The TOT suggested a positive relation (Usman, 2013) and Pecking Order Theory predicts negative relationship (Michaelas ,1999 and Petersen & Rayon ,1994)
Liquidity (LQ)	**(-/+)**	POT predicts a negative relationship and signaling theory predicts a positive relationship (Hamidi, et al.2015)
Bank Growth (GR)	**(-)**	TOT predicts a negative relationship (Najjar & Petrov, 2011).
Effective tax rate (ETR)	**(-/+)**	POT predicts a negative relationship (Titman and Wessels, 1988) and the TOT suggests a positive relationship (Johera&Lyold,1996).

Source: Authors' compilation based on different studies.

TOT: Tradeoff theory, POT: Pecking order theory. **"+"** means that leverage increases with the factor, **"-"** means that leverage decreases with the factor, **"+/-"** means that both positive and negative relations between leverage and Bank level specific factors are possible.

3.4 Estimation Techniques

This study adopts a vector autoregression (VAR) method. After detecting that the cointegration exists between series, the researchers applied the vector error correction model (VECM) to evaluate the short run properties of the cointegrated series. In VECM, the cointegration rank shows the number of cointegrating vectors. For instance a rank of two indicates that two linearly independent combinations of the non-stationary variables will be stationary. Negative and significant coefficient of the ECM indicates that any short-term fluctuations between the independent variables and the dependant variable will give rise to a stable long run relationship between the variables

In this study, Researchers have done Granger causality test to establish causal links between variables. Stationarity and stability tests were analyzed. Then, the impulse Response Functions (IRF) has also been generated to explain the response to shock amongst the variables. In order to ensure stationarity of the data, the study employed the Augmented Dickey-Fuller (ADF) unit root test. The Augmented Dickey fuller approach accounts for the autocorrelation in a series in a parametric fashion by estimating additional nuisance parameters through the addition of the first differences of the series as explanatory variables in the equation. This was necessary in order to avoid the incidence of spurious regression estimates.

4. RESEARCH FINDINGS

4.1 Descriptive Statistics of Dependent and Explanatory Variables

As it was mentioned above, the study examined the factors determining the capital structure for four banks over the period 2006 to 2015. Relevant statistics of the dependent and explanatory variables of the sample banks are presented in Table 2 that shows the Mean, Median, Mode, Maximum, Minimum, Range, Standard deviation, Skewness, Kurtosis, Jacque-Bera and Probablility.

Table 2: Descriptive Statistics

	DAR	PR	TN	SIZE	AGE	LQ	GR	ETR
Mean	0.88	10.00	5.04	11.59	30.00	1.11	19.34	27.85
Median	0.89	9.84	4.24	11.56	30.00	1.10	20.28	31.31
Mode	0.89	N/A	N/A	11.38	43	1.09	N/A	N/A
Maximum	0.98	14.87	18.52	13.24	52.00	1.31	45.64	84.08
Minimum	0.79	6.74	1.63	10.36	8.00	0.83	-12.64	-80.00
Range	0.19	8.13	16.89	2.88	44.00	0.48	58.28	164.08
Std. Dev.	0.04	2.00	3.15	0.68	16.53	0.08	13.86	23.72
Skewness	-0.11	0.87	2.21	0.47	0.00	-0.37	-0.24	-2.04
Kurtosis	3.49	3.60	9.57	3.08	1.15	5.73	2.61	12.54
Jarque-Bera	0.48	5.63	104.71	1.49	5.68	13.30	0.65	179.56
Probability	0.79	0.06	0.00	0.48	0.06	0.00	0.72	0.00

Source: Financial statements of sampled commercial Banks and own computation.

4.2 The Stationarity Test

The researchers tested the data and variables to a unit root test. The basic objective of the test is to test the null hypothesis that $\varphi = 1$ in: $y_t = \varphi y_{t-1} + u_t$ against the one-sided alternative $\varphi < 1$. So,

the researchers have defined hypothesis as:

- H_0: series contains a unit root
- H_a: series is stationary

Therefore, this is necessary in order to know whether or not the result and invariably the findings can hold in the long run. Specifically, Augmented Dickey Fuller (ADF) unit root testing was conducted for this purpose through Eviews version 8. The results show that unit root test applied to the variables at levels fails to reject the null hypothesis of non stationarity of all variables used. It implies that all variables are no-stationary at levels.

The hypothesis of stationarity is accepted when all variables are first differentiated. The results in Table 3 below suggest that DAR, Profitability, Tangibility, Size, Age, Liquidity, Growth, ETR with their ADF values are either less than 1% of -3.615588, 5% of -2.941145 or 10% of -2.609066. The result reveals also that our variables' P-values are practically zero and stationary in their first difference (i.e., they are integrated of order 1). Therefore, the researchers can test for cointegration because variables are stationary at I(1) (Brooks, 2008).

Table 3: Augmented Dickey-Fuller Unit Root Test at First Difference

	ADF	Proba-bilities	1% level	5% level	10% level	
DAR	-7.666210	0.0000	-3.615588	-2.941145	-2.609066	I(1)
Profitability	-8.894949	0.0000	-3.615588	-2.941145	-2.609066	I(1)
Tangibility	-8.656261	0.0000	-3.615588	-2.941145	-2.609066	I(1)

Size	-6.875783	0.0000	-3.615588	-2.941145	-2.609066	I(1)
Age	-6.331864	0.0000	-3.615588	-2.941145	-2.609066	I(1)
Liquidity	-7.503687	0.0000	-3.615588	-2.941145	-2.609066	I(1)
Growth	-12.03548	0.0000	-3.615588	-2.941145	-2.609066	I(1)
ETR	-6.375026	0.0000	-3.632900	-2.948404	-2.612874	I(1)

Source: Financial statements of sampled commercial Banks and own computation

4.3 *Determination of Lags*

An important preliminary step in model building and impulse response analysis is the selection of the VAR lag order. In this study, this choice was made by examining the lag structure in an unrestricted VAR originally specified with four lags, using a combination of VAR lag order selection criteria and examination of the roots of the characteristic polynomial to verify if the VAR is stable.

We used some commonly used lag-order selection criteria to choose the lag order, such as LR, FPE, AIC, SC and HQ. Table 4 presents the evidence based on the VAR Lag Order Selection Criteria. As shown in Table 4, the LR, FPE, AIC and HQ criteria suggest the use of three lags, while the SC criterion suggests the use of one lag. The lag length of one suggested by Schwarz criteria is more accurate than others suggested (Tahir and Rasheed, 2010) and when the lag length of 3 is used in our integration analysis, we have found no cointegrating vector under both trace and maximum eigen statistics. While at lag length one, we are getting one cointegrating vector under both these statistics. So, we proceed further tests with lags one (1).

Table 4: Lag Selection Criteria

VAR Lag Order Selection Criteria

Endogenous variables: DAR PR TN SIZE AGE LQ GR ETR

Exogenous variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-482.4778	NA	45.12340	26.51231	26.86062	26.63511
1	-352.4765	196.7586	1.378870	22.94468	26.07944*	24.04983
2	-303.8558	52.56296	5.299619	23.77599	29.69720	25.86349
3	-135.8807	108.9568*	0.108577*	18.15571*	26.86338	21.22557*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

Source: Computed from Eviews. FPE: Final Prediction Error, AIC:Akaike Information Criterion, SC:Schwarz Information Criterion, HQ:Hannan-Quin Information Criterion

4.4 Cointegration Test

In this study, cointegration relationship has been investigated using Johansen technique. To determine the number of cointegrated vector, Johansen (1998) developed two likelihood ratio tests: trace test (λ_{trace}) and maximum eigenvalue test (λ_{max}). If there is any divergence between these two tests, it is advisable to rely on the evidence based on the λ_{max} because it is more reliable in small samples (Odhiambo, 2005).

From the Table5, Johansen cointegration test shows that both trace statistic (λ_{trace}) and maximal eigenvalue (λ_{max}) statistic indicate that there is at least one cointegrating vector. We can reject the null hypothesis that there is no cointegrating vector in favour of one cointegrating vector under both test statistics at 5 percent level of significance. This significance level gives a

strong evidence that the variables are cointegrated of order one and evolve with each other and have a long run relationship (Sobhen Morshed,2010). Since, the rank is equal to 1 which is more than zero and less than the number of variables; the series are cointegrating among the variables. Nevertheless, we will proceed to estimate the VECM model.

Table 5: Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.774682	177.0218	169.5991	0.0190
At most 1	0.652900	120.3925	134.6780	0.2524
At most 2	0.564187	80.18314	103.8473	0.6134
At most 3	0.448045	48.62252	76.97277	0.8887
At most 4	0.284730	26.03955	54.07904	0.9783
At most 5	0.166581	13.30593	35.19275	0.9817
At most 6	0.117952	6.381611	20.26184	0.9323
At most 7	0.041541	1.612276	9.164546	0.8529
Trace test indicates 1 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 *	0.774682	56.62926	53.18784	0.0214
At most 1	0.652900	40.20938	47.07897	0.2242
At most 2	0.564187	31.56063	40.95680	0.3788
At most 3	0.448045	22.58297	34.80587	0.6303
At most 4	0.284730	12.73361	28.58808	0.9382
At most 5	0.166581	6.924320	22.29962	0.9828

At most 6	0.117952	4.769336	15.89210	0.9074
At most 7	0.041541	1.612276	9.164546	0.8529

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Computed from Eviews

The following table presents the estimates of the normalized cointegrating coefficients and their respective standard errors as to reflect how much cointegration there is for the analyzed period. As one can notice, we displayed in Table 6 the relationships between bank leverage and its determinants factors. The cointegrating equation reported shows that the long- run estimate for Tangibility, Age, Liquidity and Growth are positive and significant at 5%, the long-run estimate for Size is negatively significant at 5%, and Profitability is negatively significant at 10% while long-run estimates of Effective tax rate are negatively insignificant at any usual significance level. Therefore, the results reveal an integrating equation, with normalized cointegrating coefficients listed in table6. Hence, an error correction model should be applied.

Table6: Normalized Cointegration Coefficients

Variable	DAR	PR	TN	SIZE	AGE	LQ	GR	ETR	C
Cointegration Coefficients	1.000	-0.003	0.008	-0.045	0.0017	0.543	0.0018	-5.59E-05	-1.0443
Standard errors		0.0017	0.0012	0.006	0.0003	0.042	0.0002	0.00013	0.050
t-ratio values		-1.76	6.67	-7.5	5.67	12.93	9	-0.49	20

Source: Computed from Eviews

4.5. Long run Relationship

The long run relationship between Leverage, Profitability, Tangibility, Size, Age, Liquidity, Growth and Effective Tax Rate for one cointegrating vector for the Rwandan commercial Banks in the period 2006-2015 is displayed below (standard errors and t-statistics are displayed in parenthesis).

DAR_{t-1}=-1.05-0.003(PR_{t-1})+0.008(TN_{t-1})-0.05(SZ_{t-1})+0.002(AG_{t-1})+0.54(LQ_{t-1})+0.002(GR_{t-1})-5.59(ETR_{t-1})

Se = (0.0017) (0.0012) (0.006) (0.0003) (0.042) (0.0002) (0.00013)

t = (-1.767) (6.8024) (-7.3823) (6.7765) (12.8784) (8.286) (-0.446)

The Significance here is measured by t-statistic. Typically, a t-statistic above 2 or below -2 is considered significant at the 95% level. Two (2) is used as a rule of thumb because in the t-distribution it is necessary to know how many degrees of freedom available before deciding whether the value of the t-statistic is significant at the 95% level. From the long run equation, variables like Tangibility, Age, Liquidity and Growth are positively significant at 1% level, size was negatively significant at 1% level and profitability is negatively significant at 10%. Contrarily, it appears that variable "Effective Tax Rate" was not significant because its t-stat of -0.446 was below critical value at any usual significant level (such as 10%, 5% and 1%).

4.6 Vector Error Correction Model (VECM)

The theorem of granger representation implies that if there is cointegration between variables of the model, it is necessary to estimate its short run relationship through vector of error correction model (VECM). The VECM model provides long-term relationship and also short-term dynamics of the endogenous variables. This model shows the achievement of long-term equilibrium and the rate of change in the short term to achieve equilibrium. In the long run, endogenous variables must converge to their co-integrated relations. In VECM, if the error correction term is negative and significant, then it indicates that any short-term fluctuations between the dependent and independent variables will give rise to a stable long-run relationship (Khanna, et al.2015). Having established that variables in model are I(1) and cointegrated, a VECM with one cointegrating relation and one lag has been established as it is indicated by trace test and eigenvalue test.

4.6.1 Short run Relationship

The error correction part (in Appendix1) represents the short run relations and the equation of short run effect is presented as:

$$\Delta DAR_t = \underset{(-0.046)}{-0.0003} \underset{(-2.516)}{-0.94} u_{t-1} + \underset{(0.0617)}{0.024}\Delta DAR_{t-1} \underset{(-1.4944)}{-0.006}\Delta R_{t-1} \underset{(-0.4486)}{-0.002}\Delta W_{t-1} \underset{(-0.814)}{-0.02}\Delta S_{t-1}$$

$$\underset{(-0.1668)}{-0.004}\Delta G_{t-1} + \underset{(0.2387)}{0.061}\Delta Q_{t-1} + \underset{(0.784)}{0.003}\Delta INF_{t-1} + \underset{(0.226)}{6.8}\Delta ETR_{t-1}$$

The t-statistics shows that in short run all variables are statistically insignificant at any usual significance level (1%, 5% and 10%). The coefficient of -0.94 (speed of adjustment) carries the correct sign "negative" and it statistically significant at 5%, thus the error correction model representation is validated. It requires more than one year so that leverage is adjusted to

change in explanatory variables. Interpreting the results, it is observed that if there is a chock, there will be a correction of 94% each year to bring the long run equilibrium to its normal trend.

4.7 Granger Causality Test

Granger causality test is a technique for determining whether one time series is useful in forecasting another. It can determine whether there is causality relationship between variables. Recall that although cointegration between two variables does not specify the direction of a causal relation, if any, between the variables. Researchers verify the direction of Granger Causality between DAR, PR, TN, SIZE, AGE, LQ, GR and ETR. Estimation results for granger causality between the variables are presented in Appendix2.

The study used F- statistics and probability to measure causality between the variables. F- Statistics and probability values constructed under the null hypothesis of non causality show that there is a causal relationship between those variables. Appendix2 provides the results of pair wise analyses. Significant probability values denote rejection of the null hypothesis. This study reject the null hypothesis if the probability value is less than any usual significance level (such as α= 0.10, 0.05 or 0.01) otherwise do not reject the null hypothesis if the probability value is more.

If we fail to reject the former null hypothesis and reject the latter, then we conclude that one variable changes are Granger-caused by a change in other. Unidirectional causality will occur between two variables if the null hypothesis one equation is rejected. Bidirectional causality exists if both null hypotheses

are rejected and no causality exists if there is no null hypothesis that is rejected.

Looking at appendix2, It is found in our study that Age "Granger cause" Profitability unidirectional at the 5% significance level, Effective tax rate "Granger cause" Profitability unidirectional at the 10% significance level, Tangibility "Granger cause" growth unidirectional at the 10% significance level and Age "Granger cause" effective tax rate unidirectional at the 10% significance level.

4.8 Diagnostic Tests

Table7 outlines the details of diagnostic tests for autocorrelation, normality, serial correlation and heteroskedasticity. These diagnostic checks are based on the null hypothesis that there is no residual autocorrelation, no serial correlation for the LM test, residuals are multivariate normal, and that there is no heteroskedasticity for the White heteroskedasticity test.

The portmanteau test for autocorrelation results shows that there is no autocorrelation because the p-value for h lag is greater than the significance level of 0.05. The LM test, which is a stricter test for correlation, is also applied in the analysis and the results (p-value of 0.2619) show that there is no serial correlation at one lags used.

As for the normality test, the authors reject the null hypothesis of a normal distribution as the JB test statistic of 367.7082 with a p value of 0.0000 is a clear indication of non normality at 1 and 5 percent. Also, residues do not suffer from heteroskedasticity problems because the *p*-value is considerably in excess of 0.05. Results indicate the presence of non-normal residuals but, as

indicated by Gonzalo (1994), Johansen method still provides the most robust results than the other methods, even when the errors are non-normal. In addition, Johansen (1990) and Ahmed et al. (1999) also observed non normal residuals in their studies.

Table 7: The Results of Diagnostic Tests:

The tests for Autocorrelation, Normality, Correlation, Heteroskedasticity			
	H_0	**d.f**	**Prob**
VEC Residual Portmanteau Tests for Autocorrelations	No residual autocorrelation up to lag h	184	0.8972
VEC Residual Serial Correlation LM Tests	No serial correlation at lag order h	64	0.2619
VEC Residual Normality Tests	Residuals are multivariate normal	16	0.0000
VEC Residual Heteroskedasticity tests	Residuals are homoskedastic	648	0.3960
[Residual Portmanteau Tests for Autocorrelations at lag 3, LM Tests for serial autocorrelation of residuals at lag 1, Jarque-Bera test for normality, Joint test for heteroskedasticity calculated in EViews 8.0] If $p>0.05$, we accept H_0 df – degrees of freedom;			

Source: Author's computation with Eviews version 8.

4.9 Impulse Response Functions Analysis

Using this model, which provides information for the long-run relationship of the variables, we perform Impulse Response Function analysis. These impulse response functions show the dynamic response of the bank leverage to a one-period standard deviation shock to the innovations of the system and also indicate the directions and persistence of the response to each of the shocks over 10 periods. In what follows, we have concentrated on shocks to the banks'capital structure which is represented by leverage in this study. In figure 1, shocks to three of the variables are negatively significantly different from zero and are transitory, shocks to the other three variables are positively significant, but only two of them are persistent, and

other remaining two "Profitability and Effective tax rate" are neutral, i.e., irresponsive. The actual impulse response function shown in figure1 is based on the vector error correction (VEC) earlier estimated.

Variables that have persistent and significant effects on the bank leverage are the Tangibility, Size, Age, Liquidity,and bank growth. The response of the leverage to a one-period shock to profitability is a transitory appreciation. Variable Profitability and Effective tax rate have a significant impact on bank leverage by nearly two percent between one and three year's time and continues to be neither positive nor negative permanently.

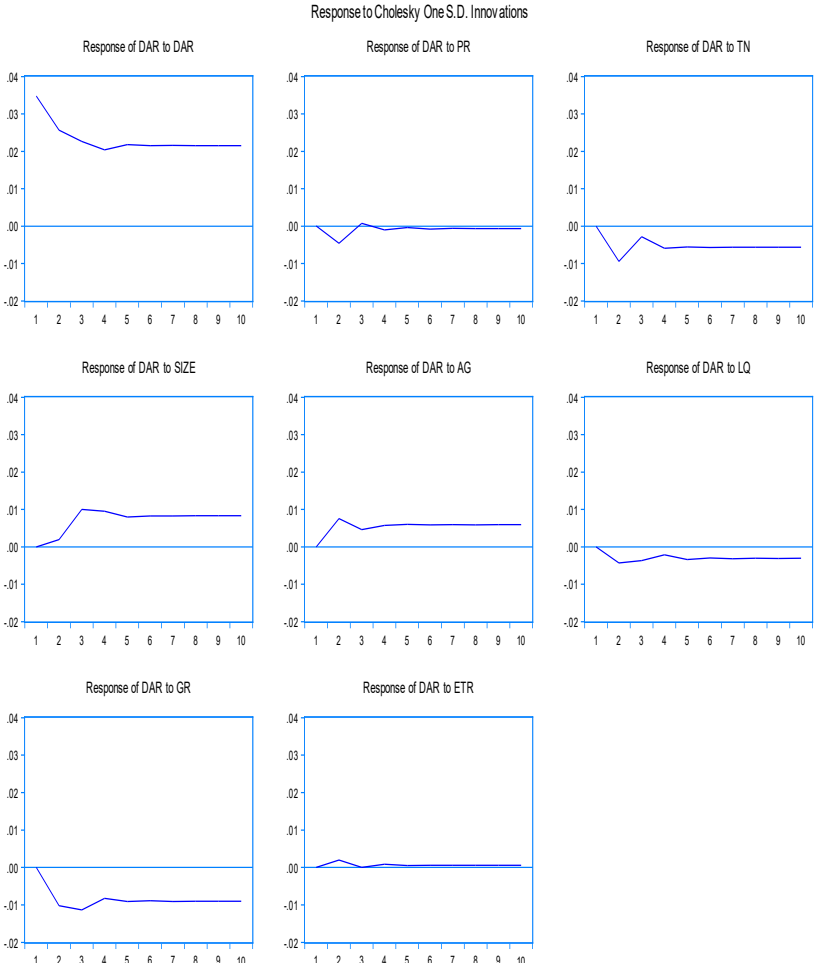

Figure1: **Impulse Response Functions**

4.10 Capital Structure Consistency theories and Results Summary

The preceding sections present the overall results of the study. Thus, in this section the hypotheses formulated are tested followed by analyses of the results for each explanatory variable and their importance in determining capital structure. Results obtained from analysis, expressed in terms of the signs and statistical significance of the coefficients for the selected seven independent variables, are presented in table 8.

Profitability was found to be negatively related with Bank's leverage ratio and statistically significant at 10% level. This result is consistent with predictions of pecking order theory which states that firms prefer to finance first with internal funds before raising external financing. The observed sign was consistent with the findings of Xiaoyan (2008), Gropp and Heider (2007), Titman & Wessels (1988), Rajan and Zingales (1995), and Booth et al.(2001). A profitable bank is more likely to utilize its retention before taking debts - the considered-to-be more expensive financing source.

The positive coefficient of relation observed between Bank leverage and tangibility provides a realistic evidence for the tradeoff and pecking order theories that expected a positive relationship between variables. The high significant relationship between tangibility and leverage is consistent to the previous research findings of Rajan and Zingales (1995), Amidu et al. (2007), and Frank and Goyal (2004) which suggest that firm's borrowing capability depends upon collateralizable value of assets.

Variable Size was found to have statistical significant negative impact on the commercial Banks' capital structure. Theoretically, pecking order theory, tradeoff theory and signaling theory suggested that larger firms tend to have better borrowing capacity relative to smaller firms. Hence, the analyzed result is not consistent with the implementation of pecking order theory, tradeoff theory and signaling theory. The positive and significant relationship between age and leverage was supported by the tradeoff theory and was consistent with findings of Usman (2013) and Kwashie (2014). They suggested the positive relation between leverage and age of the firm. They stated that a firm which has excess cash flow would still prefer to use debt in its operational activities.

The statistical significant at 1% level and positive long run relationship of liquidity and leverage, was consistent with a theoretical analysis of signaling theory which states that high liquidity firms may use external resources to finance their projects. This result is consistent with the empirical evidence of Hamidi, et al.2015. For bank growth, the positive relationship result of growth with leverage is statistical significant at 1% and was not consistent with the applicability of static tradeoff theory and previous empirical findings of Titman and Wessels (1988), Ahmed et al., (2010) and Najjar and Petrov (2011).

As it is seen in the Table 8, the Effective tax rate has negative significant influence on capital structure of commercial Banks in Rwanda. This result was consistent with pecking order theory that suggests a negative relation between effective tax rate and capital structure , and has also been supported empirically by the works of Kim and Sorensen (1986), Titman and Wessels (1988), Sogorb-Mira (2005) and Gupta &Newberry (1997).

Table 8: Summary of the Results

Variables	*Predicted Sign*	*Obtained Sign (Longrun Effect)*	*Theory*	*Hypothesis Confirmed?*
PR	*(-/+)*	*(-)**	*POT*	*YES*
TN	*(+)*	*(+)**	*POT and TOT*	*YES*
SIZE	*(+)*	*(-)**	*-*	*YES*
AGE	*(-/+)*	*(+)**	*TOT*	*YES*
LQ	*(-/+)*	*(+)**	*Signaling Theory*	*YES*
GR	*(-)*	*(+)**	*-*	*YES*
ETR	*(-/+)*	*(-)*	*POT*	*NO*

Source: *Authors' compilation (*means the relation is significant).*

5. CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

This study investigates the factors determining banks capital structure, hypotheses were formulated and the study used inferential research design. Data were analyzed using descriptive analysis and vector autoregression (VAR) model employing the statistical Software "EVIEWS 8". After seeing that the selected variables are stationary at I(1) and cointegrated, the vector of error correction model(VECM) with one cointegrating relation and one lag has been established as it was indicated by trace test and eigenvalue test.

The resulted normalized cointegration equation indicated that variables Profitability and Size affect negatively the bank leverage. It shows also that Tangibility, Age, Liquidity and Bank growth affect positively the bank leverage while the Effective tax rate does not have any significant effect on bank leverage. With the application of vector error correction model, we obtained plausible estimates of the long-run coefficients. With very few exceptions, we found a significant positive long-run correlation between leverage and variables like Tangibility, Age, Liquidity and Growth and a significant negative long-run relationship between leverage and two variables namely profitability and size.

Profitability is negatively related to debt ratio, and consistent with the predicted sign that is consistent to POT. Variable tangibility is positively correlated with leverage in long run. This correlation is consistent with the theory of POT and TOT**.** Age and Liquidity are positively related to Bank debt ratio in long run and consistent with tradeoff theory and signaling

theory respectively. Size is negatively related to Bank debt ratio and not consistent with the predicted sign. The variable Growth is positively related to Bank leverage and not consistent to the predicted sign. On the other hand, even though it is consistent with pecking order theory, Effective tax rate is negatively statistically insignificant in long term.

Taking into account the short rum model, results show that all variables are statistically insignificant at any usual significance level (1%, 5% and 10%). The coefficient (speed of adjustment) is negatively significant at 5%, thus the error correction model representation is validated.

In testing the consistency of the capital structure relevancy theories with the capital structure decisions made in the selected commercial Banks, we found that all the suspected determinant factors of capital structure decisions in the commercial Banks indicate compliance to the tradeoff theory and pecking order theory.

These findings are in line with the study of Ahamad and Wan (2015) in Malaysia, Aremu et al.(2013) in Nigerian Banking Sector, Kibrom (2010) and Weldemikael (2012) in Ethiopian Banks, Octavia and Brown(2008) in developing countries, *Sogorb-Mira* and *López-Gracia (2003),* Titman and wessels (1988) in America and Mahshid (2013) in Iranian banks.

5.2 RECOMMENDATIONS

In light of the results which are confirmed by this study and discussed in detail in the previous paragraphs, we recommend that external investors and shareholders should appreciate the discussed factors that determine the capital structure of commercial Banks and observe its performance before making decisions of whether or not to buy or sell its particular stock. To protect themselves from excessive use of corporate leverage through the use of protective covenants, lenders should consider the studied factors to evaluate and predict the risk associated with lending capital to their respective borrowers.

To expend the literature in Rwanda regarding capital structure, Future studies can use other indicators for these factors like Bank risk, dividend payout, and macroeconomic factors such as inflation, GDP growth and interest rate to demonstrate the impact of both internal and external variables on the choice of capital structure in Rwanda. This study can also be replicated to other industries in Rwanda especially to the medium sized enterprises and microfinance firms.

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APPENDICES

Appendix 1: Vector Error Correction Estimates

Long-term Estimates Standard errors in ( ) &t-statistics in [ ]		**Short-term Estimates (Error Correction)** Standard errors in ( ) &t-statistics in [ ]	
Cointegrating Eq:	**cointEq1**	ΔU(-1)	-0.940338** (0.37374) [-2.51605]
DAR(-1)	1.000000	ΔDAR(-1)	0.023987 (0.38866) [0.06172]
PR(-1)	-0.003070*** (0.00174) [-1.76749]	ΔPR(-1)	-0.006530 (0.00437) [-1.49441]
TN(-1)	0.007974* (0.00117) [6.80239]	ΔTIN(-1)	-0.002087 (0.00465) [-0.44860]
SIZE(-1)	-0.045459* (0.00616) [-7.38225]	ΔSIZE(-1)	-0.017122 (0.02103) [-0.81415]
AG(-1)	0.001732* (0.00026) [6.77652]	ΔAG(-1)	-0.000374 (0.00224) [-0.16680]
LQ(-1)	0.543078* (0.04217) [12.8784]	ΔLQ(-1)	0.060961 (0.25541) [0.23867]
GR(-1)	0.001765* (0.00021) [8.28599]	ΔGR(-1)	0.000343 (0.00044) [0.78444]
ETR(-1)	-5.59E-05 0.00013 [-0.44639]	ΔETR(-1)	6.38E-05 (0.00028) [0.22605]
C	-1.046592	C	-0.000271 (0.00586) [-0.04623]

Source: Authors' computation from Eviews (***, ** and * means the values are significant at 10%, 5% and 1% respectively).

Appendix 2: Granger Causality Test

Pairwise Granger Causality Tests				
Null Hypothesis:	**F-Statistic**	**Probability**	**Decision**	**Relationship**
PR does not Granger Cause DAR	0.30760	0.5826	Do not reject	No relation
DAR does not Granger Cause PR	0.30369	0.5850	Do not reject	
TN does not Granger Cause DAR	2.36489	0.1328	Do not reject	No relation
DAR does not Granger Cause TN	0.04927	0.8256	Do not reject	
SIZE does not Granger Cause DAR	0.25211	0.6187	Do not reject	No relation
DAR does not Granger Cause SIZE	1.54499	0.2219	Do not reject	
AG does not Granger Cause DAR	0.01119	0.9163	Do not reject	No relation
DAR does not Granger Cause AG	0.05394	0.8177	Do not reject	
LQ does not Granger Cause DAR	1.78521	0.1899	Do not reject	No relation
DAR does not Granger Cause LQ	1.67259	0.2041	Do not reject	
GR does not Granger Cause DAR	0.48839	0.4891	Do not reject	No relation
DAR does not Granger Cause GR	0.01815	0.8936	Do not reject	

ETR does not Granger Cause DAR	1.20634	0.2794	Do not reject	No relation
DAR does not Granger Cause ETR	0.61947	0.4364	Do not reject	
TN does not Granger Cause PR	1.97996	0.1680	Do not reject	No relation
PR does not Granger Cause TN	0.00527	0.9425	Do not reject	
SIZE does not Granger Cause PR	0.47925	0.4932	Do not reject	No relation
PR does not Granger Cause SIZE	0.16740	0.6849	Do not reject	
AG does not Granger Cause PR	6.89632	0.0126**	Reject	
PR does not Granger Cause AG	0.73390	0.3973	Do not reject	
LQ does not Granger Cause PR	0.53692	0.4685	Do not reject	No relation
PR does not Granger Cause LQ	0.02770	0.8687	Do not reject	
GR does not Granger Cause PR	0.11925	0.7319	Do not reject	No relation
PR does not Granger Cause GR	1.26770	0.2676	Do not reject	
ETR does not Granger Cause PR	3.13088	0.0853***	Reject	
PR does not Granger Cause ETR	0.00052	0.9820	Do not reject	

SIZE does not Granger Cause TN	0.59577	0.4452	Do not reject	No relation
TN does not Granger Cause SIZE	0.85709	0.3607	Do not reject	
AG does not Granger Cause TN	1.36608	0.2502	Do not reject	No relation
TN does not Granger Cause AG	0.52465	0.4735	Do not reject	
LQ does not Granger Cause TN	0.29925	0.5877	Do not reject	No relation
TN does not Granger Cause LQ	2.08989	0.1569	Do not reject	
GR does not Granger Cause TN	0.13266	0.7178	Do not reject	
TN does not Granger Cause GR	2.85752	0.0996***	Reject	
ETR does not Granger Cause TN	0.02826	0.8674	Do not reject	No relation
TN does not Granger Cause ETR	0.37637	0.5434	Do not reject	
AG does not Granger Cause SIZE	0.12351	0.7273	Do not reject	No relation
SIZE does not Granger Cause AG	0.31249	0.5796	Do not reject	
LQ does not Granger Cause SIZE	0.05633	0.8137	Do not reject	No relation
SIZE does not Granger Cause LQ	0.02697	0.8705	Do not reject	

GR does not Granger Cause SIZE	0.28400	0.5974	Do not reject	No relation
SIZE does not Granger Cause GR	0.07437	0.7866	Do not reject	
ETR does not Granger Cause SIZE	0.12253	0.7284	Do not reject	No relation
SIZE does not Granger Cause ETR	2.16213	0.1501	Do not reject	
LQ does not Granger Cause AG	0.17290	0.6800	Do not reject	No relation
AG does not Granger Cause LQ	0.31650	0.5772	Do not reject	
GR does not Granger Cause AG	0.03394	0.8549	Do not reject	No relation
AG does not Granger Cause GR	1.77097	0.1916	Do not reject	
ETR does not Granger Cause AG	0.07395	0.7872	Do not reject	
AG does not Granger Cause ETR	3.13176	0.0853***	Reject	
GR does not Granger Cause LQ	0.37288	0.5453	Do not reject	No relation
LQ does not Granger Cause GR	0.48340	0.4913	Do not reject	
ETR does not Granger Cause LQ	0.14600	0.7046	Do not reject	No relation
LQ does not Granger Cause ETR	0.77024	0.3860	Do not reject	

ETR does not Granger Cause GR	0.92774	0.3419	Do not reject	No relation
GR does not Granger Cause ETR	0.44558	0.5087	Do not reject	
** denotes significant at 5% and *** denotes significant at 10%				

Appendix 3: Variables and their Measures

VARIABLES		DEFINITION	MATHEMATICAL EXPRESSION
Dependent Variable	Debt to asset Ratio	Ratio of total liability to total assets	Total Liability ---------- Total Assets
Explanatory Variables	Profitability	Ratio of Operating income to Total assets	Operating Income ---------- Total Assets
	Tangibility	Ratio of Tangible (fixed) assets to Total assets	Fixed Assets ---------- Total Assets
	Size	Natural Logarithm of Total Assets	ln(*Total Assets*)
	Age	Number of years stay in business	*Number of years*
	Liquidity	Ratio of current assets to the current liabilities	Current Assets ---------- Current Liabilities
	Bank Growth	Percentage increase (change) in total assets	$(TA_{current\ year} - TA_{previous\ year})$ ----------x 100 $TA_{previous\ year}$
	Effective Tax Rate	Tax expense divided by pretax profit	Tax expenses ---------- X100 Pretax profit

Source: Author's self presentation basing on literature review

Appendix 4: Data of the Selected Banks Studied

BANK	YEAR	DAR	Bank Specific Factors						
			PR	TN	SIZE	AGE	LQ	GR	ETR
BK	2006	0.88	10.55	4.19	11.38	40.00	1.09	26.09	35.9
	2007	0.89	8.65	4.40	11.72	41.00	1.07	39.68	31.3
	2008	0.87	11.52	4.88	11.70	42.00	1.10	(1.41)	31.4
	2009	0.88	9.55	4.42	11.93	43.00	1.09	25.77	28.96
	2010	0.84	9.47	9.40	12.19	44.00	1.08	30.14	28.83
	2011	0.79	8.64	6.87	12.57	45.00	1.21	45.64	18.44
	2012	0.80	10.73	6.77	12.68	46.00	1.19	12.12	18.56
	2013	0.83	10.60	5.03	12.95	47.00	1.26	30.84	20.52
	2014	0.81	10.49	4.29	13.09	48.00	1.31	14.26	19.52
	2015	0.82	10.01	4.11	13.24	49.00	1.28	16.29	20.41
I&M BANK	2006	0.91	10.68	2.64	11.21	43.00	1.07	13.85	16.71
	2007	0.91	10.29	2.23	11.53	44.00	1.07	36.53	12.6
	2008	0.93	9.95	3.34	11.52	45.00	1.04	(1.09)	49.43
	2009	0.91	12.42	4.46	11.38	46.00	1.08	(12.64)	41.33
	2010	0.87	14.70	5.01	11.35	47.00	1.09	(3.34)	29.87
	2011	0.87	14.87	4.57	11.44	48.00	1.13	9.78	34.73
	2012	0.86	14.83	3.91	11.61	49.00	1.13	19.06	28.79
	2013	0.85	13.75	3.21	11.74	50.00	1.15	13.75	33.26
	2014	0.85	11.24	2.72	11.92	51.00	1.15	19.48	26.36
	2015	0.86	10.70	2.32	12.05	52.00	1.16	14.32	30.88
ECO-BANK	2006	0.98	11.43	18.52	10.44	11.00	0.83	6.39	(80)
	2007	0.90	7.23	10.35	10.71	12.00	0.99	31.30	(0.03)
	2008	0.91	10.46	7.93	10.93	13.00	1.02	25.07	(4.8)
	2009	0.85	10.11	10.22	11.03	14.00	1.06	10.74	69.16
	2010	0.89	9.27	6.65	11.39	15.00	1.04	43.30	84.08
	2011	0.89	9.51	7.39	11.45	16.00	1.09	5.79	14.32
	2012	0.89	9.39	6.92	11.70	17.00	1.09	28.43	47.33
	2013	0.89	10.15	7.69	11.64	18.00	1.10	(6.35)	5.22
	2014	0.91	8.70	5.78	11.87	19.00	1.08	26.36	45.8
	2015	0.92	8.90	4.14	12.04	20.00	1.10	18.18	47.29

	2006	0.89	7.54	3.73	10.36	8.00	1.11	41.22	31.31
	2007	0.89	8.34	2.67	10.59	9.00	1.11	26.3	32.14
	2008	0.82	9.72	2.55	10.72	10.00	1.21	13.83	35.83
	2009	0.85	6.74	2.10	10.74	11.00	1.19	2.57	32.36
	2010	0.86	8.45	1.63	10.96	12.00	1.17	23.80	36.64
	2011	0.87	9.00	2.21	11.15	13.00	1.16	21.07	34.2
	2012	0.89	8.93	2.58	11.34	14.00	1.14	21.64	31.61
	2013	0.89	7.63	2.48	11.58	15.00	1.10	26.70	30.03
	2014	0.9	7.92	3.41	11.81	16.00	1.09	25.18	31.38
	2015	0.9	7.03	3.94	12.09	17.00	1.08	32.8	32.31

Source: Researchers' own computation based on the Annual Financial Reports of Selected Commercial Banks from 2006 to 2015.Where DAR: Debt Asset ratio, PR: Profitability, TN: Tangibility, LQ: Liquidity, GR: Growth, ETR: Effective tax rate.

INFLUENCE OF SUBJECT AREAS ON ENVIRONMENTAL KNOWLEDGE OF SECONDARY SCHOOLS' STUDENTS IN CITY OF KIGALI

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ABSTRACT

The purpose of this study was to explore what Rwandan students of secondary schools know about environment because environmental knowledge can be one of determinants of their future behaviours and actions towards addressing environmental issues. From a sample of 250 students from 3 Districts of Kigali City (Nyarugenge, Gasabo and Kicukiro); it was found that in general, environmental knowledge of students was still low. So the researchers recommended initiating specific programme of Environmental Education within secondary schools in order to have a greater consideration of students on environmental values.

Key words: Environmental knowledge- Subject area influence- Secondary School Student

1. INTRODUCTION

This study comes under the Environmental Education (EE) and aims at assessing the environmental knowledge in relationship with educational background of secondary schools' students. Indeed, EE should play the greatest role in environmental protection because it aims to direct young learners to explore and investigate their own environment. Wilke (1997) defines environmental knowledge as knowledge regarding environmental issues.

These issues would be local in the early years of children and thus expand into regional, national and international concerns at succeeding grade levels. As children grow older, their information about issues increases in depth and in quality. Socrates quoted by Rather (2007: 44) said:"the o*ne who had the knowledge should be other than virtuous*".

This implies that through EE, the researchers expect children to gain knowledge, skills and values they need to make and take decisions, which will sustain rather than deplete the resources. To Pelgrim *et al* (2007), ecological knowledge has substantial environmental, human, and economic values, as it codes for and contributes to a wide range of ecosystem good and services, including current and future pharmaceutical uses, agricultural diversity in terms of both crops and livestock, and wild harvest opportunities for food, medicine, and fuel.

On the other hand, Jannah *et al* (2013) emphasise that environmental literacy is the ultimate goal and the best way to address environmental issues. This infers that there is connection between knowledge and solving environmental issues.

2. BACKGROUND OF THE STUDY

Environmental Education has evolved for many years. It got a big push in 1972, when the representatives at the UN Conference on the Human Environment in Stockholm, Sweden recommended that the UN establish an international EE programme. The United Nations Educational, Scientific, and Cultural Organization (UNESCO, 1978) followed up on the recommendation by sponsoring a series of EE workshops and conferences around the world. In 1975, representatives from member nations met in Belgrade, in the former Yugoslavia, to outline the basic definition and goals of EE.

Then in 1977, representatives from more than 60 nations gathered in Tbilissi, in the former Soviet Republic of Georgia, for a follow-up to Belgrade conference. Delegates to these two international conferences ratified the following definition of EE and drew up a set of objectives such reported in following terms: Environmental Education *is "a process aimed at developing a world population that is aware of and concerned about, the total environment and its associated problems, and which has the knowledge, attitudes, skills, motivation, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones."*

3. PROBLEM STATEMENT

At my best knowledge, there are no studies conducted for assessing relationship between educational background and environmental knowledge of secondary schools' students in Rwanda. Throughout the world, some scholars tried to analyse the issue and their studies revealed low level of environmental knowledge. As for students' knowledge in secondary schools, Rosta *et al* (2011) conducted a study on Environmental Knowledge and Attitude among Students in Sabah, in Malaysia. Their research found that environmental awareness among students is highly influenced by their background, knowledge towards the environment. The objectives of this study were to identify levels of knowledge on environmental literacy and attitude towards environmental issues that are occurring in Malaysia presently.

The results show that in general, students in Sabah, particularly from form 4 level, have high level of environmental knowledge except for several items which measure the current environmental issues in Malaysia such as Carbon dioxide and climate change. Their attitudes are influenced by the level of knowledge that they have concerning the environment. Gambro (1991) conducted a survey on structural model of environmental knowledge among high school students of Northern Illinois (USA). The research was to assess the current levels of environmental knowledge and to examine multiple influences on twelfth-grade environmental knowledge for a national probability sample of high school students.

The assessment of the amount of environmental knowledge possessed by American high school students revealed low levels of knowledge. Most students could recognize basic facts

concerning environmental problems; however, they could not apply their knowledge to comprehend the consequences or potential solutions of the problems. Students also demonstrated extremely little growth in environmental knowledge from tenth to twelfth-grades.

In the same vein, Magda *et al* (2009) measured the level of environmental knowledge among preparatory school students in Alexandria, Egypt. The research focused on students' knowledge towards some environmental concepts. Results of the study revealed that 77% of the students had poor level of environmental knowledge and that 23% had fair level. Following six EE sessions, an improvement in their knowledge was observed where 69% of the students had a satisfactory level of knowledge toward the environment. These results support the need for development and implementation of EE programmes as part of the regular school curriculum.

4. OBJECTIVES OF THE STUDY

Specifically, this study aims to:

- Assess environmental knowledge of secondary schools' students of Kigali City;
- Examine whether the subject area influences environmental knowledge of Rwandan secondary schools' students of Kigali City.

5. RESEARCH METHODOLOGY

For conducting this study, the researchers adopted a survey research design through which the field data were collected by questionnaire from June to December 2013. The target

population of the study was 24,595 students of upper secondary level of 25 schools from 3 urban districts (Nyarugenge, Gasabo and Kicukiro) in Kigali City (MINEDUC, 2012). For determining sample size, the Yamane (1967) formula was used and developed as follows:

$n= N/1+N(e)^2$ where **n**= is sample size; **N**= Size of Target Population and **e** (0.063)= error margin or level of confidence. So, the sample size calculated is n= **$24596/1+24596(0.063)^2$= 249.39 rounded to 250 respondents.**

Ten (10) students were selected from each school that made a total sample size of 250 respondents i.e. total number of schools sampled in three districts of Kigali City. For identifying students' sample in each school, the researchers used the systemic sampling technique where sampling interval was calculated and defined as K (250/25=10), i.e. every K^{th} subject on a list of all students of year 5 and year 6, were selected for inclusion in the sample.

After finding the sampling interval, the researchers chose randomly each number included in that interval until he got sample size of each school. The results were processed using the Statistical Package for the Social Science (SPSS 16) and analysed based on statistical techniques as frequencies, Percentages and measures of association, Chi-Square (χ^2) in crosstabs.

For testing knowledge of respondents, the information was gathered through the study of some key aspects that give a holistic view of the environment. Those features include the concept of environmental education, ecosystem functioning,

atmospheric pollution, biodegradable and non-biodegradable waste, renewable and non-renewable resources, water pollution, world environment day. In order to test the informants' opinions, questions set in multiple choice and the respondents had to give only one correct answer.

6. FINDINGS PRESENTATION, INTERPRETATION AND DISCUSSION

The key informants here are students as indicated on different tables below. The interviewees were required to respond on a Likert scale to the statement related to EE definition.

Accordingly, the first specific question about the components of EE definition was addressed to respondents in order to explore their understanding of it.

6.1 Demographic information of respondents

Information was received from 129 female (51.4%) and 121 male (48.6%). This could justify the balance between gender observed in the formal educational sector currently in Rwanda. Regarding age of respondents, the minimum age was 15, the maximum was 29 and the average was 19. This highlights that the respondents were able to give reliable answers.

6.2 How students conceptualise EE

It is agreed that the philosophy of any science is incarnated in its concepts. This is why respondents were required to give their opinions regarding EE definition by choosing between Yes, No or Not sure, among items proposed in Table 1.

Table 1: **Respondents' knowledge about EE definition**

	Students' responses			
Items	Yes (%)	No (%)	Not sure (%)	Total (%)
EE increases knowledge and awareness about environment and challenges linked	88	5.6	6.4	100
EE develops skills and expertise to address these challenges	61.6	15.6	22.8	100
EE fosters attitude, motivation and commitment to take responsible action	44.0	30	26	100
EE comprises three models of education about, in and for environment	75.6	6	18.4	100

Source : Field survey, June-December, 2013

As Table 1 shows it, regarding the definition component of EE aiming at knowing whether EE can increase knowledge and awareness, majority of respondents (88% of students) had agreed that EE can increase knowledge and awareness of people about environmental issues while 12% of students remained ignorant of the issue. Actually, knowledge and awareness are closely linked. Environmental awareness can arise from many activities and education being just one of them and it is the first step toward deeper understanding. Developing knowledge often requires a pedagogy, a formal methodology for constructing knowledge with the student, something that is absent in simple information transfer.

According to Matthews (2004), to be environmentally aware, people must have some knowledge of the environmental laws and structures, so they apply this knowledge for the protection of the environment and challenges associated to it. This is why UNESCO (1978) emphasises that the awareness helps students to acquire sensitivity to the total environment and its problems by developing the ability to perceive and discriminate among stimuli; process, refine, and extend these perceptions; and use this new ability in a variety of contexts whereas the knowledge helps students to acquire a basic understanding of how the environment functions, how people interact with the environment, and how issues and problems dealing with the environment arise and how they can be resolved. Furthermore, Mumford *et al* (2000) argue that knowledge is the accumulation of information and the mental structures used to organize that information.

Regarding skills and expertise, it is also noteworthy that the majority of respondents (61.6% of students) indicated that EE can develop skills and expertise to address environmental issues and challenges associated against their counterparts (48.9% of students) who lack of understanding as they disagreed or were not sure what the concept meant. Skill is an essential part of both formal and non-formal EE programs. Focusing on the investigations that involve local environmental systems, problems, and issues associated to it and expertise can easily help to acquire competencies to know how and so foster such skills.

Similarly, as regards the knowledge of how EE can encourage attitude, motivation and commitment to take responsible action, results of the study revealed that respondents had a poor level of knowledge of the issue because most of students

(56 %) disagreed with the statement.

Indeed, developing attitudes of appreciation and concern for the environment is a subtle process that is difficult to deliberately teach. Many educators believe that attitudes change primarily from a variety of life experiences which can take place outside as well as inside the classroom but the ultimate goal of EE programmes is to develop the capacity for action and participation.

All in all, EE gives the capacity to act responsibly in daily life with a broad understanding of how people and societies relate to each other and natural systems. Environmental Education implies thus the process of developing that capacity due to motivation and this is in connection with Microsoft Encarta (2009) ascertaining that the strength that determines behaviour such as the biological, emotional, cognitive, or social forces that activate and direct environmental behavior. So, those forces provoke the feeling of enthusiasm, interest, or commitment that makes learners to conduct actions towards environment.

6.3 Etymological meaning of ecology

In past times, many people used to confuse ecology, ecosystem, biosphere, biodiversity, biome, food chain, etc. as they could use them interchangeably, as if they were synonyms. However, it proves necessary that learners distinguish clearly these concepts because they are closely linked. Better understanding them remains very commendable because this can help the students to better understand environmental systems and how they work. Accordingly, the understanding of ecological systems could allow learners to predict the consequences of human activity on the environment. So, respondents were asked to state the

etymological meaning of the ecology from the question whose answers were designed in multiple choices but one of them was more correct. Before analysing their answers, it was useful to recall the meaning of ecology. According to Haeckel (1866) quoted in Vallée (2002), etymologically, the concept e**cology** comes from two Greek words (**οἶκος,** house or habitat and **λογία**, study of) sharing the same root word as economics; thus ecology is the scientific study of interactions among organisms and their environment, such as the interactions organisms have with each other and with their abiotic environment. Thus, the views of respondents to the meaning of ecology are presented in Table 2 below.

Table 2: Knowledge of respondents regarding the meaning of ecology

	Responses (in %)				
Subject areas of students	Study of home	Study of the world	Natural life	Study of nature	
Math-Chemistry-Biology	10	13.3	56.7	20	χ^2 value
Math-Physics-Geography	0	0	51.4	48.6	P= 0.05
History-Economics-Geography	8	20	56	16	
Computer-Economics-Management	5.7	14.3	77.1	2.9	
Accountancy	0	28.6	54.3	17.1	
Physics-Chemistry-Biology	52	4	24	20	
Tourism	10	0	45	45	
English-French Kinyarwanda	0	0	40	60	
Public works (Engineering)	0	10	50	40	0.00
Math-Computer-Economics	12	16	44	28	
History-Economics-Literature	0	20	80	0	
% of total	10	12.4	52.8	24	100

Source: Field survey, June-December, 2013

Data from Table 2 above depicted that few students (10%) who know the etymological meaning of ecology is still low. Regarding the knowledge of the etymology of ecology within subject areas, students (52.8%) from combination subjects of Physics-Chemistry-Biology seem to be well informed than others. Indeed, these students have possibly got information from

the media. They are followed by students from Mathematics-Economics-Computers with 12% of those who knew the etymological meaning of ecology. By contrast with what has been discussed previously, the students who have Biology or Geography in their curriculum were the most informed about environmental matters than the students from other subject combinations. But this section shows that the students who have Geography in their subject combinations were coming among the last. These subject combinations include Tourism (10%), History-Economics-Geography (8%).

Computer-Economics-Management comes the last but one (5.2%) of subject combination of History-Economics-Geography, Mathematics-Physics-Geography, English-French-Kinyarwanda, Accountancy, History-Economics-Literature, and Engineering whose each one represents 0%, i.e. the students in these combinations did not know the etymological meaning of the concept ecology. Then, the responses were also analysed using the Pearson's chi-square test of significance. The observed Chi-Square value was 0.00 at level of significance (P)= 0.05. Since Chi-Square observed is smaller than Chi-Square critical value (0.00<0.05) results were statistically significant. So, null hypothesis stipulating that there is no difference in ecology conceptualization within subjects' areas of respondents, was completely rejected.

The views presented by each group were great in variety, as seen in the different subject areas of respondents, implying that the responses of the surveyed were too varied.

As it has been discussed above, ecology is the study of the relationship between organisms and between the organism and the environment.

The structural and functional unit of ecology is known as the ecosystem. According to Basak (2009), ecosystem is a unit that covers all organisms of a given area as well as their relationship to the inorganic environment. The organisms within an ecosystem form a biocenosis, their inanimate environment is called a habitat or abiotic. The totality of all ecosystems on earth is called the biosphere it means where life is found on the planet and the species interact with their biotic and non-biotic components. So respondents were asked to state the meaning of ecosystem concept and their answers are reported in Table 3 below.

Table 3. **Meaning of ecosystem**

	Responses (in %)				
Subject areas of students	Plants & animals	Biotic & Abiotic	Plants & light	Weeds & Microorgnisms	χ^2 values
Math-Chemistry-Biology	63.3	10	13.3	13.3	
Math-Physics-Geography	54.3	8.6	14.3	22.9	P= 0.05
History-Economics-Geography.	36	4.	40	20	
Computer-Economics-Management	34.3	8.6	22.9	34.3	
Accountancy	34.3	14.3	25.7	25.7	
Physics-Chemistry-Biology	28	56	0	16	
Tourism	50	10	30	10	0.00
English-French-Kinyarwanda	80	0	0	20	
Public works (Engineering)	30	0	60	10	
Math-Computer-Economics	68	12	4	16	
History-Economics-Literature	20	20	20	40	
% of total	45.2	14	20	20.8	100

Source: Field survey, June-December, 2013

As Table 3 above indicates concerning the meaning of ecosystem, it is obvious that majority of respondents (86%) of students) did not give a correct and complete answer while 14% of students only identified correctly the good answer, which means that ecosystem is the study of relations between biocenosis (biotic) and abiotic as well as relations between biocenosis itself. Within subject areas, contrary to expectations that Biology and geography should give correct answer than those who have not them in their curriculum, only students (56%) from Mathematics-Physics-Biology gave more correct answer. This is due to the fact that this subject combination has Biology as component but also the personal information from mass media or their teachers and parents.

They are followed by students (20%) from History-Economics-Literature, students (14.3%) from Accountancy, students (12%) from Mathematics-Economics-Computer, and students (10%) from Mathematics-Chemistry-Biology, Tourism (10%) and students from Mathematics-Physics-Geography and computer-Management (10%). Students from History-Economics-Geography (4%) are the last whereas those from English-French-Kinyarwanda and Engineering (0%) are at the bottom of the list.

This means that they do not know exactly the meaning of ecosystem. Then, the results were also analysed using the Pearson's Chi-Square test of significance. The observed Chi-Square value was 0.00, thus less than 0.05. This means that there is significant difference in environmental knowledge due to subject areas of respondents. In other words, the subject area of respondents influences their knowledge on the meaning of ecosystem concept.

6.3.2 Biosphere

In order to test knowledge about biosphere as a component of ecological domain, respondents were then requested to designate the largest area of living organisms on the Earth among ecosystem, biome, biosphere and population.

The data from Table 4 show the level of knowledge of the respondents regarding meaning of biosphere. It is obvious that majority of respondents (60.8% of students) did not succeed to provide a correct answer about biosphere.

Ecosystem as largest area of living organisms on the earth was indicated by 35.2% of students, 4% of them believed that the largest area of living organism is biome and 21.6% of students designated population, although all answers were wrong.

Table 4. The largest area of living organisms on the Earth

	Responses (in %)				
Subject areas of students	Ecosystem	Biome	Biosphere	Population	
Math-Chemistry-Biology	60	3.3	23.3	13.3	χ^2 values
Math-Physics-Geography	34.3	0	57.1	8.6	P= 0.05
History-Economics-Geography	32	16	20	32	
Computer-Economics-Managementt	25.7	0	45.7	28.6	
Accountancy	14.3	2.9	54.3	28.6	
Physics-Chemistry-Biology	68	4	8	20	
Tourism	30	0	50	20	
English-French-Kinyarwanda	0	0	80	20	
Public works (Engineering)	30	0	60	10	0.00
Math-Computer-Economics	32	12	32	24	
History-Economics-Literature	40	0	20	40	
% of total	35.2	4	39.2	21.6	100

Source: Field survey, June-December, 2013

Correct responses were given by less than a half of students (39.2%). As for the respondents within subject areas, students from English-French-Kinyarwanda (80%) by surprise gave correct answers about the largest area of living organisms which is biosphere. These students were followed by those from Engineering (60%), students from Mathematics-Physics-Geography (57.1%), those from Accountancy (54%), Computer-Economics-Management (45.7%), Tourism (50%), Mathematics-Economics-Computer (32%), students from Mathematics-Biology-Chemistry who designated the correct answer were (23.3%). Students from Mathematics-Physics-Chemistry (8%) were the last to give correct answer although there is Biology in their curriculum. The last but one was students from History-

Economics-Geography and History-Economics-Literature (20%) to point out biosphere as the largest area of living organism on the earth. These results were surprise because students, who have geography and Biology in their curriculum, did not succeed to provide better answer than those who have not. Then, responses were also analysed using the Pearson's Chi-Square test of significance. The Chi-Square critical value computed was 0.00 at level of significance (P)= 0.05. Given that results were statistically significant, there is significant difference of environmental knowledge due to subject areas of respondents. This is the case of English-French-Kinyarwanda (80%), Public Works (60%), Mathematics-Physics-Chemistry (57.1%) who came among the first to give correct response.

It may be possible to confuse the concepts above i.e. ecosystem, biome biosphere and population which are all the domain of Ecology. Earth, as an environmental perspective, includes several systems: lithosphere (or sphere of solid part of earth), the hydrosphere (or sphere of water) and atmosphere (sphere of air). The biosphere can be defined as the sphere of living which exists in lithosphere, hydrosphere and atmosphere. It is known as the container of biodiversity (various forms of life) which is considered as the content of biosphere. So compared to ecosystem, biosphere is the largest area of living because an ecoystem can be applied to portions of varying size of the biosphere, for example a pond or a dead tree.

A smaller unit of ecosystem like a pond is called a microcosm, while a meso-ecosystem could be a forest, and a macro-region ecosystem could be for example a watershed. Another concept which is confused with ecosystem is the biome which means a large area with similar flora, fauna, and microorganisms.

The difference between ecosystem and biome is that ecosystem is much smaller than biome. But biome can be thought of many similar ecosystems throughout the world grouped together. Biome could be for example the tropical rainforest, temperate broadleaf and mixed forests, temperate deciduous forest, taiga, tundra. Other concepts linked to previous concepts that people used to confuse, are concepts of population and community (biocenosis). According to Waples and Gaggiotti (2006), the population in ecology is a unit of analysis. It consists of individuals of the same species that live, interact and migrate through the same habitat. But a community (biocenosis) means different species bound together in a common habitat and the members of this community may be plants as well as animals in a given ecosystem.

6.4 Biodegradable and Non-biodagradable waste

Regarding non degradable waste, respondents were asked to designate among the items below which of them is the most suitable. Non biodegradable waste is waste that does not break down into natural components and exists in the environment for a long time. The examples given here could be tyres, plastics (sachets), computer-hardware, metals, etc while biodegradable waste is waste that can break down into natural components and be recycled into the life cycle naturally, such as food refuse, paper, cardboard, corpses of animals, dead trees, and sawdust, etc.

Table 7. Respondents' knowledge on biodegradable and non-biodegradable waste

	Responses (in %) n=250				
Subject areas of students	Paper	Food refuses	Sachets	Sawdust	χ^2 values
Math-Chemistry-Biology	40	6.7	50	3.3	P= 0.05
Math-Physics-Geography	11.4	8.6	74.3	5.7	
History-Economics-Geography	28	4	56	12	
Computer-Economics-Managementt	37.1	14.3	42.9	5.7	
Accountancy	22.9	20	48.6	8.6	
Physics-Chemistry-Biology	4	8	80	8	
Tourism	45	20	35	0	
English-French-Kinyarwanda	80	20	0	0	0.00
Publicworks (Engineering)	30	0	60	10	
Math-Computer-Economics	8	8	76	8	
History-Economics-Literature	20	40	20	20	
% of total	25.6	11.6	56	6.8	100

Source: Field survey, June-December, 2013

According to responses from the above table, it is clear that majority of respondents know something about non-biodegradable waste (56% of students) as they stated that sachet is non- biodegradable waste. Regarding respondents within their subject areas, students from Physics-Chemistry-Biology know more than others since 80% of them provided correct answer i.e sachet. They were followed by students from Math-Economics-Computer (76%), those from Math-Physics-Geography (74.3%),

Engineering or public works (60%), History-Economics-Geography (56%) and students from Math-Chemistry-Biology (50%) whose knowledge was rated at more or less equal to 50%. Knowledge of students from English-French-Kinyarwanda to this environmental issue was judged to be null because their answers were scored 0%. The last but one, was the category of students from History-Literature-Economics with 20%. Then, these responses were analysed by using the Pearson's Chi-Square test of significance which showed that the results were statistically significant since the Chi-Square critical value was 0.00 at level of significance (P)= 0.05.

Conversely, responses revealed that knowledge differs from subject combinations. The knowledge of the issue might depend on personal information because in Rwanda, people know that using sachet is banned by Law n°57/2008 of 10/09/2008 in its article 3 stipulating that manufacturing, using, importing and selling polythene bags is hereby prohibited in Rwanda. If people must keep in mind the potential hazard of biodegradable waste, it is important for them to know in what way they can help to make sure that less non-biodegradable material is left in the environment. This is a way of becoming an environment friendly consumer by following the everyday tips on how people can contribute to less non-biodegradable materials.

6.5 Knowledge of respondents on renewable and non-renewable resources

Non-renewable resources concern limited supply that cannot be replaced or that can be replaced only over extremely long periods of time and they include fossil fuels as coal, petroleum, natural gas and mineral deposits such as copper ore, diamond

ore iron ore and gold ore, etc while renewable resources are those that may be replaced over time by natural processes, such as fish or natural vegetation as products like timber, or wild mushrooms, etc. Accordingly, respondents were asked to choose the correct answer among the items and state which of them can fit to environmental issue under study. Table 5 below presents the answers of respondents.

Regarding resource conservation, the knowledge of the respondents about renewable resource is still low for the majority of students because 36% pointed out the gold. The fair answer was designated only 17.2% of respondents.

Concerning respondents within their subject areas, students from History-Geography-Economics and Accountancy were the first to give the correct answer at the rate of 52%. Students from Accountancy made a surprise because in other many issues they did not provide correct answers. They were followed by students from Mathematics-Physics-Geography at 45.7%, Mathematics-Chemistry-Biology with 26.7%, Public works (Engineering) rated at 24%, Tourism and English-French-Kinyarwanda- rated at 20% each.

Table 5. Knowledge of respondents about non-renewable resources

	Responses (in %) n=250				
Subject areas of students	Timber	Wild mushrooms	Fish	Gold	χ^2 values P= 0.05
Math-Chemistry-Biology	23.3	13.3	36.7	26.7	
Math-Physics-Geography	20	14.3	20	45.7	
History-Economics-Geography	0	28	20	52	
Computer-Economics-Management	20	20	17.1	42.9	
Accountancy	4	4	40	52	
Physics-Chemistry-Biology	10	10	70	10	
Tourism	0	20	60	20	
English-French-Kinyarwanda	20	40	20	20	
Publicworks (Engineering)	28	12	36	24	0.00
Math-Computer-Economics	20	0	80	0	
History-Economics-Literature	20	0	80	0	
% of total	17.2	15.2	31.6	36	100

Source: Field survey, June-December, 2013

The last category but one is made of students from Physics-Chemistry-Biology scored at 10%. Students from History-Economics-Literature and Mathematics-Economics-Computer were the last to have an idea about the issue under study. The results were also analysed by using the Pearson's Chi-square test of significance. The Chi-Square critical value was 0.00 at level of significance of P-value of 0.05. This means that results

were statistically significant. Thus, here, subject area contributes significantly to influence the Environmental knowledge of the secondary school students. The knowledge of resources, especially non-renewable ones is very important because their conservation focuses on maintaining an adequate supply for sustainable exploitation and rationale use. But the renewable resources as forest must also be conserved because of their importance. In addition, forests provide for example many social, economic, and environmental interests. Apart from timber and paper products, forests provide wildlife habitat and recreational opportunities, fight against erosion and flooding of soil, help provide clean air and water, and contain wonderful biodiversity. Forests play also an important role as defense against global climate change.

6.6 Knowledge of respondents about environmental pollution

Environmental pollution in its broad sense infers that any action can degrade environmentally. Indeed, this implies any action that can destroy the environment such as radiation, wind, erosion, noise, chemical substance that can affect air, water, and soil as well as humans.

6.6.1 Greenhouse gases effect on atmospheric pollution

In order to test the respondents' knowledge about greenhouse gases, they were requested to state among those proposed below, which gas is most responsible of greenhouse gas effect. So, the answers of participants were tabulated according to different issues as exposed in Table 6.

Indeed, Table 6 depicts that majority of respondents (65.9% of students and 69% of teachers) in this study designated carbon dioxide (CO_2) as the main gas responsible of greenhouse gas effect; for them this gas truly causes global warming. This concludes that the level of their knowledge on the issue in average is higher since 65.9% of students pointed out the dioxide of carbon ($C0_2$).

All those gases presented below contribute to greenhouse effect but studies conducted up to now reveal that the dioxide of carbon (CO_2) is the most polluting gas of the atmosphere since man had developed fire technique.

Table 6. Main gas responsible for Greenhouse effect

	Responses (in %) n=250				
Subject areas of students	CO_2	O_2	H_2	N_2O	χ^2 values
Math-Chemistry-Biology	90	3.3	0	6.7	P= 0.05
Math-Physics-Geography	82.9	5.7	2.9	8.6	
History-Economics-Geography	58.3	8.3	12.5	20.8	
Computer-Economics-Management	37.1	20	2.9	40	
Accountancy	65.7	5.7	5.7	22.9	
Physics-Chemistry-Biology	88	4	0	8	
Tourism	55	15	15	15	
English-French-Kinyarwanda	60	20	20	0	
Publicworks (Engineering)	90	10	0	0	
Math-Computer- Economics	44	8	8	40	
History-Economics-Literature	40	60	0	0	0.00
% of total	65.9	10	5.2	18.9	100

Source: Field survey, June-December, 2013

Concerning respondents in their subject areas, results reveal that respondents from almost subject areas provided the correct answer that is the CO_2. These were the cases of students from both Mathematics-Chemistry- Biology and Engineering (90%) followed by Physics-Chemistry-Biology (88%), Mathematics-Physics-Geography (82.9%), Accountancy (65.7%), French-Kinyarwanda (60%), English-History-Economics-Geography (58.3%) and finally students from, Tourism (55%). Those who obtained the lowest record were the students from Mathematics-Computer-Economics and History-Economics-Literature (40%). In the last position came the students from History-Economics-

Geography rated at 37.1% while they have in their curriculum components dealing with the environment. Using the Pearson's Chi-square test of significance, the computed Chi-Square critical value was 0.00 at level of significance (P)= 0.05, i.e. the results were statistically significant. This implies that subject area influences environmental knowledge of respondents. Greenhouse effect is the trapping of a fraction of the infrared radiation emitted by the Earth in its atmosphere. This trapping is achieved in particular by greenhouse gas emissions which are increasing the temperature on surface or at low altitude of Earth.

Several scientists have discussed the issue regarding greenhouse gases; they all concluded that that greenhouse gases occur naturally in the environment and result from human activities (Mastrandrea and Schneider, 2009). This said, the most abundant greenhouse gas is water vapour, which reaches the atmosphere through evapo-transpiration from oceans, lakes, rivers, plants and animals. But the main gas responsible for Greenhouse effect is the Carbone dioxide.

6.6.2 Knowledge of respondents about water pollution

Water is such a precious resource from the environment and accordingly, it makes the life worth living. However, in case it becomes polluted, it turns into death agent. Thus, Public Health specialists assume that water stands for life and death all together. Besides, Basak (2009) noted that life and human civilization began with water and flourished wherever water was available in abundance but several cities and civilizations disappeared due to the shortage and pollution of water. For testing their knowledge, students and teachers were asked to state the correct and complete

answer among the items proposed below.

Their responses are recorded in Table 7 below.

Table 7. Causes of water pollution

	Responses (in %) n=250				
Subject areas of students	Intensive livestock farming	Paper mills	Recreational boating	Humans bathing in the water	χ^2values P= 0.05
Math-Chemistry-Biology	30	33.3	10	26.7	
Math-Physics-Geography	54.3	11.4	11.4	22.9	
History-Economics-Geography	28	24	8	40	
Computer-Economics-Management	8.6	20	20	51.4	
Accountancy	14.3	11.4	14.3	60	
Physics-Chemistry-Biology	16	20	20	44	
Tourism	35	20	10	35	
English-French-Kinyarwanda	40	20	20	20	
Publicworks (Engineering)	60	0	0	40	0.00
Math-Computer-Economics	14.7	4.8	6.2	10.2	
History-Economics-Literature	0	0	0	100	
% of total	27.2	16.8	12.8	43.2	100

Source: Field survey, June-December, 2013

Regarding water issues, Table 7 illustrates the knowledge of the respondents about the causes of water pollution. As concerns the causes of especially fresh water pollution, 72.8% students and 70% of teachers gave an incorrect and incomplete answer.

Only 27.2% of students and 30% of teachers succeeded to provide a correct response among alternatives proposed; i.e. intensive livestock farming. The presence of Eschericheria coli in a sample of water of 100ml is an alarm signal of fecal pollution. That is why people consider drinking water as the one which had not been in contact with human and animal exemptions. Within subject areas of respondents, students from Engineering rated at 60% occupied the first position to state correct answer.

They were followed by students from Mathematics-Physics-Geography as rated at 54.3%, English-French-Kinyarwanda (40%), Tourism (35%) and Mathematics-Chemistry-Biology (30%). Students from History-Literature-Economics had the lowest rate of knowledge rated at 0%. The category of last but one comprised the students from Computer-Economics-Management with a score of 8.6%.

Results from this point were also analysed by using the Pearson's Chi-square test of significance and the Chi-Square critical computed was 0.00 at level of significance (P)= 0.05 what means that the results were statistically significant. The results in table highlight that the knowledge of this issue depend on the educational background of the respondents.

6.7 Date of the world environment day celebration

The knowledge of the World Environment Day is important because its annual commemoration is now one of the United Nations' primary ways to raise global awareness of environmental issues and to help stimulate political attention, public action, and personal commitment to environmental management. So, respondents were asked to designate when the World Environment Day is celebrated.

As the outcomes in Table 8 below can speak for themselves, the knowledge of the date to celebrate the World Environment Day is usually on 5th June. Respondents' information on this issue is low because it has been emphasised by 27.2% of students and 40% of teachers.

Table 8. Knowledge of respondents about the World Environment Day

	Responses (in %) n=250				
Subject areas of students	January 31	June 5	August 25	October 31	χ^2 values P= 0.05
Math-Chemistry-Biology	13.3	23.3	26.7	36.7	
Math-Physics-Geography	25.7	17.1	31.4	25.7	
History-Economics-Geography	12	36	28	24	
Computer-Economics-Management	5.7	20	40	34.3	
Accountancy	11.4	34.3	40	14.3	
Physics-Chemistry-Biology	16	28	4	52	
Tourism	20	30	40	10	
English-French-Kinyarwanda	0	40	60	0	
Publicworks (Engineering)	10.5	2.9	5	0	
Math-Computer-Economics	16	40	24	20	0.01
History-Economics-	0	0	80	20	
% of total	15.2	27.2	32	25.6	100

Source: Field survey, June-December, 2013

The World Environment Day has been established by the United Nations General Assembly in 1972 for commemorating the opening of the Stockholm (Capital City of Sweden) Conference

on the Human Environment. On the same day, the General Assembly created the United Nations Environment Programme (UNEP), which is now the United Nations' principal agency for environmental action. Since then, the World Environment Day has been celebrated every year on June 5. Regarding the knowledge of the date within subject areas of respondents, the students from Subject-combinations of English-French-Kinyarwanda and Mathematics-Computer-Economics seemed to know more than others since they rated 40% to give the correct answer.

They were followed by students from History-Economics-Geography with a rate of 36%, those from Accountancy with a score of 34.3% and Tourism rated at 30%. Contrary to expectations, students supposed to have environment in their curriculum failed to provide the right answer. This is the case of students from subject-combinations of Physics-Chemistry-Biology (28%), Mathematics-Chemistry-Biology (23.3%), and Mathematics-Physics-Geography (17.1%).

The results above were analysed by using the Pearson's Chi-Square test of significance which showed that the Chi-Square critical value was 0.01 at level of significance (P)= 0.05; Given that the results were statistically significant, therefore, it can be said that knowledge of the World Environment Day depends on the respondents' subject area.

CONCLUSION AND RECOMMENDATIONS

At the end of this paper about environmental knowledge among students of secondary schools, it was found that overall; their environmental knowledge level was low except for some issues. Poor level of knowledge was detected in many environmental aspects where the respondents failed to provide correct responses like: ecology (only 10% of students succeeded to provide correct definition), ecosystem (only 14% of students gave correct definition), biosphere (only 39.2% of students succeeded to provide good answer), gave correct response). About water pollution, only 27.2% of students gave correct response, regarding the World environment day, 27.2% of students succeeded to give good answer.

However, the fair level of knowledge was detected about environmental education definition as it was recognised by majority of respondents. However, the fair level of knowledge was detected about environmental education definition as it was recognised by majority of respondents who stated that EE plays a role of increasing knowledge and awareness (88%), developing skills and expertise (61.6%) and as components which has three models of education namely: about, in and for environment (75.6%). The $C0_2$ was designated by 69.9% of students as main gase of greenhouse's effect, responsible of atmospheric pollution.

The results were correlated by using Chi-Square and it was found that knowledge was depending on the educational background of respondents.

The results of this study showed that in most cases students who do not have environment in their curriculum succeeded

better to give correct answers than those who were supposed to do it. To Cincera (2016), Environmental issues are usually broadly covered by media even though there are often many mistakes in the explanation of scientific phenomena.

It is obvious that students usually know that there are environmental problems through informal and non-formal education but knowledge based on programmes of formal Environmental Education might improve their knowledge and awareness and correct existing misconceptions.

For this reason, the results can be applied in educational systems for modification of curriculum, for improving environmental knowledge of students as influential decision makers in the future who must sustain the sustainable development. Hines et al 1986-7), Hungerford and Volk (1990), Heimlich and Ardoin (2008) report that many people simply believe that environmental knowledge and awareness are the keys.

Besides, UNESCO (1985) notes that knowledge of ecology serves as a critical foundation for interpreting aspects of many environmental issues and that this goal level should not be treated lightly. Then, it emphasises that simpler definitions of a given concept should be introduced before more complex definitions (e.g., a community as a group of plants and animals living together in the same area, before a community as a food web or as a system of energy transfers).

This is why the researchers suggest to Government and Policy makers to think seriously about the problem and to integrate Environmental Education into secondary schools as independent subject in order to enhance environmental knowledge of students.

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PROMOTING REGIONAL PEACE AND SECURITY BY GOVERNING INSTRUMENTS OF CONFLICT: A CASE OF RWANDA

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ABSTRACT

One of the fundamental challenges to peace and security to Africa in general and the Great Lakes Region in particular has been the unrelenting proliferation of small and light weapons. The proliferation of these weapons has been adjudged as the most pressing security challenge to societies, oiling intractable conflicts and posing major obstacles to social-economic development of states.

As the use of small and light weapons has become a common denominator in the manifestation of both old and new threat societies are facing, various instruments have been crafted at international and regional level meant to extirpate the proliferation of these lethal tools of conflicts. This study examines the extent to which Rwanda through its National Focal Point managed to implement these instruments, specially the Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Regions, the Horn of Africa and Bordering Sates.

To weave the perspectives captured herein, the study depended almost exclusively on the content analysis of existing literally materials. The study revealed that through various measures instituted, Rwanda made major strides in curbing the proliferation of small and light weapons in a region where political conflicts are rife. Though achievements have been recorded however, the study posits that more need to be done in terms of border control and regional cooperation on information sharing has to be reinforced among other issues.

KEYWORDS: Small arms, Light weapons, Proliferation, Arms control, Conflict, violence

1.1. *Background of the study*

The dismantling of the bipolar political ideology resulted in a new era of international interactions where the possibility of governing non-strategic instruments of conflict, specifically, Small Arms and Light Weapons (SALW) evolved. These weapons have been the biggest challenge on the international agenda since the end of World War II (WWII) (UN, 1997). Readily available and easy to use, SALW have been the primary or sole tools of violence in almost every recent conflict dealt with by the United Nations (U.N). In the hands of irregular troops operating with scant or no respect for international and humanitarian law (IHL), these weapons have taken a heavy toll of human lives, with women and children accounting for nearly 80 per cent of the casualties (Kofi Annan, 1997).

The current statistics show that out of the estimated 500 million small arms and Light weapons in circulation world-wide, 100 million are found in Africa (AU, 2012; Shah, 2006; Stohl et al 2010; AWEPA, 2006, Osimen, 2015). As AEFJN (2016) notes, these have caused between 8 and 11 million of victims. Hence, due to their highest level of lethality, small arms, specially the AK-47 are considered African weapons of mass destruction, producing about 90 percent of all civilian casualties in conflicts. The choice of these weapons has been that there are easy to use, conceal and maintain (Vendley, 2016). These have been the weapons of choice in many of the conflicts in Africa, particularly in the Great Lakes Region, especially those involving non-state actors.

Their widespread availability has contributed to massive violations of human rights and international humanitarian law, to the development of a culture of violence that has shattered the social fabric of many societies. Worth to note is that these

weapons have been *ipso facto* major drivers of the phenomenon of child soldiers and since the end of Cold War period, the Great Lakes Region has been awash with these weapons and the security environment in this region remains fragile due in part to their continued availability.

As regions continue to grapple with the effects of these weapons, several mechanisms have been initiated in order to curb the unrelenting flow of these weapons in Africa. It is within this perspective that regional protocols were crafted among them the Nairobi Protocol for the Prevention, Control and Reduction of Small and Light Weapons in the Great Lakes Region, the Horn of Africa and Bordering States. Prior to this protocol, a Regional Centre on Small Arms and Light Weapons (RECSA) had been established in March 2000 which subsequently led to the creation of National Focal Points (NFPs) on small arms control and management by its member states.
With its help, member states have designed their own National Action Plans (NAPs) (Rwanda revealing its own in 2010, RNFP (2016)) with different goals meant to rid the region of illegally held SALWs. As Stephen Goose (2011) notes, Rwanda has been the latest example of what happens when SLW are freely sold to countries plagued by ethnic, religious, and nationalist strife. As the country continues its transformational drive following a sour war and the genocide of 1994 against the Tutsi, it became imperative to design mechanisms meant to curb the illegal possession and dealing in SALW.

These include but not limited to local legislations (such as Law relating to arms of 18th November, 2009) but also to the adoption of ancillary measures meant to rein in illicit proliferation of SALW. Given various instruments instituted by various organs

at global and local level, the study sought to analyze the extent to which the Government of Rwanda dealt with issues related to the proliferation of small arms as per the Nairobi Protocol.

1.2. *Statement of the Problem*

During the Cold War period as Mogire (2016) notes, arms control negotiations focused on major weapons systems like nuclear bombs, ballistic missiles, and aircraft. This was partly because of the devastation that a nuclear war could cause. Nevertheless, these are not the weapons that are being used in many of today's conflicts. He adds that the current conflicts now depend almost entirely on SALW.

Hence to reduce armed conflict and global insecurity, there is need to focus attention on these instruments. It is worth noting that the uncontrolled proliferation and stockpiling of SALW before, during and following violent conflicts has led to many regions being flooded with small arms with devastating consequences on individual (human), national and international security. As Mogire (2012) notes these weapons have been the primary instruments of violence, have prolonged or aggravated conflicts, produced massive flows of refugees, undermined the rule of law and spawned a culture of violence and impunity.

The illicit proliferation and misuse of small arms has become a worldwide, progressively complex (Religion for Peace, 2016), and multifaceted phenomenon that touches people from all work of life. By virtue of their easy availability, low-cost and manageability, SALW have become the weapons of choice in most conflicts in the 21th century. As for Religion for Peace (2016) notes these weapons are the leading contributors to the escalation of a culture of violence and to the militarization of

societies. Due to this phenomenon m**ore than 1,000 lives are lost each day to small arms violence.**

According to Conaway (2016) the security environment in nearly every post conflict state is extremely fragile due in part to the continued availability of SLWs. These weapons have undermined economic development, governance and democratization efforts in most African states. In countries as varied as El Salvador, Albania, the Democratic Republic of Congo (DRC), Burundi, Kenya and Mali, the prevalence of SALW contributes to enormously increased crime rates, resulting in some cases with more deaths in a year of "peace" than during war (AEFJN, 2015).

As Conaway (2016) notes whether used to regroup opposition forces, form gangs or commit crimes, the presence of SLW leads to continued violence and instability in post conflict societies. This dovetail with Stohl's (2010) views who argue that in Africa, weapons have been circulating through conflicts, leaving one conflict zone and entering another where demand is greater. In West Africa, the same weapons, and sometimes even the same soldiers, moved from one conflict to another – from Liberia to Sierra Leone, then to Côte d'Ivoire, and then to Guinea – during the decade and a half of conflict in the region. Some weapons from Chad have been used in Darfur, while weapons in Somalia have originated from Djibouti, Ethiopia, Egypt, Eritrea and Libya, Uganda and Yemen (Stohl 2009).

There has been an established arms supply route between Somalia, Ethiopia, and Sudan for many years supplying the SPLA and civilians, (Safer World, 2011). This was observed by Mkutu (2011) who argues that the conflict in neighboring Somalia,

Sudan, Ethiopia, and Uganda contributed to the proliferation of weapons in the Rift Valley region of Kenya. He adds that this proliferation has fuelled deadly violence among pastoralist communities in the Rift Valley region of Northwestern Kenya as well as in the northeastern Uganda. Chelule (2014) opines that the "*leakage*" of weapons that are sneaked into Kenya and the neighboring countries from Somalia, has spread insecurity all over to Kenya leading to underdevelopment of most of northern part of Kenya.

Baker citing Sang (2010) noted that Africa's Great Lakes Region is renowned for some of the most beautiful and ecologically diverse freshwater systems in the world including Lake Victoria, the world's second largest lake. Regrettably, the region is also notorious for an abundance of illicit SALW; a problem that has created protracted conflicts, political instability and prevalence of armed crimes. The Great Lakes Region and the Horn of Africa are both severely affected by the scourge of SALWs (Eavis, 2002). Yet, until recently, though some measures have been taken to curb the proliferation of these weapons, the implementation for some states has hit a snag.

Therefore, the current initiatives are prompted by the growing realization that the proliferation of small arms lies at the heart of many of the problems facing these regions. As Eavis (2002) notes the conflicts in Burundi, the DRC, Northern Uganda, Southern Sudan, and Somalia are all fuelled by these weapons. Porous borders and conflict dynamics mean that the security and stability of the Great Lakes and Horn sub-regions are closely intertwined; for example, the conflict in the D.R.C fuels the illicit trafficking of weapons in and through the Horn of Africa. Chelule (2014) notes that small arms in the hands of

rebels, fighters, war profiteers, which are often recycled from one country to another in Africa has been responsible for conflicts in such countries as Sudan, Somalia, Rwanda, Uganda, Angola, Sierra Leone, DRC and others.

Though the East African region has witnessed the destruction of tens of thousands of small arms and hundreds of tones of ammunition in the recent past, the proliferation of SALW in the region continues to be a major challenge to cross-border and internal security. Their proliferation affects the intensity and duration of violence and has encouraged militancy rather than a peaceful resolution of unsettled grievances (ICRC, 1999). Recognizing peace and security as vital ingredient for their concerted efforts for regional integration; regional states have crafted overarching mechanisms designed to curb the proliferation of these instruments of conflicts.

It is within this spirit that the Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region, the Horn of Africa and Bordering States entered into force as a legally binding document on 5 May 2006.

Furthermore it is in that perspective that RECSA, an institutional framework arising from the Nairobi Declaration to coordinate the joint effort by National Focal Points in Member States to prevent, combat and eradicate stockpiling and illicit trafficking in SALW in the Great Lakes Region and Horn of Africa was established at the Third Ministerial Review Conference in June 2005 (RECSA, 2008).

The Nairobi Protocol requires certain measures including but not limited to national legislations, strengthening of operational capacity and sufficient measures to control SALW both state-owned and in civilian possession. Recognizing that

the availability of illicit SALW within communities create fears, exacerbate conflicts and hinder social cohesion and peace building efforts (NAP,2009), Rwanda, a member state recovering from appalling conflict and the genocide against Tutsi of 1994 came up with Rwanda National Focal Point (RNFP) as an organ responsible for the development of national policy and the implementation of programmes and activities on small arms as per the requirements of the United Nations Programme of Action(UNPoA) (NFP, 2016).

Uganda and Kenya established their own National Focal Points (NFPs) in 2001 and 2003 respectively (Mkutu, 2011). The RNFP as an interagency directorate comprises of various ministries and departments, such as, Defence, Foreign Affairs, Interior Security (National Police), Trade and Industry (customs) and Justice. The Civil society is also represented by three Non Government Organisations (NGOs) on the RNFP (RNFP, 2016).

In addition the law No 13/200 of 14/06/2000 modifying the decree-Law No 12/97 of 7th May, 1979 concerning firearms and their ammunitions was revised so as to respond to regional and international requirements that Rwanda is party to. The law No 33/2009 of 18/11/2009 relating to arms delineates procedures for the acquisition, possession, carriage, manufacturing, sale, storage and obtaining of all types of arms and ammunition. All these instruments have been designed to cater for international and regional adopted programmes and protocols meant to curb the proliferation of SALW, and these chiefly help introducing the gist of this study – As in a situation where the international and regional frameworks for SALW control are evolving, it is important to take stock of the current agreements and analyze their implementation.

The study investigates various mechanisms initiated by the Government of Rwanda meant to control the proliferation of SALW as enshrined in the Nairobi Protocol signed in Nairobi on April 21st, 2004 ratified by the Presidential Order No 61/1 of 28th December, 2004 (NAP, 2009). The study unearths the extent to which these initiatives have ushered in the end to illicit proliferation of SALW in Rwanda and close the gap on underexplored area related to the implementation of measures instituted in line with international and regional instruments.

1.3. *Research Question*

Due to carnage caused by SALW, different declarations were made and protocols crafted at different levels. In Africa, the general understanding has been that in some states, conflicts have ended but without delivering peace dividends due to problems related to SALW. Consequently attempts have been made to combat regional glut in SALW by instituting various measures meant to rein in their proliferation. Therefore the study sought to answer the following extensive question:

To what extent Rwanda has contributed to the implementation of the Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region, the Horn of Africa and Bordering States?

1.4. *Research Hypothesis*

According to Theodorson (1961), cited by Ahuja (2007) a hypothesis is a tentative statement asserting a relationship between certain facts. In addition Kerlinger (1986) describes it as a conjectural statement of the relationship between two or more variables. As Amini (2005) notes, it is a presumptive statement of a preposition or a reasonable guess based on available evidence that the researcher intends to check. Thus

the study hypothesis states that- measures adopted by the Government of Rwanda meant to curb the proliferation of SALW have tremendously contributed to the implementation of the Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region, the Horn of Africa and Bordering States.

1.5. *Research Objective*

The thrust of this study dwells on investigating the extent to which measures instituted by the government of Rwanda have managed to root out the proliferation of SALW and challenges to their implementation.

1.6. *Research Design*

The bulk of this study has been confined to in-depth analysis of various articles on different protocols instituted to tackle the scourge of SALW regionally and globally. The United Nations programme for Action (UNPoA), and other regional instruments designed to curb the proliferation of SALW were scrupulously analysed. The internet was used to supply relevant information on the subject matter. Data was presented in a discursive and narrative format. A non-structured interview was conducted to capture various views of key informant most importantly member of the RNFP.

1.7. *Conceptual Definition*

As the study draws from different streams, it sought to clarify different key terms used. The following definitions were provided by the Rwandan Law no 33of 18 November 2009 relating to arms.

1.8. ***Light Weapons:***
portable weapons designed for use by several persons serving as crew. These include heavy machine gun (HMG), automatic cannons, howitzers, mortars of less than 100 mm calibre, grenade launchers, antiaircraft weapons and launchers and shoulder-fired rocket launchers.

1.9. ***Small Arms:***
weapons designed for personal use they include light machine guns, machine guns, machine pistols, automatic rifles and assault rifles and semi-automatic rifles. These are also portable shell firing cannons, explosive grenades, incendiary or gas grenades and mines.

1.10. ***Illicit trafficking:***
import, sales, movement or export of arms, ammunition and other related materials from or across the territory of one state to that of another state if any one of the states concerned does not authorize it or if these arms are not marked.

1.11. ***Illegal arms:***
arms which are prohibited by Rwandan laws and international conventions.

1.12. ***Marking:*** operation consisting in printing a serial number, the producer's name as well as the place and country of production on the arm, the frame and on the replacement spares for arms during their production.

2. LITERATURE REVIEW

To fully ensure that the UN instruments on SALW are implemented, various African regional instruments have been subsequently adopted. Some of them are legal and others are political. The next section stifles through four major instruments instituted at regional level meant to weed Africa of illicit SALW.

2.1 Regional instruments meant to curb the proliferation of small and light weapons

The last decade has seen a major attempt by the international community to address the issue of the illicit international trade in SALW. Over a period of roughly a decade, a framework for the control of SALW in Africa has gradually been created. This framework has been developed, in part, in regional responses to two main United Nations instruments to control small arms. These are the 2001 UN programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All Its Aspects (POA) and the 2001 UN Firearms Protocol.

It is in that perspective that a number of regional agreements also emerged. Some African regions have crafted various instruments meant to curb the proliferation of SALW. These instruments contain strong references meant to curtail the transfer of arms where these risk being used in breach of international humanitarian law and these are legally binding.

2.2 The Bamako Declaration

The Bamako Declaration is an Africa-wide consensus which addresses the illicit proliferation, circulation and trafficking of small arms and light weapons (Chelule, 2014). It is a politically binding control instrument which was adopted by the ministerial conference of member states of the defunct Organisation of African Unity (OAU) now African Union (AU) in Bamako, Mali on the 1st December 2000.

This Declaration on an African Position on the Illicit Proliferation, Circulation and Trafficking of Small Arms and Light Weapons aims at developing an African Common Position on the Illicit Proliferation, where all members agree on its terms on the illicit proliferation, circulation and trafficking of SALW and of the AU, to encourage the codification, marking, record keeping and harmonisation of legislation which governs the production, trading, brokering, importation exportation and the licit possession and use of small arms and ammunition in the country governing imports, exports and the licit trade (Stemmet, 2001, conflict trend 2009, Chelule, 2014).

2.3 The Nairobi Declaration and the Nairobi Protocol on Small Arms and Light Weapons

The Nairobi Declaration on the problem of illicit Small Arms and Light Weapons in the Great Lakes Region and the Horn of Africa was signed on March 15th 2000 by Foreign Affairs Ministers form eleven (11) countries from the Great Lakes and Horn of African region. On 21st April 2014 the member states then agreed the Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region, the Horn of Africa and Bordering

States (UNPoA-ISS, 2016).

This entered into force on 5 May 2006 as a legally binding instrument. It provides a framework for national small arms legislation (Chelule, 2014). The protocol requires certain national legislative measures, the strengthening of operational capacity and sufficient measures to control SALW both state-owned and in civilian possession.

2.4 The Economic Community of West African States (ECOWAS) Convention on Small Arms and Light Weapons

The Economic community of West African States adopted a landmark binding Convention to reduce armed violence in the sub-region. This convention was signed by Heads of State and Government on 14 June 2006 in Abuja (Nigeria). This completed the transformation of the 1998 ECOWAS Moratorium on Light Weapons into a legally-binding instrument.

The Moratorium was a voluntary measure adopted by the ECOWAS Heads of State and Government in 1998. This was the first-and so far only-regional moratorium on the importing, exporting and manufacturing of small arms, and as such was highly important first step to addressing the crisis at a regional level. However as the Moratorium was voluntary, it had little or no monitoring mechanism (AEFJN, 2016). The new convention however, has a monitoring and implementation mechanism and has been seen as major step towards the end of endemic armed violence in West Africa.

2.5 The Southern African Development Community (SADC) Protocol.

The Southern African Development Community (SADC) on the Control of Firearms, Ammunition and Related Materials of 2001 aims at preventing, combat and eradicate the illicit manufacturing of firearms, ammunition and other related materials, and their excessive and destabilising accumulation, trafficking, possession and use in the Region (Mogire,2012).

The protocol seeks to promote and facilitate cooperation and exchange of information and experience in the Region to prevent, combat, and eradicate the illicit manufacturing of, excessive and destabilising use and accumulation of, trafficking in, possession and use of, firearms, ammunition and other related materials. The protocol seeks the states to co-operate closely at the regional level as well as at international fora to effectively prevent, combat, and eradicate the illicit manufacturing of, excessive and destabilising use and accumulation of, trafficking in, possession and use of, firearms, ammunition and other related materials in collaboration with international partners (Ayuba, 2014).

Although, international and regional agreements provide a roadmap for reducing the illicit small arms trade, they are still insufficient and the proliferation and illicit trafficking of SALW is a reality. In some cases implementing these agreements has met with lack of political will as well as resources.

3. DISCUSSION OF KEY FINDINGS

It is widely believed that SALW have irreversibly changed the landscape of conflict and society in the Great Lakes Region in particular and Africa in general. Unless regional bodies keep on clamping down on the proliferation of these weapons, communities will likely continue to endure the tremendous consequences of these deadly tools of conflict.

In its drive to implement the UNPoA as well as the Nairobi Protocol for the Prevention, control and reduction of small arms and light weapons in the Great Lakes Regions, the Horn of Africa and bordering states, Rwanda came up with a raft of measures meant to weed out illegally held arms on its soil. The following table and graph show the extent to which Rwanda through RNFP managed to control the spread of SALW through instituted mechanisms and the table below demonstrates achievements already recorded.

Table 1: Achievements in terms of surplus, seized, confiscated, obsolete small arms and unexploded ordinances

YEAR	MINES	UXO's(TONES)	FIREARMS	AMMUNITIONS(TONES)
1994	134	2,566		
1995-2000	663	25,163		
2001-2003	149	6,525		
2005-2006			7500	266
2007-2009	324	17,232	25,141	
2010-2011			160	
2011-2016			298	4
TOTAL	**1,270**	**52 T**	**33099**	**270 T**

Source: Rwanda National Focal Point, April 2016

Sifting through table No1 and graph 1, it is patently clear that during the period of 1994 up to 2009; mines and unexploded ordnance were of major concern. In fact the widespread of mines (Mogire, 2012) renders vast areas of territory uninhabitable; they are targeted at civilian population and these not only force them to flee their homelands, but also prevent them from returning.

Landmines that were laid between 1990 and 1994 were responsible for killing and maiming hundreds of people preventing them from their daily activities, mainly farming. During this period which followed the terrible period of war and genocide against Tutsi, demining various identified minefields was at top priority. Kayumba (2009) notes that as a response to this problem, the Rwandan National Demining Office (NDO) was established in April 1995 entrusted with the tasks of coordinating all demining activities as well as proposing appropriate strategies.

Through various survey efforts in the period 1995 and 2006, a total of 52 mined areas were identified. This represented a total of 1,946,754.5 square meters of area in which antipersonnel mines were known or suspected to be emplaced (Kayumba, 2009). After a high level campaign that reached the entire population and carried out throughout schools, the biggest number of Landmines and UXOs was neutralised or destroyed either by burning or controlled explosions (RNFP, 2016).

The process was to ensure that those items are made unusable. As a result, roads, commercial centres as well as factories were reopened, farmland cleared, agricultural activities resumed and more than 600,000 people resettled without fear of being killed or injured (Kayumba, 2009). Having fulfilled its obligation under Article 5 of Ottawa Land Mine Treaty Rwanda was declared in 2009 as the first country landmine-free in the World by the Cartagena Summit on a Mine-Free World in Colombia

(New Times, 2009). Mozambique, the once known as the most mined country in the World declared itself free of mines in 2015 after 171, 000 mines were cleared over the course of twenty two years (Smith, 2015).

It is evident that the launching of RNFP under the Ministry of Internal Security on 20th March 2003 came as a closing chapter to proliferation of SALW in Rwanda. Apart from crafting a five year Action Plan adopted in 2009, which marked an important step in efforts to tackle the proliferation of illicit SALW, RNFP came up with a raft of measures and some of them were expressed by RNFP's officer in the following terms: "*after the adoption of the law on small arms, six months of amnesty were given to those who held small arms illegally so that they can surrender them voluntarily to government officials without being punished, and this continues to bear fruits*". He succinctly quipped that: "*Task forces as well as joint teams were established at district levels nearer the people; awareness campaign in secondary schools and universities took a centre stage; media-such as community radio stations most importantly Musanze, Rubavu and Rusizi were frequently used and civil society has been a reliable instrument in awareness campaign on the impact of SALW as well as in the advocacy for voluntary surrendering of illegally held firearms"*.

As AEFJN (2012) argues where Focal Points exist they have facilitated the collaboration of civil society with the government, military forces and police, thus favouring progress and building trust between government and civil society. In addition it is in line with international and regional declarations and protocols, which recognize the role of NGOs in fighting the proliferation of SALW, that KNFP works closely with some civil society organisations such as Oxfam, Safer World, APFO etc.(Mugweru, 2010).This synergy between civil society and government agencies quickened the process of curbing the proliferation of SALW in Rwanda leading the country to be secure in a region

where development has been crippled by political violence.

It is within the above highlighted perspective that in addition to 7500 small arms which were publicly destroyed by burning in 2005 and 2006 in Eastern and Southern provinces respectively, a total of 25.141 small arms were destroyed by cutting by mid-October 2009. In addition, 160 firearms in 2010-2011 were destroyed by cutting (RNFP, 2016). This exercise continued and recently in 2016, 298 arms of a private security company known as -*ISCO Intersec Security*-were made unusable by cutting (RNFP, 2016). In terms of ammunitions, 266 tonnes were destroyed and the number decreased significantly as during the subsequent period of 2011-2016 only 4 tonnes were destroyed. Working hand in hand with regional bodies has been also fruitful. In December 2008; the Government of Rwanda received two modern arms marking machines from RECSA and in 2014 one machine. In addition, this regional body has been providing training to police officers and financial as well as technical services to RNFP (RNFP, 2016).

Even though Rwanda has recorded tremendous achievements against the proliferation of SALW, challenges remain. The geographical political configuration upon which Rwanda finds itself remains a challenge. The persistent situation of conflicts in neigbouring countries as well as porous borders remains cogently problematic. There have been repeated reports of skirmishes and military incursions along the borders of the DRC and Rwanda-most frequently, Bugeshi area.

This dovetails with AYUBA's (2014) views that in West Africa, the terrain remains fertile for the proliferation of SALW due to poor governance, inefficient institutions, porosity of borders as well as corruption. Consequently this constrained states' capacity in meeting the Millennium Development Goals (MDGs) in West Africa.

Shamba (2004) concurred to the above views that because of the cycle of violence experienced in the region (Great Lakes Region), the frontier areas between Uganda, Sudan and DRC have become the theatre of the proliferation of light weapons. Chelule (2014) added that porous boundaries which have no fence or wall to separate countries have contributed immensely to the ease of movement of SALW through countries.

Furthermore it is imperative to note that the current political crisis in Burundi which has already killed 400 people and almost 2500000 fleeing the country (UN, 2016) is likely to exacerbate the proliferation of guns and illicit arms trafficking across borders. As people managed to put hands on military arsenal during the failed coup attempt, people are currently armed than ever.

1. CONCLUSION AND RECOMMENDATION

The Government of Rwanda in its drive against the proliferation of SALW has recorded impressive achievements. Strategies adopted have been responding positively and global as well as regional instruments were the most significant guiding principles in trying to clamp down on the proliferation of SALW. With sound National Action Plan and subsequent measures crafted, Rwanda has become a striking example in curbing the proliferation of SALW in a region marred by political violence. This corroborates with RESCA's former Executive Secretary Francis K. Sang who noted that Rwanda has done a great job in controlling the distribution of fire arms despite the fact that other sub-region have failed to honor their obligations (Gahiji, 2013).

Nevertheless, it is patently clear that even though achievements have been recorded, challenges remain. Hence regional cooperation on information sharing has to be strengthened. There is need for improved border management mechanisms by boosting cross-border cooperation. Effective strategies should be used to control various unauthorized entry/exit routes in the region by recognizing and enlisting the support as well as cooperation of bordering communities.

In addition global and regional coordinated effort is needed to eradicate entrenched armed rebel groups operating in the Great Lakes Region, especially in the DRC. There is need to quicken the process of establishing the Regional Training Centre on SALW. Regional and national agencies established to coordinate mechanisms meant to curb the proliferation of SALW must continue working closely with civil society.

There is need to encourage research in line with knowledge dissemination on the effects of these lethal weapons and RNFP in synergy with RECSA must come up with a new National Action Plan on small arms.

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