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A COMPARATIVE STUDY OF COMPANIES' HEALTH: ALTMAN'S Z-SCORE APPROACH TO BANKRUPTCY PREDICTIONS USING R

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ABSTRACT

Financial analysis provides the basis for understanding and evaluating the results of business operations and explaining how well a business is doing as well as help creditors, investors, and managers determine if a company can pay the interests and principal on its debt, earn an acceptable return on invested capital, growing or shrinking, control costs, and grow its market share. This study used the Altman's z-score analysis to predict a firm's insolvency. Altman uses the standardised financial performance of firms in determining their financial health. Four companies: Guinness and Seven Up in the FMCG sector and Mobil and Eterna Oil in the Oil and Gas sector were studied and compared. The data used were sieved from the financial statements of these companies for 2012 and 2013 financial years. The study results for the period revealed the weaknesses of Seven Up Plc which z-score was less than 3.0 which showed it had 50:50 chance of bankruptcy and survival. Guinness Plc had a z-score of 4.854 (2013) and 5.341 (2012), a decline in the financial health in 2013 relative to 2012 though it can still be opined that the company is healthy. Eterna Oil has a z-score of 30.190 (2012) and 17.027 (2013) a decline also in 2013 relative to 2012, though the company enjoys a sound financial health. Mobil Plc has a z-score of 4.177 (2013) and 4.701 (2012) a marginal decline as well in 2013 relative to 2012 though also still financially sound.

KEYWORDS: Z-score, financial health, standardised, R, bankruptcy

Introduction

There has being many controversial questions on the issues of liquidation of companies. Our study is to use Altman Z-score to predict the bankruptcy of some companies (Guinness Plc, Eternal oil, Mobil Plc). Altman's Z-score is a tool used widely in finance for analyzing and predicting the risks of bankruptcy of listed firms. The Z-score is a number computed as a sum of weighted financial variables. Altman used companies' data from 1950s and 1960s in obtaining the original Z-score model, which might be outdated. Thus, using more recent data to estimate new Z-score model is essential to evaluate the ability of analyzing and predicting the risk of bankrupcies of listed firms. Given the relatively high frequency of bankruptcies filed by publicly-traded businesses, and the threat posed to suppliers and other stakeholders that rely on firms' solvency for their own success, a reliable bankruptcy model with consistent predictive power is essential in today's business environment. One common bankruptcy prediction method is Altman's Z-Score formula. The objective of this study is to apply Altman's Z-Score in a contemporary analysis during a period of rapidly-changing business conditions. This research work studies the predictive ability of the Z- Score using data from 2012 and 2013 and applies it to a group of firms (Guinness Plc, Mobil Plc, and Eternal oil). In addition to using current data, this study extends current research by utilizing Altman's Z- Score with a new subset of firms.

The original model, using US data, was put forth by Altman (1968) and aims at predicting corporate bankruptcy. While Altman proved in his paper that the model is highly accurate for the US, does this mean that it is also as accurate in an international setting? Is the model robust in predicting corporate

bankruptcy in the Nigeria? The purpose of this paper is extending the Altman approach to company's health in Nigeria. This basically means that the new model will be constructed using the guidelines from Altman's ground breaking paper. The Altman's model will be constructed on the basis of several financial and economic ratios. Those ratios will be statistically analysed by first evaluating them in a univariate approach.

Investment is the commitment of financial resources which have been saved with the expectation of some positive rate of return. Investing one's savings in financial securities is to improve the financial stability. Using the financial analytical tools and the acceptance of quantitative techniques by the investment community has changed the investment scenario. Investment decisions require scientific knowledge, a systematic approach and professional expertise on the part of the investor. Such a decision would ensure an effective mix of safety, rate of return and liquidity.

Financial analytical valuation process requires both internal and external comparison of financial and non - financial data to measure financial and operational efficiency, as well as to determine the strengths and weaknesses of an organization. Kahl (2002) argues that investment decisions are affected by the degree of uncertainty on a firm's prospects and that stakeholders, such as creditors may postpone their decision to learn more about the distressed firm's on better information. Thus uncertainty of financial performance makes investors to be more prudent in choosing a prospective company. Any prudent investor would require an array of tools to predict the volatility of a company's performance. This study looked into company's health and likelihood of bankruptcy to aid investors in knowing the state of the companies they are investing on.

Identification of company malaises, operation and financial, finds some of its foundations in ratio analysis. Before the advent of quantitative measures of business performance one would have employed specific firms which would supply creditworthiness information concerning other firms. Studies concerning company failure concluded that defaulting companies showed significant different ratio measurements than non-defaulting firms (Smith & Winakor, 1935). Beaver (1966) and Tamari (1966), both utilised financial ratios analysis in a bankruptcy prediction setting. The latter study used a matched sample of bankrupt and non-bankrupt firms, comparing their respective ratios on an individual basis. Altman (1968) brilliantly saw, "definite potential of ratios as predictors of bankruptcy" and recognize that ratios assessing profitability, liquidity and solvency were among the most significant. He advocated using the method to perform a multivariate analysis rather than individually assessing the ratios in a univariate setting. This eventually led to the well-known Altman Z-score model, which this paper extends upon.

Even though the foundations of this paper lie in the insightful paper by Altman (1968), it does deviate slightly from it which enables a significant contribution to the existing literature. One of the main points where this paper deviates from Altman's is in its geographical application. Compared to Altman's paper, where public US manufacturing firms were used, this paper used a dataset comprised of public Nigeria firms.

Firstly, addressing the accounting divergence, the accounting practices for depreciation and amortization of both countries differ as they directly impact on earnings before interest and taxes (EBIT). According to PriceWaterhouseCoopers (2005), while both US Chevron and Nigeria Chevron are similar to IFRS in terms of depreciation and amortization, there are differences concerning changes in the depreciation method and the maximum life of an intangible asset.

Secondly, there is the issue of differing financial possibilities nowadays. These possibilities and instruments allow users of them to manage company aspects which effectively change the firm's underlying probability of default. In support of and extension to this claim is Marin (2013), stating that the possibility of filing bankruptcy is lower for firms managing foreign currency risk.

The outcome of this paper will be a Nigeria specific Altman Z-score model. To the best of my knowledge, such a model does not currently exist at the time of writing this paper. The proposed Nigeria model will contribute to the existing literature by not only taking into account the

divergence problems, but also taking on and modelling some of the criticism hurled at Altman's original model.

The type of information required from the analysis of financial statements may vary depending upon the user for whom the information is required. Management's responsibility is to employ resources efficiently to meet the objectives of the business (Foss, Knudsen & Montgomery, 1995). Investors need information to help them to decide whether they should buy, hold, or sell. Furthermore, investors are interested in financial information that enables them to assess the ability of the firm to pay dividends (i.e. return on investment) for their stocks (Helfert, 1991). Financial statements may assist the public by providing information about the trends and recent developments in the prosperity of the firm and the range of its activities (Higgins, 1995).

The analysis of a firm's financial statements is undertaken with the purpose of extracting significant information relating to firm's objectives, profitability, efficiency and degree of risk. This is achieved by using ratios relating to key financial variables and analysis of the statements and the notes relating to them. Because ratio analysis employs financial data taken from the firm's balance sheet, statement of retained earnings, and income statement, these reports and their interrelations must be mastered to fully understand the significance of the various financial ratios (Betker, 1995).

The main aim of the study is to identify the company's health using Altman-Z score. The specific objectives are: to compute relevant financial ratios for companies studied, compute companies' z-scores using information from their financial statements, use the variables in the annual financial statement of companies to determine their health, compare the health of companies studied based on their z-scores, predict companies' bankruptcy likelihood using their z-scores and make recommendations to companies studied.

Materials and Methods

The study covers companies in Nigeria, both in manufacturing and other sectors. The companies considered in this study are Guinness Plc, Mobil Plc, Eternal oil Plc and Seven up Plc. We used two

of the leading Manufacturing companies (Guinness Plc and 7up Plc) and also two of the leading Oil and Gas sector (Mobil Plc and Eternal Oil Plc).

The data obtained were secondary data obtained from financial reports of the listed companies at the Nigeria Stock Exchange and the Capital Markets Authority. The secondary data were current assets and liabilities, total assets, retained earnings, earnings before interest and taxes, book value of equity and sales. The market price of the firm's stock used in conjunction with the equity number in the financial statements to compute the market value of equity was obtained from the official publication in the newspaper (Business Day). The value of each ratio was computed by researcher.

The Altman Z-Score (named after Edward Altman, the New York University professor who devised it) is a statistical tool used to measure the likelihood that a company will go bankrupt (Wikipedia, 2014). Altman used a statistical technique called multivariate analysis to the mix of traditional ratio analysis techniques, and this allowed him to consider not only the effects of several ratios on the "predictiveness" of his bankruptcy model, but also how those ratios affected each other's usefulness in the model.

The formula for the Z-Score is:

$$Z - score = 1.2 * (Working\ Capital)/(Total\ Assets) + 1.4 * (Retained\ Earnings)/(Total\ Assets) + 3.3 * (Operating\ Earnings)/(Total\ Assets) + 0.6 * (Market\ Capitalization)/(Total\ Liabilities) + 0.999 * (Sales)/(Total\ Assets)$$

The working capital / total assets ratio is a good indicator of a firm's ability to make good on what it owes in the next few months. The Retained Earnings/ Total Assets ratio is a good indicator of how in debt the company is and whether it has a history of profitability. The Operating Earnings/ Total Assets ratio is a measure of efficiency in that it indicates how many kobo the company generates in earnings for every Naira of assets it owns. The Market Capitalisation/ Total Liabilities ratio is a fluid measure of the market's "confidence" in the company. The Sales/ Total Assets ratio measures the company's efficiency in delivering sales from its assets.

The Procedure is as follows:
Firstly, obtain the financial identities used in the ratios from the financial statements of the companies for the two years considered. Secondly, the ratios were computed for each of the company studied. Finally, Altman's equation for insolvency prediction was evaluated using the ratios obtained. With Altman's model, when Z-score < 1.81, high likelihood of bankruptcy, when Z-score > 3.0, low likelihood of bankruptcy, and when 1.81 < Z-score < 3.0, indeterminate.

R studio was the software employed in executing the analysis for this study.

Results

Table 1: Financial measures for the studied companies

Performance Measures	Guinness		Eterna Oil		Mobil Plc		Seven Up	
	2012	2013	2012	2013	2012	2013	2012	2013
Total Assets (T.A)	106.01	121.06	32.44	17.12	33.56	40.73	48.09	51.37
Working Capital (W.C)	60.81	69.78	6.86	8.64	21.23	26.35	18.82	23.51
Retained Earnings (R.E)	36.27	36.31	319.05	285.03	2.88	3.48	9.69	11.96
Earnings before Interest and Tax (E.B.I.T)	22.48	20.81	1.60	1.66	4.7	5.73	1.68	2.88
Market Value of Equity (M.V.E)	266.96	270.7	2.35	2.35	42.93	42.93	10.31	12.58
Book Value of Total liability (B.V.T.L)	67.39	75.02	25.78	8.75	26.97	31.19	38.18	38.79
Sales	116.46	122.46	90.49	99.31	80.8	78.74	59.86	64.09

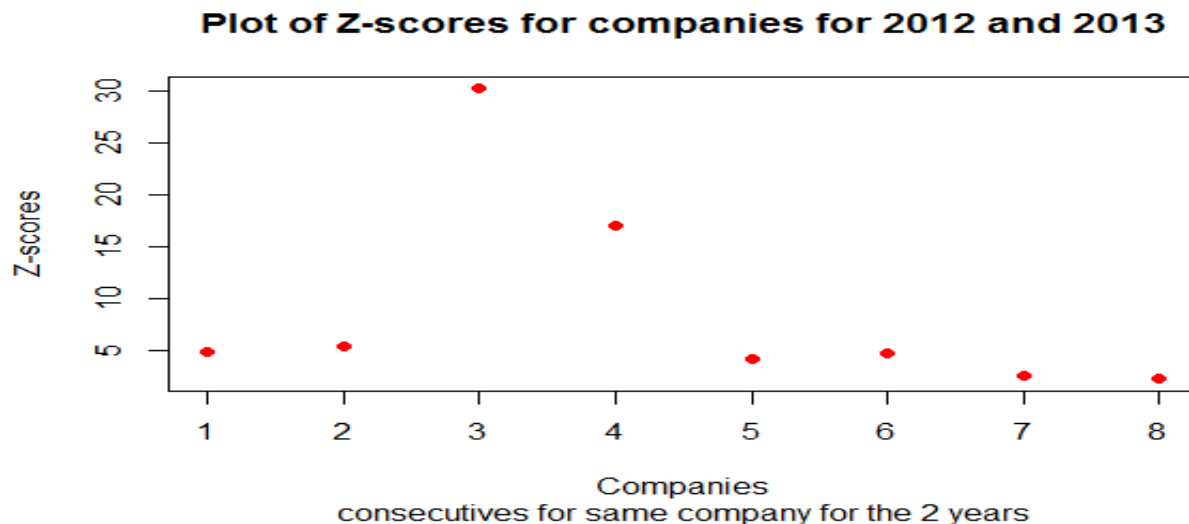Source: Financial statements of each company (2012, 2013)

Fig 1: Plot of Z-score for the companies for 2012 and 2013

Table 2: Summary of Z-scores for each Company per year.

Year	Guinness Plc	Eterna Oil	Mobil Plc	Seven Up Plc
2012	5.34	30.190	4.117	2.501
2013	4.85	17.027	4.701	2.234

Table 3: Summary of Financial ratios

Ratio	Guinness Plc		Eterna Oil		Mobil Plc		Seven Up Plc	
	2013	2012	2013	2012	2013	2012	2013	2012
WC/TA	0.576	0.574	0.505	0.211	0.647	0.633	0.458	0.384
RE/TA	0.300	0.342	16.649	9.835	0.085	0.086	0.233	0.198
EBIT/T	0.172	0.212	0.097	0.049	0.141	0.140	0.056	0.034
MVE/BVTL	3.608	3.961	0.269	0.091	1.376	1.592	0.324	0.270
SALES/TA	1.012	1.099	5.801	2.789	1.933	2.408	1.248	1.222

Table 3 show the financial ratio of each firm which are:

Working Capital to Total Assets: Guinness in 2013 was 0.576 and 0.574 in 2012. Eterna Oil in 2013 was 0.505 while 2012 was 0.211. Mobil increased by 0.014 in 2013 (0.647) from 2012 (0.633) and Seven up was also greater in 2013 (0.458) than 2012 (0.384). Guinness Plc was more liquid in 2013 by 0.2% (57.6% – 57.4%), Eterna oil increased its liquidity by 29.4% (50.5% - 21.1%), Mobil Plc increased its liquidity marginally by 1.4% (64.7% - 63.3%) while Seven Up also increased by 5.3% (23.3% - 18%)

Retained earnings to Total assets: Guinness PLC in 2013 is 0.300 while 2012 was 0.342, Eterna Oil in 2013 was 16.649 while 2012 was 9.835, Mobil PLC while 2013 was 0.085 while in 2012 was 0.086 and Seven up in 2013 was 0.233 while 2012 was 0.198. Guinness Plc decreased in cumulative profitability in 2013 by 4.2% (30% - 34.2%), Eterna oil increased in cumulative profitability by 6.81% (16.649% - 9.835%), Mobil Plc decreased in cumulative profitability in 2013 by 0.1% (8.5% - 8.6%) while Seven Up Plc also increased by 4% (23.3% - 19.8%)

Earnings before interest and tax to Total assets: For Guinness Plc in 2013 was 0.172 while 2012 was 0.212, Eterna Oil in 2013 was 0.097 while 2012 was 0.049, Mobil Plc in 2013 was 0.141 while 2012 is 0.140 and Seven up in 2013 was 0.056 while 2012 was 0.034. Guinness Plc decreased in productivity in 2013 by 4% (17.2% - 21.2%), Eterna Oil increased in productivity by 4.8% (9.7% - 4.8%), Mobil Plc increased in productivity by 0.1% (14.1% - 14%) and Seven Up increased in productivity by 2.2% (5.6% - 3.4%).

Market value of Equity to Book value of total liabilities: Guinness Plc in 2013 was 3.608 while 2012 was 3.961 (35.3% decrease), Eterna Oil in 2013 was 0.269 while 2012 was 0.091 (17.8% increase), Mobil Plc in 2013 was 1.376 while in 2012 was 1.592 (21.6% decrease) and Seven up Plc in 2013 was 0.324 while 2012 was 0.270 (5.4% increase).

Sales to Total Assets: Guinness PLC in 2013 was 1.012 while 2012 was 1.099 (8.7% decrease), Eterna Oil in 2013 was 5.801 while 2012 was 2.789 (301.2% increase), Mobil Plc in 2013 was 1.933 while 2012 was 2.408 (47.5% decrease) and Seven up Plc in 2013 was 1.248 while 2012 was 1.222 (2.6% increase).

The results from **table 2** above show the z-score of each firm which are:

Guinness Plc has a z-score of 4.854 (2013) and 5.341 (2012). This implies a decline in the financial health of the company in 2013 relative to 2012 though it can still be opined that the company is healthy. Also, Eterna Oil has a z-score of 30.190 (2012) and 17.027 (2013). This is also a case of decline in the financial health of Eterna oil in 2013 relative to 2012, yet the company enjoys a sound financial health. In addition, Mobil Plc has a z-score of 4.177 (2013) and 4.701 (2012). This company had a marginal decline in her measured financial health in 2013 relative to 2012 though also still financially sound. Lastly, Seven Up Plc has a z-score of

2.234 in 2013 and 2.501 in 2012. This shows that there was also a decline in the financial health of Seven Up Plc in 2013 relative to 2012 and the company is really struggling though we cannot conclude that it is healthy or not.

Discussion

Conclusions reached from the results above are: Firstly, relevant financial ratios were computed as well as the z-scores for the companies compared for years 2012 and 2013. Secondly, Guinness Plc, Eterna Oil and Mobil Plc are financially sound and have low likelihood of bankruptcy as per their financial reports in the studied years. In addition, Seven Up Plc result is indeterminate; hence we cannot conclude on its healthiness or otherwise. Furthermore, there was general decline in the z-scores of all the companies in 2013 relative to year 2012. Also, Eterna Oil has least likelihood of bankruptcy as it has the highest z-score of all the companies compared. Lastly, the companies compared differed significantly in their financial health.

It was therefore recommended that though Guinness Plc, Eterna Oil and Mobil Plc are stable, they should address the ratios that decreased in 2013 so as to do better in subsequent years. Also, they should consolidate the current organization and business strategy and sustain the measured health of their companies. Lastly, Seven Up Plc should be careful with their strategy because they have 50:50 chance of bankruptcy and survival, the current business strategy should be looked into and improved upon to change the fortunes of the company and reverse the downward.

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CRITICAL ANALYSIS ON THE POST ECONOMIC MELTDOWN FINANCIAL PERFORMANCE OF GUARANTY TRUST AND ACCESS BANKS IN NIGERIA

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ABSTRACT
The global economic meltdown hit the financial world very hard and many financial institutions Nigerian's inclusive still grapple with the effect of that phenomenon and many are yet to recover from it. This study critically evaluated the financial performance of some big and technologically re-engineered banks in Nigeria using some financial performance measures, and also compared the financial performances of the banks considered. Guarantee Trust Bank Plc and Access Bank Plc were selected for the study and data on their post – economic meltdown performances was obtained from their financial statements over the period. Descriptive analysis of the performances was presented and t-test was used to ascertain compare the banks' performance. The results show that GTB performed better than ACCESS in four of the financial measures tested where mean difference was significant (earnings per share, $p = 0.002$; profit after tax, $p = 0.013$; operating income, $p = 0.030$; gross earnings, $p = 0.013$), ACCESS was better in only one of the financial measure (investment subsidiaries, $p = 0.029$) while they do not differ significantly in the other financial measures. These results are in consonance with recent banking rankings in the country where GTB was constantly ranked above Access Bank in virtually all performance indicators. It is concluded that GTB has a better operational efficiency than Access as seen from the results. It is therefore recommended that Access bank improve in its operational efficiency to keep pace with others within the industry.

KEYWORDS: Post-meltdown, Operational efficiency, Financial performance, Mean difference.

Introduction

The importance of a vibrant, transparent and healthy banking system in the mobilization and intermediation of fund, for the growth and development of the economy need not be over-emphasized. Worthy of note is the fact that the level of functioning of the financial sector depend on the perception and patronage of the citizens towards its services, the situation where the public losses confidence in the financial institutions, can result in panic and consequential financial and economic woes. The absence of confidence in any organization is attributable to opaque management practices with deleterious effect on its performance (Al-Faki, 2006).

The Nigerian banking sector has witnessed remarkable changes in recent times given the increasing wave of globalization, structural and technological changes and integration of financial markets. The reforms in the Nigerian banking sector marked another giant stride in the history and development of the Nigerian banking industry. Banking industry in the world overplays fundamental roles in the development and growth of the economy, it plays the crucial roles of lubricating the payment system, resources mobilization and credit allocation. The effective and the efficient performance of these roles and the intermediation between the surplus and the deficit units of the economy are largely anchored on the level of development of the financial system. It is in view of these that the banking sector receives greater attention and has become the most regulated and controlled sector by government and its agencies (Imala, 2005).

In any country, the banking sector occupies an important place in the financial system. The reasons for this are the role banks play in the development of an economy. Banks among others play the following roles in an economy:

They act as intermediary between the deficit and surplus units in an economy, that is, they mobilize funds and allocate them among competing ends. Secondly, they facilitate the use of appropriate monetary policy instruments as well as make the transmission mechanism reliable and policies effective. Thirdly, the banking sector is instrumental in the pursuit of stabilization policies and in structural transformation. The main source of funds for Banks is deposits and the main application of funds is loan and investment. (Osuka and Osadume, 2013)

The deregulation of the banking industry initiated by the Babangida administration in the 1980s has changed not only the structure but also the contents and service structure of banking business. Just as the number of banks grew from 40 in 1985 to 125 in 1991, the techniques of delivering banking services and range of products and services in the Market have also changed. The changes have been described as a "revolution" while others see them as another banking boom comparable to what was witnessed in the fifties. The antecedent of banks proliferation and lack of control by the supervisory authority led to the paper profit declared by banks in order to stay afloat. The effect of these unethical practices led to the distress in the banking industry with the introduction of the prudential guidelines and statement of accounting standard which majorly dwelt on the provisioning for loans and advances. The lesson to learn from the distress in the banking industry was that profitability alone does not determine the yardstick for financial performance of banks. The deficiency of profitability as a measure of financial performance led to the use of CAMEL which is an acronym for capital adequacy, Asset quality, Management, Earnings and Liquidity by Monetary authorities. Since the introduction of CAMEL, the banking industry has improved tremendously with respect to their financial performances (Osuka and Osadume, 2013).

The scenario of commercial banking in Nigeria has been characterized by low capitalization which consequently affected their financial performance. While re-capitalization of Nigerian banks may address this concern, the effect of the exercise on banks performance remains an empirical one. The main problem addressed in this study, is whether recapitalization of Nigerian banks has improved their financial performance (Sani and Alani, 2013).

McCall & Walker (1973) studied commercial banks in New Hampshire to determine whether or not control by mutual savings banks affect commercial bank profitability and also focused on the role that ownership and control play on profitability of banks in analyzing the impact of ownership and control on some banks in the United States. It was concluded that management or owner-controlled status did not affect the profit rates of these banks. In Nigeria, the impact of ownership and control on the performance of banks is significantly different. Alashi, (2002) identified ownership structure as one of the major variables that could be used to explain financial distress in Nigerian banks. In contrast, Heggestad ((1977) in the study of bank pricing behavior affirmed that prices of bank services decreases with the degree of monopoly in banking markets.

Researches on factors impacting on profitability of commercial banks have also been vigorously extended to market interest rate sensitivities. Since revenues of commercial banks are largely from interest income, it follows that fluctuations in interest rates should have an impact on the profitability and overall financial performance of these banks. There have been some studies relating to the profitability of commercial banks in Nigeria. Ogunlewe (2001) in a study of the monetary policy influence of bank's profitability, using data from Nigerian banks found the determinants of bank profitability to include reserve ratio, permissible credit growth, stabilization securities and exchange rate. Uchendu (1995) investigated the effect of monetary policies on the performance of Nigerian commercial banks. He found that whether you use all banks data, six banks or the then three large banks' data, the dominant factors influencing bank profitability are interest rates, exchange rate, bank reserves, banking structure and unit labor costs, particularly when return on capital is used as measure of profitability. He concluded that stable and

realistic monetary and banking policies are important for the profitability of commercial banking business in Nigeria. The study by Uchendu is significant because it is an attempt to shed more light on the factors that influence commercial bank profitability in Nigeria. By so doing, it assists the industry managers in identifying the dominant variables to manage in order to improve performance.

The issue of re-capitalization is a major reform objective; re-capitalization means increasing the amount of long-term finances used in financing the organization. Re-capitalization entails increasing the debt stock of the company or issuing additional shares through existing shareholders or new shareholders or a combination of the two. It could even take the form of mergers and acquisitions or foreign direct investment (Asiedu, 2004). Whichever form it takes the end result is that the long term capital stock of the organization is increased substantially to sustain the current economic trend in the global world. Even though re-capitalization policy of the Central Bank of Nigeria (CBN) has increased the capital base and made them competitive players for the economic development of this country, there are still some noticeable drawbacks being envisaged.

This study examined and compared the Gross Earnings, Operating Income, Operating Expense, Profit after Tax, earning per Share (basic), Retaining Earnings Reserve, Customer Deposits, Investment in Subsidiaries, Investment in Associates and Investment in Securities of two banks in Nigeria over a period of five years post economic meltdown. The findings of this study would help banks retrace their financial activities in other to achieve a greater financial status in the coming years. The objectives pursued in this study were to determine the financial performance of Guaranty Trust and Access Banks with reference to CAMEL and, to compare the performance of both banks post economic meltdown based on the different financial performance measures

Materials and Methods

The data used for this study was a quantitative secondary data measuring the performances of Guaranty Trust and Access Banks extracted from their Financial Statements published online from 2009 to 2013. The performances measured were gross earnings, operating income, operating expenses, profit after tax (PAT), Earning per share, retained earnings reserve, customers deposit, investment subsidiaries, and investment securities all extracted from financial statements of the stated banks. The descriptive of the data showing the means and standard deviation was obtained as a measure of their level of performance while t-test was employed to ascertain differences in the mean performances of the banks. Microsoft Excel was used in the analysis.

Results

The results from the analysis using Microsoft Excel 2013 are displayed in the charts and table below:
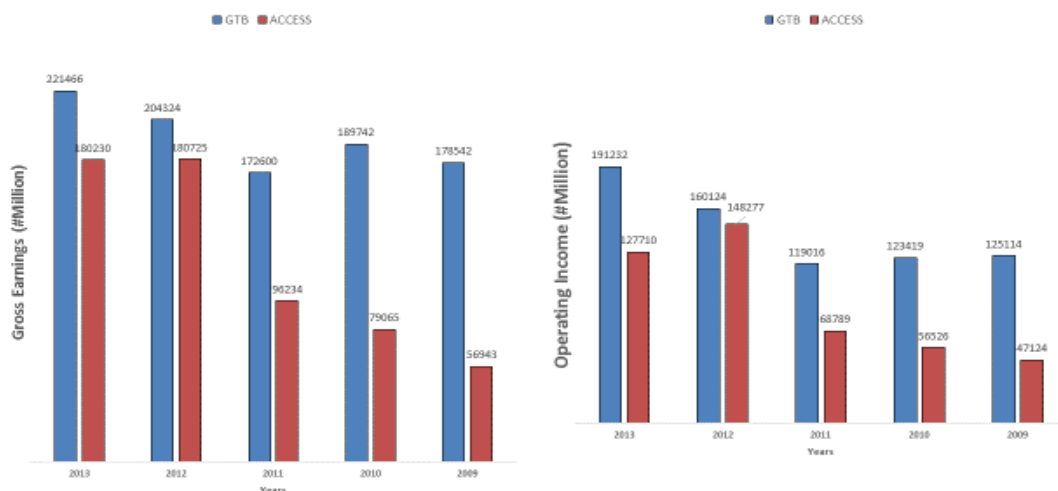
Fig. 1: Bar charts of Gross Earnings and Operating Income of GTB and Access Bank
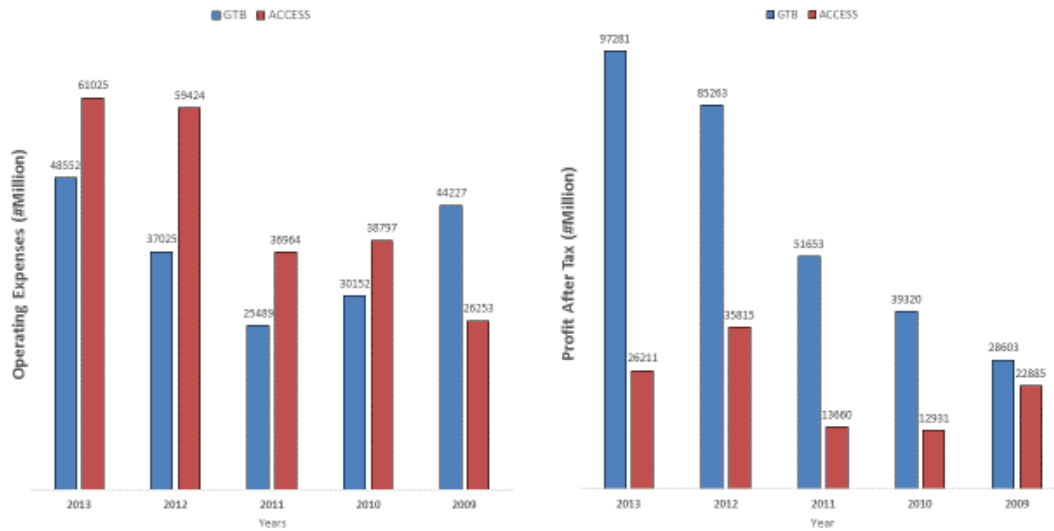
Fig. 2: Bar charts of Operating Expenses and Profit after Tax of GTB and Access Bank
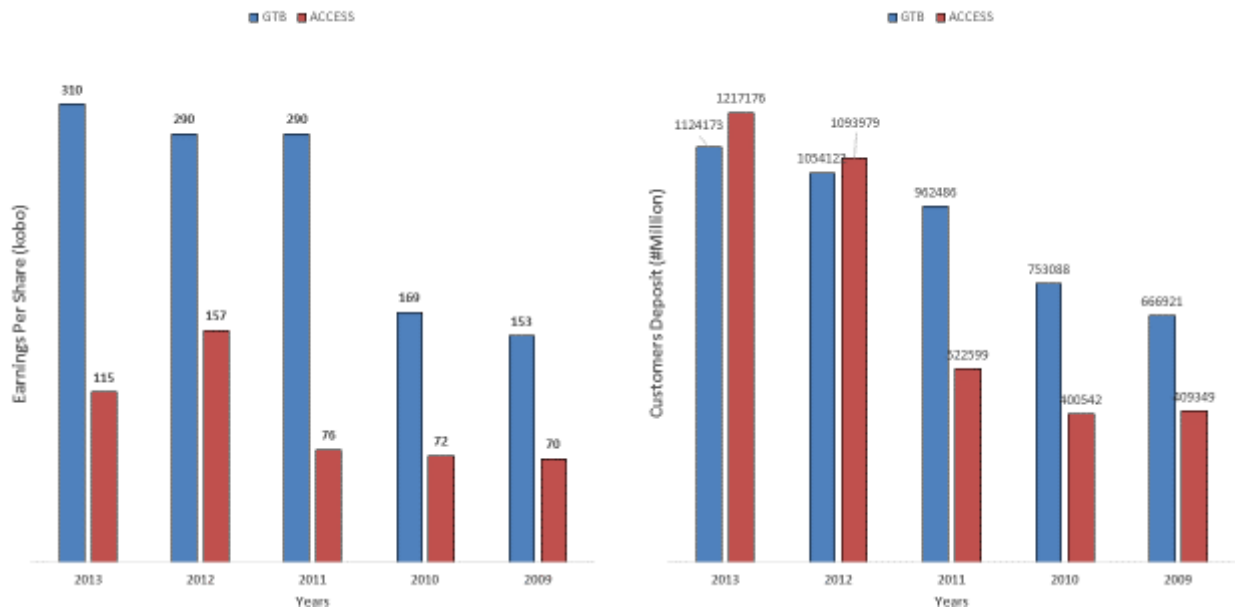
Fig. 3: Bar charts of Earnings per Share and Customer Deposit of GTB and Access Bank
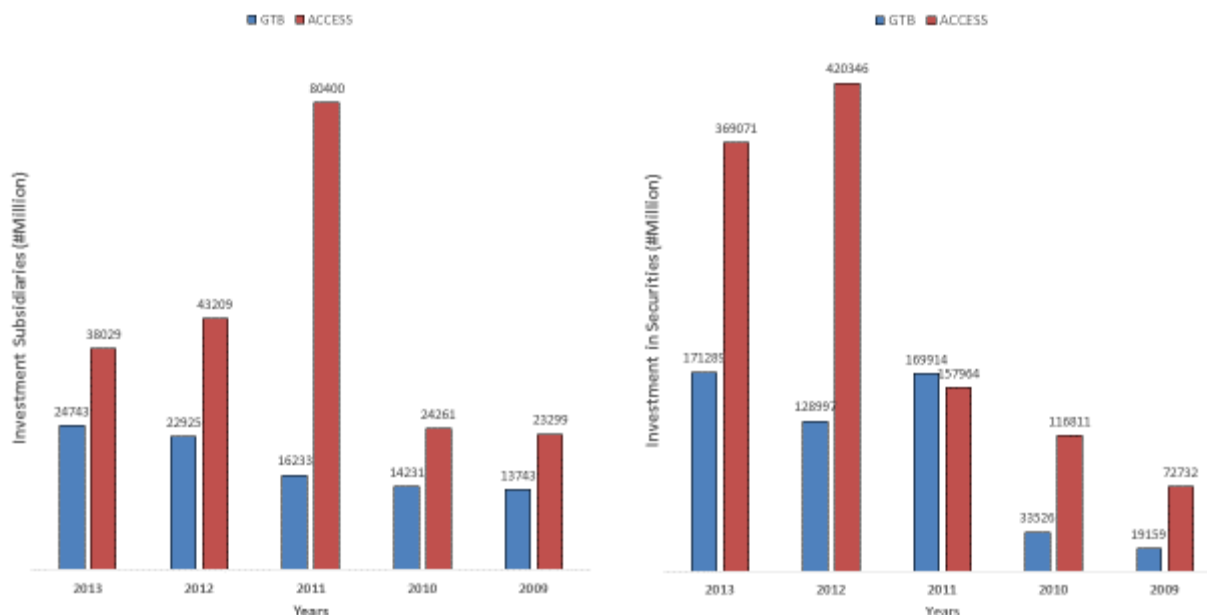
Fig. 4: Bar charts of Investment in Subsidiaries and Investment in Securities of GTB and Access Bank

Table 1:
Mean, Standard Deviation, and the t-value obtained from GTBank, Access Bank and measure of their mean differences for various financial performance measures.

Performance Measures	Bank	Mean	Std. Dev.	df	T	p
Gross Earnings (#Million)	GTB	193334.80	19835.54	8	2.719	**0.013**[*]
	ACCESS	118639.40	58143.37			
Operating Income (#Million)	GTB	143781.00	31205.22	8	2.197	**0.030**[*]
	ACCESS	89685.20	45350.09			
Operating Expenses (#Million)	GTB	37089.00	9552.98	8	-0.924	0.191
	ACCESS	44492.60	15149.83			
Profit After Tax (#Million)	GTB	60424.00	29623.89	8	2.740	**0.013**[*]
	ACCESS	22300.40	9496.33			
Earnings Per Share (kobo)	GTB	242.40	74.97	8	3.846	**0.002**[*]
	ACCESS	98.00	37.80			
Customers Deposit (#Million)	GTB	912158.00	195628.15	8	0.930	0.190
	ACCESS	728729.00	395027.82			
Investment in Subsidiaries (#Million)	GTB	18375.00	5110.53	8	-2.207	**0.029**[*]
	ACCESS	41839.60	23216.70			
Investment in Securities (#Million)	GTB	104577.00	73587.07	8	-1.586	0.076
	ACCESS	227384.80	156742.07			

Note:[*]Bold p-values show those where GTB and Access differ significantly at 5%

Table 1 reveals that the mean gross earnings of GTBank was #193334.80m (std. dev = #19835.54) while that of Access Bank was #118639.37m (std. dev. = #58143.37). This implies that GTBank performed significantly better than Access Bank over the five years post economic meltdown (p < 0.05). A look at fig. 1 will show that over the five years, GTBank's gross earnings were greater than that of Access Bank. While the difference was very wide in the first three years (2009 – 2011), the gap narrowed in 2012 and 2013.

Also, the mean operating income of GTBank was #143781.00m (std. dev. = #31205.22) and that of Access Bank was #89685.20 (std. dev. = 45350.09) revealing that GTBank was also significantly better in operating income than Access Bank (p < 0.05). Fig. 2 shows that the gap between the two banks was wide in all the years except 2012.

The outcome of the operating expense show that the mean opex of GTBank was #37089.00 (#9552.98) and that of Access was #44492.60 m

(#15149.83). This result meant that GTBank performed better than Access Bank in the management of operating expense though not significantly (p > 0.05). A peep at fig. 3 reveals that GTBank's operating expense was better (lower bars) in 2010 – 2013 but worse (higher bar) only in 2009.

The mean GTBank's profit after tax was #60424.00 m (#29623.89) while that of Access bank was #22300.40 (#9496.33) and it can be seen that GTBank performed significantly better than Access Bank (p < 0.05). Fig.4 shows that the gap in the profit after tax of GTBank was very widely different to that of Access Bank in all the years except 2009.

The earnings per share measure reveals that GTBank have a mean of 242.40 kobo (std. dev. = 74.97 kobo) and Access Bank's was 98.00 kobo (std. dev. = 37.80 kobo). The implication here is that GTBank performed significantly better that Access Bank (p < 0.05) and fig. 5 supports the claim that GTBank's earnings per share (eps) was significantly higher than Access' for all the periods reviewed.

GTBank's mean customer deposit was #912158.00m (std. dev. = #195628.15) while that of Access was #728729.00m (std. dev. = #395027.82). It can be deduced that the difference in customer deposit was not significant (p > 0.05). Fig. 6 show that GTBank's customer deposit was higher for the first three years (2009 – 2011) but lower than that of Access in the last two years (2012 – 2013).

Furthermore, the mean Investments in Subsidiaries of GTBank was #18375.00m (std. dev. = #5110.53) and that of Access Bank was #41839.60m (std. dev. = #23216.70) revealing that Access Bank has significantly higher investment in subsidiaries than GTBank (p < 0.05). A view of fig.7 reveal that Access Bank's investment in subsidiaries was higher in all the years than GTBank's and very pronounced in 2011.

Lastly, GTBank's mean investment in securities was #104577.00m (std. dev. = #73587.07) and that of Access was #227384.80m (std. dev. = #156742.07). Though it can be seen that Access Bank's investment in securities was higher than that of GTBank, the difference was not significant (p > 0.05). Fig. 8 show that GTBank was higher up till 2011 and Access took over the lead in 2012 and 2013.

Discussion
The findings of this study show that GTBank performed better than Access Bank in respect of gross earnings, operating income, operating expense, profit after tax, earnings per share and customer deposit while Access bank was better in investments. Weighing these measures of performance in the light of CAMEL, GTBank had better earnings (gross earnings, profit after tax and earnings per share). Also, in asset quality, Access Bank had better performance (Investment in subsidiaries and investment in securities) while GTBank had better performance in customer deposits. In addition, as per management, GTBank performed better in managing operating income and operating expenses. This agreed with GTB (2012), Omoh (2014), Opeyemi (2016), and Agusto & Co. (2015) which all put GTB before Access Bank in most operational ratings in recent times

The research work had shown that most of the measures under study increased over time in the bid of the banks to recover from the meltdown and put themselves on the part of growth again. It can then be concluded that Guaranty Trust Bank was better in most financial performance measures while Access Bank was better only in investment in subsidiaries and securities.

Banks are the back bones of any economy and their performance is very vital for the growth and expansion of such economy. Though, GTBank and Access Bank are rated as very strong, profitable, and growing banks, it was discovered that GTBank was performing better than Access bank. It is therefore recommended that Access bank do everything possible like embarking on aggressive marketing to improve on its earnings, and manage its operating income and expense to put itself on the part of growth and profitability. Also, it should strive to improve on its earnings per share to be able to increase the shareholders' investment.

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EVALUATION OF HEAVY METALS IN SOME COSMETIC PRODUCTS IN LAGOS NIGERIA.

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ABSTRACT

The harmful effects of hidden hazardous heavy metals in cosmetics are not well emphasized in Nigeria. These metals are known to be of toxic effects to human according to the results of several studies. This study was aimed at evaluating the presence of heavy metals like: Arsenic (As), Cadmium (Cd), Chromium (Cr), lead (Pb), Nickel (Ni), Mercury (Hg) and Zinc (Zn) in selected cosmetics. Thirty samples of imported cosmetics classified as: Nail polish (Np), Eye shadow (Es), Perfume (Pf), Body spray (Bs), Lipstick (Ls) and Powder (Pd) were purchased from three major markets (Balogun, Idumota and Ojota markets) in Lagos State, Nigeria. Samples of these cosmetics were prepared and analyzed for the various concentrations of the metals present using flame atomic absorption spectrometer. The results obtained showed the presence of these metals in the analyzed cosmetics at varying concentrations. The ranges of the concentrations obtained for As, Cd, Cr, Pb, Ni, Hg and Zn were: 0.50 – 2.40 ppm, 0.20 – 6.10 ppm, 0.80 – 5.80 ppm, 0.20 - 3.20 ppm, 1.10 – 12.20 ppm, 0.10 – 1.80 ppm and 7.20 – 19.60 ppm respectively. The peak concentrations respectively detected for As, Cd, Cr, Pb, Ni, Hg and Zn, were: 2.40 ppm in Pd-27, 6.10 ppm in Ls-15, 5.80 ppm in Es-6, 3.20 ppm in Ls-12, 12.20 ppm in Np-3, 1.80 ppm in Pd-27 and 19.60 ppm in Pd-26. Obtained concentrations for this study were relatively higher compared with similar studies carried out in the European axis. Our results suggest that dermal exposure to heavy metals through the use of cosmetics is the major route of exposure to these metals. Users of cosmetics should avoid excessive use of it since these metals could pose hazardous health effects on them.

INTRODUCTION

Heavy metals refer to any metallic element that has a relatively high density and is toxic or poisonous even at low concentrations (Lenntech, 2014). They are found naturally in the environment in rocks, water and soils. Therefore, they exist in the manufacture of pigments and can be used in trace quantities into raw materials used in the manufacture of the various cosmetic products available to users. Some of these metals are used in cosmetics for one reason or the other, for example Cadmium's (a deep yellow to orange element) colour properties enables it to be used in some lipsticks and facial cosmetics, thiomerasl (mercury) as a preservative, the progressive hair dye lead acetate and a number of tattoo pigments such as red cinnabar (mercuric sulfide) and so on. Apart from the regulated intentional uses of these heavy metals in cosmetics, they can be found as impurities also in various cosmetic products. The latter makes it very difficult to avoid exposure to heavy metals because of their prevalence nature in the environment (Nnorom *et al.,* 2005; Ayenimo *et al*., 2010; USEPA, 2013; Health Canada, 2011; Rashed *et al*., 2010).

Several researches have related the causes of some health issues to the presence of heavy metals such as arsenic, mercury, lead, cadmium, chromium, etc as impurities in cosmetics, (Darbre, 2001 and 2003; Health Canada, 2011; Harvey and Darbre, 2004; McGrath, 2003; Houston, 2007; Kawata *et al*., 2007; Liu *et al*., 2009; IARC, 2010). Adepoju-Bello *et al.,* (2012) reported that cosmetics expose users to low level concentrations of toxic heavy metals may pose potential health

issues to the users since heavy metals are known to accumulate in the biological system over time and also known to induce skin problems such as cancer. Heavy metals such as lead and cadmium are notable for their ability to accumulate in the body tissue faster than the body detoxification pathways can get rid of them; thus, a gradual build up of toxic levels which can greatly be enhanced through the application of cosmetics and other personal care products on the skin. The skin, despite being a protective barrier, some components of cosmetics such as arsenic, cadmium and lead penetrate and become available in our systems, (Health Canada, 2009). Loretz et al., (2006), found that the possibility of exposure to cosmetic products may occur when applied via spray, while dermally applied products to the mucous membranes present the possibility of enhanced availability or in the case of lips products provide the opportunity for oral ingestion. Nnorom et al. (2005), reported the significant levels of heavy metals in facial cosmetics such as eye pencil and lipsticks.

Heavy metals in cosmetics have been shown to have adverse effects on human health. Lead has been described as the environment's most harmful contaminant to arise in human civilization and has been shown to impair renal, hemopoietic and nervous system with different reports linking it to deficiency in cognitive functioning (Chukwuma, 1997; Nnorom et al., 2005). Lead poisoning leads to poor intelligent quotient (IQ) (Wang et al., 2002); inhibition of the synthesis of haemoglobin, dysfunctions in kidneys, joints, reproduction and vascular systems (Ogwuegbu and Muhanga, 2005). Al-Saleh et al., (2009), linked lead poisoning to infertility and miscarriage. High concentrations of zinc can result in stomach cramps, vomiting, skin irritation, anaemia and nausea (Odukudu et al., 2014).

International agency for Research on Cancer (IARC) 2010, reported that cadmium and its compounds are considered human

carcinogens. It is extremely toxic even at low concentrations. Nickel though a trace elements required in the body in minute quantities, can accumulate in the kidneys, bones and thyroid and cause toxicity (Rashed et al., 2010). Allergy to nickel is common and it can cause severe contact dermatitis (Health Canada, 2010). IARC (2010), arsenic and its inorganic compounds are considered to be carcinogenic to humans. Chromium (VI) ion (Cr^{6+}) is a known human carcinogen; inhalation causes lung cancer (Agency for Toxic Substances and Disease Registry (ATSDR), 2008). Mercury is a neurotoxin and the prolonged use of products containing it can lead to inflammation of the liver, kidneys and urinary track infection, (Ramakant et al., 2014). Mercury is particularly hazardous during foetal development and it is readily absorbed by the skin. Neither mercury nor thiomerasl are highly common as direct ingredients or impurities, but its high toxicity means that the presence of mercury in any cosmetics is of concern (Adepoju-Bello et al., 2012).

Arsenic, cadmium, lead and mercury are among the metals banned as intentional ingredients in Canada. The aim of this study was to determine the concentrations of As, Cd, Cr, Pb, Hg, Ni and Zn in commonly used cosmetics available in Lagos State, Nigeria and to assess if the concentrations are within the acceptable standards.

MATERIALS AND METHODS
The modified method of Umar and Caleb, (2013) together with Hydride Generation/Cold Vapor Atomic Absorption Spectroscopy was used for Arsenic and Mercury in this work.

Collection of Samples
Thirty different cosmetics in the classes of nail polish (1-5), eye shadow (6-10), lipstick (11-15), perfume (16-20), body spray (21-25) and powder (26-30) were bought from Balogun, Idumota and Ojota markets, Lagos State, Nigeria. The cosmetics were coded as shown in Table 1.

Table 1: Samples list and their codes

Samples Code	Samples Brand	Samples Code	Samples Brand
Np-1	Colodion gel 3.2.1	Es-6	Black Opal
Np-2	Viva	Es-7	Iman
Np-3	Everyone	Es-8	Romantic
Np-4	Vienne	Es-9	My Colour
Np-5	Liz	Es-10	Ushas
Pf-16	Seduction	Lp-11	Island Beauty Blue Flame
Pf-17	Professional	Lp-12	Mary-Kay
Pf-18	Nauveaute	Lp-13	Romantic
Pf-19	Nikita	Lp-14	Iman
Pf-20	Wishbone	Lp-15	Miss Rose
Bs-21	One love	Pd-26	Iman
Bs-22	Cool breeze	Pd -27	Black Opal
Bs-23	Treajar	Pd-28	Classic
Bs-24	Wishbone	Pd-29	Bouquet
Bs-25	Balila	Pd-30	Fashion Faire

Preparation of Standard Solutions

Analytical grade tri-oxo-nitrate (v) acid (65% sigma Aldrich) and Tetra-oxo-chloric (VII) acid (70% Sigma Aldrich) were used for samples preparation. Calibration standards for each heavy metal were prepared each day from the certified standard stock solution (1000 ppm manufactured under ISO 9001 quality Assurance System Perkin Elmer) in the range of 0.5 to 10 ppm. All solutions were prepared in double distilled water. Dilution correction was applied for samples diluted or concentrated during analysis.

Preparation of Samples

The solid samples were crushed in a porcelain mortar. 2g of each sample was weighed using analytical balance and then taken into a 100 ml digestion flask. 10 ml of Tri-oxo nitrate (V) acid (HNO_3) was added and the flask was placed in the dark over night. On the next day, 5 ml of Tetra-oxo-chloric (VII) acid ($HClO_4$) was added to it. The mixture was then placed on a hot plate at 50°C for 15 minutes and then the temperature was raised slowly up to 200°C. Heating was continued until the white fumes of the $HClO_4$ disappeared. This was done on a digester inside the fume cupboard. After the digestion, the contents were cooled and filtered through the Whatman filter paper (№ 2). Then the samples were transferred to the 50 ml volumetric flask and diluted with de-ionized distilled water up to the mark. A solution of each sample was taken into sample bottles for analysis.

A Perkin Elmer Analyst 200 Atomic Spectrometer equipped with hollow cathode lamp was used for the analysis while Hydride Generation/Cold Vapor Atomic Absorption Spectroscopy was used for As and Hg. The instrumental parameters were adjusted as specified by the manufacturer. The hollow cathode lamps for the selected metals were of wavelengths and slit wavelengths respectively as: Ni- 232.00nm ; 0.20nm, Cd- 228.80nm ; 0.70nm, Cr- 357.90nm ; 0.70nm, Zn- 213.90nm ; 0.70nm, Pb- 283.30nm ; 0.70nm, As- 193.70nm ; 0.70nm and Hg- 253.70nm ; 0.70nm. Limit of Detection (LOD) of AAS used was 0.0001ppm. The gas used was acetylene with 20Pa pressure and air 45Pa pressure. The instrument was calibrated with standard solutions and the samples were introduced to it.

RESULT AND DISCUSSION

The samples were analyzed and the concentration of the metals present were displayed in parts per million (ppm) on the display unit of the spectrometer and were presented in Table 2, as follows,

Table 2: Concentrations of Heavy Metals in Analysed Cosmetics Samples

Sample Codes	As (ppm)	Cd (ppm)	Cr (ppm)	Pb (ppm)	Ni (ppm)	Hg (ppm)	Zn (ppm)
Np-1	1.00	1.80	1.20	ND	ND	1.20	13.60
Np-2	0.80	2.10	2.30	1.30	**1.10**	1.20	
Np-3	**0.50**	ND	ND	ND	**12.20**	1.60	9.40
Np-4	0.70	4.00	3.80	1.80	2.70	1.10	
Np-5	0.80	2.40	2.60	1.90	3.00	0.40	
Es-6	1.10	ND	**5.80**	1.80	4.80	0.70	7.80
Es-7	1.00	2.00	3.10	1.30	1.90	**0.10**	
Es-8	1.00	1.20	3.20	ND	7.80	0.60	**7.20**
Es-9	1.10	1.90	2.30	1.20	2.90	0.50	
Es-10	1.20	2.10	5.20	0.90	2.10	1.10	
Ls-11	1.20	1.80	2.80	ND	ND	0.80	8.80
Ls-12	0.70	3.60	2.00	**3.20**	ND	0.30	10.80
Ls-13	0.90	5.90	3.10	2.00	2.00	0.10	
Ls-14	1.00	3.80	1.40	2.10	1.90	0.30	
Ls-15	1.20	**6.10**	1.30	2.00	2.70	1.00	
Pf-16	1.90	3.60	1.90	1.90	1.90	1.00	
Pf-17	1.90	2.10	1.10	1.90	2.90	1.20	
Pf-18	1.80	2.00	3.80	1.70	2.00	0.90	
Pf-19	1.10	ND	**0.80**	1.80	ND	0.90	11.80
Pf-20	1.20	ND	1.20	ND	ND	0.80	12.80
Bs-21	1.00	2.20	3.80	2.00	4.00	1.00	
Bs-22	1.90	**0.20**	2.20	**0.20**	7.20	1.30	
Bs-23	2.10	1.20	2.00	ND	2.00	0.70	
Bs-24	2.00	3.30	4.00	1.80	2.60	0.50	
Bs-25	1.80	2.80	2.90	1.90	1.80	1.10	
Pd-26	1.80	ND	1.80	ND	4.80	1.20	**19.60**
Pd-27	**2.40**	4.20	1.80	2.20	1.50	1.80	
Pd-28	1.70	2.50	1.10	1.40	1.80	0.80	
Pd-29	1.40	3.60	1.60	1.60	3.10	1.20	
Pd-30	1.60	3.10	2.00	1.50	3.60	1.00	

ND= Not Detected

Table 3: Mean, Standard Deviation and Range of Each Heavy Metal Analyzed in all the Cosmetics in ppm

Heavy Metals	Mean (ppm) ± SD	Range (ppm)
As	1.33 ± 0.40	0.76 – 1.78
Cd	2.75 ± 0.84	1.80 – 4.24
Cr	2.49 ± 0.78	1.66 – 3.92
Pb	1.74 ± 0.39	1.30 – 2.53
Ni	3.27 ± 0.90	1.30 – 2.53
Hg	0.88 ± 0.25	0.50 – 1.20
Zn	13.03 ± 4.22	9.80 – 19.60

The results of the analysis indicated the uneven distribution of the metals and their concentrations. The highest concentration of Zn was found in sample Pd-26 (19.60 ppm), Ni in sample Np-3 (12.20 ppm), Cd in sample Ls-15 (6.10 ppm), Cr in sample Es-6 (5.80 ppm), Pb in sample Ls-12 (3.20 ppm), As in sample Pd-27 (2.40 ppm) and Hg in sample Pd-27 (1.80 ppm). The mean concentration of the heavy metals for all the cosmetics analyzed in decreasing order were 13.03ppm

for Zn, 3.27ppm for Ni, 2.75ppm for Cd, 2.49ppm for Cr, 1.74ppm for Pb, 1.33ppm for As and 0.88ppm for Hg. Table 4, shows the distribution of the metals in the various cosmetics considered.

Table 4: Mean concentration of heavy metals in the cosmetic products.

Forms of Cosmetics	As (ppm)	Cd(ppm)	Cr(ppm)	Pb(ppm)	Ni(ppm)	Hg(ppm)	Zn(ppm)
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Nail polish	0.76±0.16	2.58±0.85	2.48±0.93	1.67±0.26	4.75±4.36	1.10±0.39	11.50±2.10
Eye shadow	1.08±0.07	1.80±0.35	3.92±1.34	1.30±0.32	3.90±2.20	0.60±0.32	7.50±0.30
Lipstick	1.00±0.19	4.24±1.60	2.12±0.72	2.53±0.51	2.20±0.36	0.50±0.34	9.80±1.00
Perfume	1.58±0.35	2.57±0.73	1.76±1.08	1.83±0.08	2.27±0.45	0.96±0.14	12.30±0.50
Body spray	1.76±0.40	1.94±1.12	2.98±0.81	1.45±0.74	3.52±2.00	0.92±0.29	17.50±1.70
Powder	1.78±0.34	3.35±0.63	1.66±0.31	1.68±0.31	2.96±1.21	1.20±0.33	19.60±0.00

The highest concentration of Zn in this study was 19.60 ppm in sample Pd-26, this value was greater than a concentration of 0.332 ppm reported by Odukudu et al., (2014). This may be adduced to the shinning nature of Zinc, this may tempt manufacturers to add either regulated or unregulated amount of it in the various samples.

Cd highest was 6.10 ppm in sample Ls-15, this was higher than the impurity level of 3 ppm obtained in a similar research reported by Health Canada (2009). The value obtained for Cd in this work exceeded the limits suggested by Nnorom et al., (2005) of 1ppm, and 0.50 ppm by Gondal et al., (2010). Ni highest concentration was found in sample Np-3, as 12.20 ppm, this level was below the safety permissible level of 1701µg/g (Basketter, 2003) and 5 ppm, (Gondal et al., 2010). The value 3.20 ppm for Pb in sample Ls-12 was lesser than the recommended safety level of 10 ppm (Health Canada, 2009) but higher than

1 ppm (Gesund und Wirtschaftlicher, 2010), 0.2 ppm (Expert Panel, 2007) and 0.5 ppm (Gondal et al., 2010). Environmental Defence Canada (EDC), (2011) suggested a safety level of 3 ppm for As. The highest concentration of As in this study was 2.40 ppm in sample Pd-27 which was below the safety level of EDC, (2011). EDC, (2011) also recommended a safe value of 3 ppm for Hg and the highest concentration for Hg for this study was found to be 1.80 ppm in sample Pd-27 indicating that it was lower. Chromium's highest concentration was 5.80 ppm in sample Es-6, although not further varrified if it was found as Cr^{6+}. This value was higher than the permissible level of 0.00047 ppm for Cr^{6+} as reported by Odukudu et al., (2014).

Comparing Heavy Metals in the analysed Cosmetics for this Study with Similar Study carried out by Umar and Caleb, (2013), there was significant difference in the concentrations of Cd. There where mark

differences in the concentration of Ni, Pb and Cr, these indicated that the concentrations of the impurities differs with manufacturers and locations.

Furthermore, our results indicated that the major route of heavy metals entrance into the body is through dermal exposure. With the continual use of the analyzed cosmetics, users are mostly exposed to five out of the seven metals evaluated through dermal applications i.e. Zn, Ni, Cr, As and Hg. The main source of exposure of Pb and Cd is through ingestion as depicted in Figure 1.
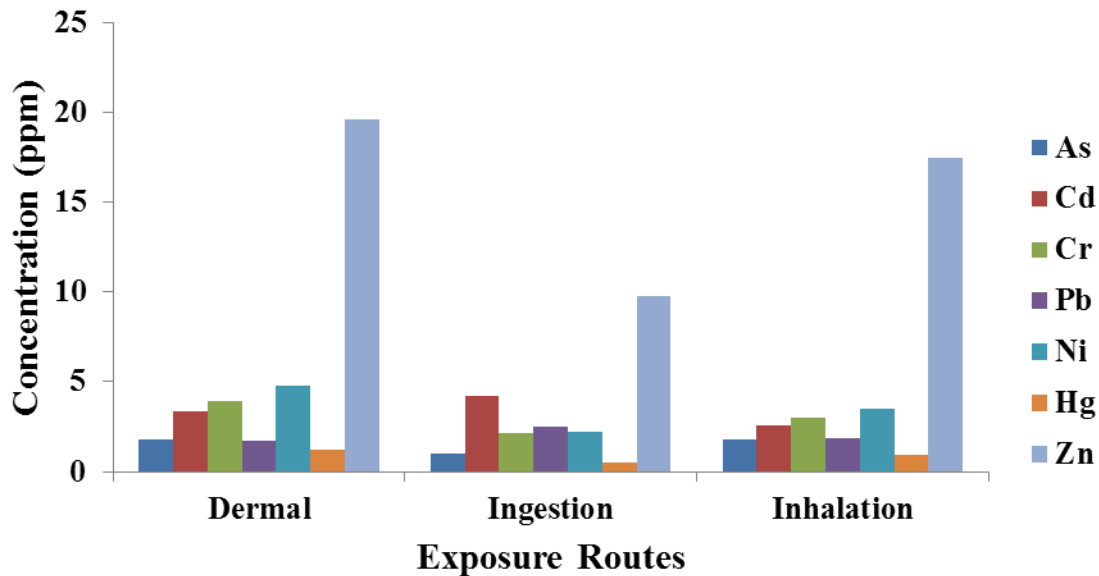

Figure 1: Routes of Heavy Metals Exposure in the Analysed Cosmetics

The study has shown notably the presence of As, Cd, Cr, Pb, Ni, Zn and Hg in cosmetics sold in Lagos state. These metals were contained in relatively high concentrations with respect to some safety limits reported. Therefore, their presence in cosmetics could act as additional source of heavy metals exposure. The possibilities of bioaccumulation in living tissues could be of potential harm to human health.

CONCLUSION
The results obtained indicated that these metals were present in cosmetics in varying concentrations. Zn had the highest concentration for all the cosmetics samples analyzed with a concentration of 19.60 ppm and a mean concentration of 13.03 ppm. The highest concentration of each metal were: As– 2.40 ppm in sample Pd- 27, Cd– 6.10 ppm in sample Ls- 15 , Cr– 5.80 ppm in sample Es-6, Pb– 3.20 ppm in sample Ls -12, Ni– 12.20 ppm in sample Np-3, Hg– 1.80ppm in sample Pd- 27 and Zn– 19.60 ppm in sample Pd-26.

The concentrations of some of these metals are relatively high in this study with respect to their known toxicity on human health. Dermal exposure is the most significant route of entrance of these metals into the body. Therefore, users of these cosmetics are at high risk of the harmful effects of these heavy metals. For other contaminant detected that were below the permissible limit, continual use of such products may cause slow release of these metals into the human body and thus manifest their harmful effects as a result of bioaccumulation over a period of time.

RECOMMENDATION
Most of these metals were present as impurities. Users should desist from indecent and excessive use of these cosmetics because of heavy metals "Add Up" and could result in long last harmful effects, Less is better. Natural beauty should be encourage and Artificial beauty jettison. Consumers are to choose safer products. Government can help pass smarter and health-protective laws. Ban

harmful and risky cosmetics, Demand that cosmetics companies fully disclose ingredients and support those that do.

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FACTORS AFFECTING THE GENERATION, MANAGEMENT AND DISPOSAL OF URBAN HOUSEHOLD SOLID WASTE IN LAGOS STATE, NIGERIA.

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ABSTRACT

Waste is a global phenomenon that has attracted global concerns, particularly household solid waste in developing countries. This household solid waste is a by-product of urbanization. population growth, technological advancement and increase in consumption pattern. It therefore means that the proper and sustainable management of household solid waste within an urban area requires the factors that influence the generation, management and disposal of such wastes, which is the aim of this paper, with a view towards finding measures that would help reduce their negative effects on urban cities beautification and sanitation. This paper established through a review of related literature that the relationships among the significant assessment variable such as residential area type, employment status, monthly income, and size of waste generated and disposed are high. The study therefore recommended intensive awareness program by the government to sensitize the populace on the management and disposal of solid wastes in city centres in order to improve the health of the citizens.

Keywords: Generation, Management and Disposal, Urban Waste

WASTE MANAGEMENT

1.0   INTRODUCTION

Waste is a wide ranging term encompassing most unwanted materials, defined by the UK Environmental Protection Act 1990, waste includes any scrap material, effluent or unwanted surplus substance or article the wise spoiled. Moreover solid wastes comprises all the wastes arising from human and animals activities that are normally solid, discarded as useless or unwanted. Or all materials that may be required by law to be disposed off (Okecha, 2000).

A United Nations Report (August, 2004) noted with regret that while developing countries are improving access to clean drinking water, they are falling behind on sanitation goals. At one of its submit in 2000 (Uwaegbulun, 2004) revealed that the World Health Organization (WHO, 2004) and United Nations International Children Education Fund (UNICEF, 2004) Joint Report in August 2004 that: "about 2.4billion people will likely face the risk of needless diseases and death by the target of 2015 because of bad sanitation". The report also noted that bad sanitation-decaying or non-existent sewage system and toilets-fuels the spread of deases like cholera and basic illness like diarrhea, which kills a child every 21seconds.

In 1992, the "Earth Summit Succeeded in alerting the conscience of the world to the urgency of achieving environmentally sustainable development. It affirms that rapid urbanization in developing world if ignored can be a threat to health, the environment and urban productivity. Cities are the engines of economic growth, but the environmental

implications of such growth need to be assessed and managed better.

In spite of the formulation of FEPA by the Federal Government of Nigeria of Decree 58 (Federal Environmental Protection Agency) on 30 December, 1988 and a national environmental policy, the environment has not been adequately protected. Interest is mainly on aesthetics, which is rarely achieved (Agunwanba, 1998). Waste pollution is irregular and restricted to the major cities. Improperly sited open dumps faces several cities examples the open dump at Ojota Lagos Nigeria, thereby endangering public health by encouraging the spread of odors and diseases uncontrolled recycling of contaminated goods and pollution of water sources (Adegoke, 1989 and Sigh, 1998).

However, in reactions to the inescapable environmental impact of delay in solid waste removal, the federal government for example, introduced the monthly environmental sanitation in the early seventies. From there the states and local governments were expected to take queue and evolve their own Solid Wastes Management (SWM) strategies based on the peculiarities of their states and environment.

From the above Lagos State had in the process of mitigating urban solid waste, set up Lagos Waste Management Authority (LAWMA) in attempt to tackle the occurrence of wastes and their hazards to society as a whole. While the unhealthy aspect of abandoned solid wastes can be contained, the avoidable features of blocked drains. One feature common in the wastes build-up and emanating environmental degradation scenario is the high cost of capital intensive nature of its amelioration as well as tackling the solid waste menace. It requires a lot of financial and human capital to minimize and attempt to eradicate the adverse effects of exposed and untreated household solid wastes in our urban centers.

Generating of household waste are the resultant of urbanization. As population drift to city centers, the consumption patterns and needs increases. Therefore these domestic wastes includes that from domestic premises, caravan sites, residential homes, educational establishments and nursing homes (and probably hospitals) which can be organic or non-organic. The organic wastes can decay which are food from the household and can be composed and returned to the soil. But these wastes such as cans of tins, plastics and bottles are inorganic and cannot be treated in the same way-as the organic. Domestic waste can pollute the environment and be indirectly dangerous to humans, therefore it is expected that the Lagos State Government would in due course arrive at the means to combat solid wastes and reduce their negative impact on area resident and the perception of our cities as being dirty, chaotic and full of traces of rotting or fermenting garbage's that emit odor

rest harmful to the human body. Obviously, the timely removal of accumulated solid wastes requires much more than Lagos State Government and other government (local governments and all LCDA's) are presently engaged in. further plans, policies and programs would need to be put on a more permanent basis in order to combat the dastardly effects of environmental degradation. Understandably, it would require effective mobilization of resources such as involving all stakeholders in regular counter measure to suppress uncontrolled solid waste generation and irregular disposal outside city continues altogether.

2.0 FACTORS AFFECTING THE GENERATION, MANAGEMENT AND DISPOSAL OF URBAN HOUSEHOLD SOLID WASTE

2.1 The factors contributing to waste generation are:

1. Traditions/canned foods

In so part of the country today, there still exists the use of leaves in the form of plates. Also the now canned food, drink, water etc, have become a means of waste generation, which has become is substantial.

2. Personal income

A study by Afroz et al. (2010) found that individuals with higher income generated more waste than lower income people and respondents that were concerned about the environment generated less waste

3. Population

Rapid increases in the population and improvements in the quality of life, especially in urban cities in the developing countries, have aggravated the problem of solid waste generation. Therefore, waste management authorities will require huge capital investments and operational strategies for collection, transportation, and disposal of solid waste

4. Environmental awareness and concern

According to Afroz et al. (2010) individuals with that are concerned about the environment generated less waste

5. Time of the year

It generally regarded that festive period of the year generate more waste than other times. The highest generation of waste is recorded in December due to festivities in the southern cities of Nigeria illustrating the influence of time of year and traditions (Afon, 2007).

2.2 The problems hindering the management of waste disposal are as follows;

6. Technical,

Technical factors influencing the system are related to lack of technical skills among personnel within municipalities and government authorities (Hazra and Goel, 2009), deficient infrastructure (Moghadam et al., 2009), poor roads and vehicles (Henry et al., 2006), insufficient technologies and reliable data (Mrayyan and Hamdi, 2006).

7. Environmental,

Matete and Trois, 2008 and Asase et al., 2009 respectively suggested that the factors affecting the environmental aspect of solid waste management in developing countries are the lack of environmental control systems and evaluation of the real impacts. Ekere et al. (2009) proposed that the involvement of the population in active environmental organizations is necessary to have better systems.

➢ Financial,

States and Local Governments have failed to adequate manage solid waste as a result of poor funding. According to (Sharholy et al., 2007), huge expenditure is needed to provide the service. The absence of financial support, limited resources, the unwillingness of the users to pay for the service (Sujauddin et al., 2008) and lack of proper use of economic instruments have hampered the delivery of proper waste management services. However, with the introduction of the private sector participation (PSP) model, there have been improvements in the efficiency of the system

➢ Socio-cultural

Waste workers are associated to low social status (Vidanaarachchi et al., 2006), situation that gives as a result low motivation among the solid waste employees. Various Government do not attach priority to these set of workers compared to other employees. You hardly find any PSP operator with well

equipped and trained and skilled personnel in the organisation.)

> Institutional

It is extremely difficult to gain an insight into the complex problem of solid waste management (Seng et al., 2010). This is because information available is very scanty from the public domain. Waste management authorities have a lack of organizational capacities (leadership) and professional knowledge.

2.3 The factors affecting waste disposal are:

> Disposal site

Most of the disposal sites in the state are open dumps without leachate treatment, protection at the bottom by a geo-membrane or clay-lined layer, gases treatment nor other infrastructures needed. For a state with a population of over 15million citizens, the three incinerators available are in adequate

> Distance

The distances to most of the official dump or disposal sites like the Ojota dump site vary from 0 km in Olusosi axis to 20km in Apapa from the city centers.

2.4 Management of Household Solid Waste

Waste Management simply means the collection, keeping treatment and disposal of waste in such a way as to render the waste harmless to human and animal life, the ecology and environment generally. It could also be said to be the organized and systematic dumping and channeling of waste through or into landfills or pathways, to ensure that they are disposed of with attention to acceptable

> Legal

The introduction of the monthly sanitation exercise that takes place on the last Saturday of the month and the every Thursday market clean up, contributes positively to the development of the integrated waste management system while the absence of satisfactory policies (Mrayyan and Hamdi, 2006) and weak regulations (Seng et al., 2010) are detrimental to it.

> Cost

The tipping charge by the cat pushes, PSP operators and the like, has led to the state suffer from the illegal disposal of waste in rivers, canals, drainage channels, empty lots and roadsides

> Materials

Materials like plastic, paper, metal, glass, organic, battery, electric and electronic are recyclable which makes their disposal economical, while other solid waste like fasces are emptied in the rivers, canals etc.

public health and environmental safeguard. Household solid waste management has become an area of major concern in Lagos Nigeria till the advent of Fashola Babatunde (SAN) government who took the challenge head on to clear the heaps/ accumulated wastes in order to win the battle against the harmful consequences of unguided waste dumping and then attainment of a clean healthy environment for the state inhabitants.

2.5 Funding and Excessive Population

Waste management is by nature capital and economic intensive. The household solid waste require huge capital outlay. Lagos State Government spends between 20-25% of its funds on waste management (Mowoe, 1990). But what this amount could accomplished is nothing compared to the population it caters for. Lagos State has a projected population of 18-22million persons and many people continue to troop into the city per day in-search for survival from other part of the country and the neighboring countries.

It is then estimated that the average individual in such mega cities as Lagos generates an average of 46kg of waste daily (Uchegbu, 1988). With it's the fund available or at least earmarked for the household solid waste management is grossly inadequate, to fund the public agencies and other private sector participants (PSP) when are involved in collection and disposal of household solid

waste to fund the procurement of equipments and materials required for effective domestic waste management and disposal. (Aigbokhavb, 2006).

2.6 Lack of Trained Professional Waste Managers
There are few sanitation and environment Engineers in Lagos compared to the enormity of the population challenge. While most private sectors operators involved in the waste management are mainly party stalwarts who know little or nothing about waste management than collection and dump at the dump site. Therefore management of waste management agency should be headed by a professional environmental manager who is well trained environmental practitioner.

2.7 The Way Out for a better Management and Disposal of Household Solid Waste in Lagos

There are two major approaches to the waste management and disposal. These are private and public arrangements. The private system is a contractual arrangement between an individual or group of persons who undertake waste disposal as a business venture and the waste generator example (P.S.P.)

This system is common among the high and medium income households who can afford the charge. The public system is more conventional. This is a situation where government establishes a waste disposal agency whose responsibility it is to collect waste from waste generators and dispose them at disposal depots.

The combination of this two system is called hybrid arrangement which is the system needed for Lagos.

Though this system is been adopted in Lagos State but lack the necessary legislator back and particularly enforcement.

The hybrid system has many attributes which support its adoption. While the public system is under state government control and supervision, the private system because of its profit motive tries to offer satisfactory service so as to get more customers and enlarge its area of operation. This motive in turn ensures that efficiency is maintained (Omuta, 1988).

This hybrid system though have help Lagos State to drastically reduce the problem of waste generation management and disposal, but operators are still facing serious challenges in the area of inability to acquire the needed modernized plants, equipments and material for effective performance, due to their capital intensive.

2.8 Application of Modern Technological System in Managing and Disposal
According to a study done by Egunjobi (1986), the problem of effective household solid waste management has to do with poor social services delivery efforts which cause unnecessary delays in solid waste clearance. It is either broken down machinery, non-maintenance of dumpsters, poorly maintained urban streets landfills site. Following the modernized technological system of managing and disposal of solid waste in Lagos State the following motorized vehicles are suggested for the Lagos State Government to acquire in

order to maintain the State Mega Status which will also enhance the best practices and enable the state minimize or free from health hazard as a result of managing and disposal of household solid waste.

- Fore-and-aft tipper truck
- Rear-loading hydraulic –computer truck
- Front loader compaction collection vehicle.
- Tilt frame Roll-off Truck (particularly suited in densely populated area with minimal street access or unpaved streets)

2.9 Disposal of Household Solid Waste in Lagos State

Recycling is very popular among developed countries, which have long realized that waste is not necessarily a waste it can be turned into money. Recycling according to (Wikipedia, 2009) report, is in most developing countries, the widespread of collection and reuse of everyday waste material such as empty beverage containers. These are collected and sorted out into common types so that the raw materials can be reprocessed into new products. Sorted waste can do the following:

- It become raw materials
- It can improve physical and environmental health.
- It can provide gainful employment.

Conclusion

Certainly, the hazard associated with the time lag in disposing solid wastes is thus a challenge to all stakeholders, especially public officials who must provide leadership, capacity building and funding or capital formation to facilitate and renew community service to ensure smooth social services delivery to all.

- There must be put in place a concerted approach to waste avoidance, minimization and reduction through modern methods of waste management and disposal using the right mix of strategies sustainable by purchasing of updated equipments there is an urgent need for well trained staff, vehicles, trucks etc as enumerated in the literature.

- It helps in establishing more raw materials for processing in factories.
- It can lead to self-reliance.
- It can help establish recycling plants.

Moreover, Lagos State Government through its Waste Management Authorities (LAWMA) launched waste recycling management initiative when it unveiled two communal waste recycle banks in an effort to deal with over 9,000tons of waste generated daily. The scheme encourage communities in the state to partner with the agency to sort waste in furtherance of its waste to wealth program. This program contributed immensely to the reduction / eradication of hips of waste in Lagos State thereby give way to the state beautification and improved healthy environment the citizens are now being.

- Land fills management and control which could give us waste-to-energy programs to generate methane gas through the land fills.
- The support of private sector and NGO's is also required most especially in the area of organizing maintenance workshops and enlightened program which should include grassroots participation and input.
- There is need for domestic waste incineration plants in each local government/ council areas.
- There should be effective penalties invoked and culprits punished, so that the enforcement of proper practices are not left to area wide waste management authorities alone.

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RELIABILITY STUDY OF SELECTED ELECTRONIC COMPONENTS- A CASE STUDY OF RESISTORS

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Abstract

Instrumentation and control electronics have been established as vital aspects of lots of processes, ranging from manufacturing to regulation for standard as with the Standard Organisation of Nigeria (SON), and the National Agency for Food and Drug Administration and Control (NAFDAC) as well as in oil exploration, transport (road, rail, marine, air) management, technical projects for research and development just to mention a few. Beyond these civil uses of instruments, the military even rely more on control instruments for precision of reliable military operations. Like any electronic gadget, a control electronic instrumentation system, comprising units (e.g. oscillator, amplifier, power supply etc.), is composed of components) like resistors, inductors, capacitors, integrated circuits, thyristors, crystals, inductors, sensors etc. This study investigates the gap between rated and measured values of selected range of components, namely: resistors. A specified variation is expected between the nominal and rated values. This specified deviation is called "tolerance". Every resistor has a specified tolerance range over which the resistance value is allowed to vary; anywhere from approximately 0.1% to 20% of the nominal value. The resistors used for this study, were sourced only from a central location in Lagos (Mushin) South-West Nigeria. Measured values notably vary from the rated values but most variations fall within coded range indicated on the components. The resistors were also tested for reliability in selected circuits. The disparity in values did not significantly affect the circuit performance in the cases examined. Resistors with values above 100 ohms show high difference while those below 100 ohms show minimal error. Components in the category investigated from Mushin may be rated good for instrument maintenance and precision electronic project for students and researchers.

1.0 KEYWORDS:
Control instrumentation, reliability, circuit performance, maintenance.

2.0 Introduction

Resistors come in many sizes, shapes, power ratings and tolerances (Holowitz and Hill, 1997). Some have values stamped on the case, while others have a group of colour bands that allows experts to make out the values. Theses discrete components are devices manufactured specifically to provide a fixed or variable resistance to fit a particular electrical circuit application.The field of electronics is run by devices called components. These components may be active or passive. Resistors, capacitors, inductors, thyristors, transistors, integrated circuits (IC), sensors are examples, just to mention a few. Instruments are electronics systems made of these components. Precisely, any technical system is an assembly of components that are connected together to form a functioning unit (Oluyo et al, 2012). This unit is usually variously called a machine, equipment or instrument. Collection, use, operation or study of instrument is called instrumentation. Instrumentation is central to control systems either in the military or in civilian applications. The focus of this research is resistor- a component which offers opposition to the flow of current (with constant resistance). The resistor is one of the simpler electronic components.

Electronic technology is now dominated by semiconductor devices, which era started in 1947 with Bardeen, Brattain and Shockley (Holowitz and Hill, 1997) of Bells Laboratory as a successor of the vacuum technology. The performance or otherwise of a machine is a function of the state of the composing devices, namely components. If a component does not perform as expected it is said to have failed. Component failure may be gradual, sudden or catastrophic.
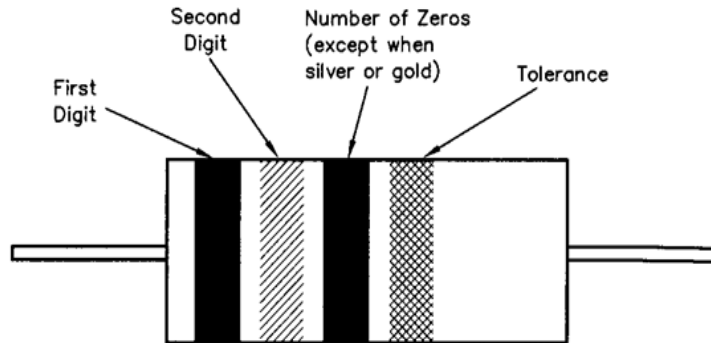

Figure 1: Carbon Film Resistor with Colour Code

The failure of a component (Loveday, 1988) in any equipment thus leads to system failure. Failure is said to be the inability of a system to perform its required function (Aggarwal, 2007). The need for continuous performance of an instrument requires that it is given regular maintenance. The resistor is one of the simpler electronic components. The resistor is hardly suspected during maintenance routines and resistor characteristics may not even be given any attention until there's a resistor-related problem with a circuit design. As a service expert, say engineer or technician, it is pertinent to consider some questions about the resistor prior to fixing a resistor related fault condition(Loveday, 1988). Ask first, what makes a resistor fail? Then, by how much can the resistance vary? Furthermore, ask what magnitude of surge can it withstand? What level of heating is expected in the resistor? A good percentage of resistor related issues may be resolved after answering these five key questions. Empirically, temperature, voltage, resistance, surge are the factors which play very important roles in failure of a resistor.

In order to specify resistors, certain rated parameters have to be indicated. These technical features include resistance value in ohms, power in watts, have rated values

a) **Value:** Resistance (ohm: Ω, k Ω, or m Ω; 1 k Ω = 10^3 Ω, 1 M = 1000 K Ω = 1,000,000Ω): indicated by colour code or written.
b) **Power:** Indicated by the size of the resistor.
c) Tolerance of the resistance: indicated by the colour code.
d) **Features:** Measured resistance corresponds with the indicated value (within the limits of the tolerance).
e) **Faulty:** Open circuit reading
f) Replace with: Resistor with same resistance (identical or better tolerance) same or higher power dissipation.

2.1 RESISTOR FAILURE

Resistor failure (Loveday, 1988)is considered to be electrical opens (open circuit), shorts (short) circuit) or a radical variation from the resistor specifications, (Watkins and Russell, 1984). Recall that components generally may fail gradually, suddenly or catastrophically (Oluyo, et al, 2012). Each of gradual failure, sudden failure or catastrophic failure may be the open circuit, short circuit or radical variation kinds of failure.

2.2 APPLICATIONS

Resistors, especially the general purpose ones, are variously used for impedance matching, loading, biasing, to limit current flow (Holowitz and Hill, 1997) and reduce voltage for many other applications while in the adjustable resistor form is used as volume control as isthe stereo, TV set, transistor or car radio. Two parameters, STOL and voltage stress are considered in this study to explain the behaviour of a given resistor, wire wound, film or composition type, behaviour prior to failure. The composition type are not used in critical applications e.g. on the medical instrumentation in which case a high reliability is a requirement.

2.3 SHORT-TIME-OVERLOAD (STOL)

This is a technical concept that is used to understand a resistor's expected voltage input and this is empirically deduced from the power rating (Watkins and Russell, 1984), which is indicated by the size of the component. STOL is a non-repetitive surge or overload condition. A maximum allowable STOL voltage exists for a given resistor. This is typically two times the maximum continuous rated voltage (V_{RATED}). In practice, ifa resistor is fed two to ten times the rated power for more than 5 or 10 sec, the component may be permanently damaged and can melt the solder joints that hold the part in place. The applied power correlates with operating temperature, which relates to oxidation.

2.4 VOLTAGE STRESS

Voltage stress is a concept that plays a vital role in resistor failure. Normally, this stress comes into play only on resistors with resistance of more than 100 kΩ and voltage of more than 500V. Voltage stress has become a problem if a modest voltage-stress overload results in a negative change in resistance that exceeds the value for the maximum-STOL-percent change!

2.5 INSTRUMENTS PERFORMANCE

Machines at work must be sustained at optimum performance (Aggarwal, 2007). This is impossible if maintenance and repairs become a hard task to achieve. Resistor-related problems come up in circuit designs from time to time. Hence component failure is a commonplace on the field of electronics. A component is said to have failed when it open circuits, short circuits or exhibits radical variation. A component misbehaves in any of the states and it is no longer reliable. However the reliability (Aggarwal, 2007) of an electronic system stems from that of its components. This study sets to investigate how reliable components sourced from a location in Lagos can be when called upon for electronic repairs or component replacement. Maintenance culture is key to any economy as this has a direct bearing on technology dependent systems and organisations. Ohm (1828) propounded a law (Ohm's Law) which relates the current (I), potential difference (V) and the resistance (R) and this is the scientific method by which the behaviour of a resistor is estimated.

3.0 Material and method

Resistors were selected from Mushin market located at Ido Oro, Lagos. South-West, Nigeria. Once mounted, the assumptions are that, the resistors in question have no defects, they perfectly terminate, and attach to the pc board (say) with an ideal solder joint. The first stage used one thousand (1000) selected components (resistors) in four (4) categories with nominal values of

(a) 33Ω, 39 Ω, 56 Ω and 68 Ω.
(b) 160 Ω, 480 Ω and 220 Ω.
(c) 1KΩ (1K0 for short),1K8, 2K2 ,3K3, 3K9 and 4K7.
(d) 10K9, 15K0, 27K0, 30K0, 33K0, 100K0, 560K and 1M Ω.

The nominal (rated) values were determined using resistor colour codes. Using high sensitive test equipment, namely, a professional digital multimeter (previously calibrated for accuracy), each resistor was measured using appropriate meter ranges. Tolerance then estimated! Circuits (shown in Figures2 and 3) were built and selected components were tried as replacements for initial components and circuit performance then studied. A consideration study for precision application outside normal civil use is also included in the analysis to cover the possibility of military engineering application. Recall that such applications (military engineering applications) require high precision for reliable delivery of strategic military services (Oluyo et al, 2012), especially if it concerns warfare and remote sensing or control. Such benchmarks as what is called "Established Reliability" becomes the yard stick to which the components have to conform to.
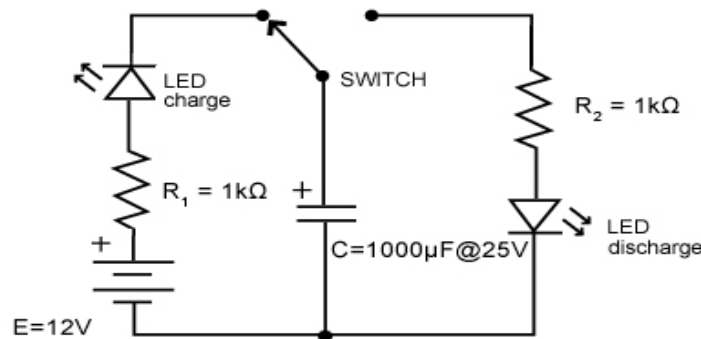

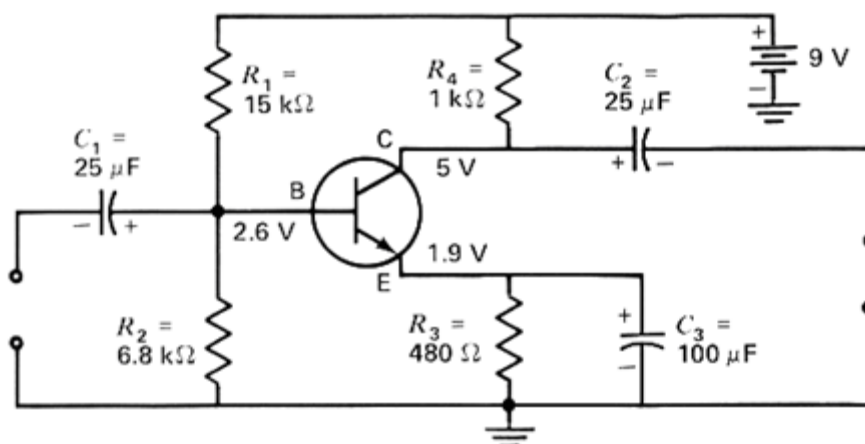**Figure 2: Test Circuit 1-Capacitor charging and discharge circuit.**

Figure 3: Test Circuit 2- Single stage amplifier

4.0   RESULT

We present the results of this study as tables 1 and two. Results of the follow up experiments presented as test circuits 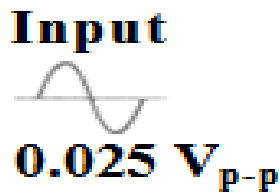(Figures 2 and 3) were monitored using portable digital dual channel oscilloscope with capability to display both input and output simultaneously. We present a replica each of the input and output of test circuit 2 in Figures 4 and 5.

Figure 4: A replica of the input to Test Circuit 2
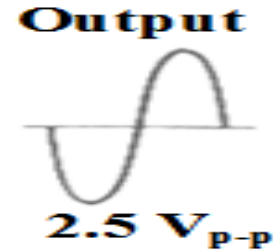
Figure 5: A replica of the output of Test Circuit 2

The summary of the resistance value measurements (measured or nominal value/Ω) and colour coded values (rated value/ Ω) is presented as tables 1 and 2.

Table 1: Results of rated and nominal values of selected resistors

SN	Rated Value/Ω	Measured Value/Ω	Difference/Ω	% Error
1	33	32.5	0.5	1.54
2	39	38.8	0.2	0.52
3	56	54.5	1.5	2.75
4	68	66.5	1.5	2.26
5	160	97.6	**62.4**	x
6	220	213.0	7.0	3.29
7	1000	700.0	**300.0**	x
8	1800	980.0	**820.0**	x
9	2200	2090.0	110.0	5.26
10	3300	3230.0	**70.0**	2.17
11	3900	3800.0	100.0	2.63
12	4700	4300.0	400.0	9.30
13	10000	9910.0	90.0	0.91
14	15000	14820.0	180.0	1.21
15	27000	26200.0	800.0	3.05
16	30000	29400.0	600.0	2.04
17	33000	32400.0	600.0	1.85
18	100000	97700.0	2300.0	2.35
19	560000	545000.0	15000.0	2.75
20	1000000	980000.0	20000.0	2.04

Table 2: Results of rated and nominal values of test resistors ("spurious" values omitted)

SN	Rated Value/Ω	Measured Value/Ω	Difference/Ω	% Error
1	33	32.5	0.5	1.54
2	39	38.8	0.2	0.52
3	56	54.5	1.5	2.75
4	68	66.5	1.5	2.26
5	160	97.6	**62.4**	63.93
6	220	213.0	7.0	3.29
7	1000	700.0	300.0	**64.86**
8	1800	980.0	820.0	**83.67**
9	2200	2090.0	110.0	5.26
10	3300	3230.0	70.0	2.17
11	3900	3800.0	100.0	2.63
12	4700	4300.0	400.0	9.30
13	10000	9910.0	90.0	0.91
14	15000	14820.0	180.0	1.21
15	27000	26200.0	800.0	3.05
16	30000	29400.0	600.0	2.04
17	33000	32400.0	600.0	1.85
18	100000	97700.0	2300.0	2.35
19	560000	545000.0	**15000.0**	2.75
20	1000000	980000.0	**20000.0**	2.04

5.0   Discussion

The result of measurements of resistor values is given in table 1. It is observed that resistor values less than 100 Ω (see serial 1 to 4 on Table 1) show minimal deviation from rated values. The least error is recorded for 39 Ω resistors with a maximum error recorded for 56 Ω.

However a rather erratic deviation is observed for each resistor above 100 Ω except for 220 Ω with a 3.29% error among error values of over 60% in each of 160 Ω, 1 KΩ and 1K8Ω. This rather strange tendency prompted some statistical investigations in which the average error as well as standard deviation was computed for all test resistor categories. The result (12.9Ω ±25.3Ω) shows that the deviation is large with the inclusion of 160 Ω, 1 KΩ and1K8Ω. Table 2 shows the result of Table 1 with the resistor values above 100ohms (shown in red) removed as indicated with x in red (see Table 2 serial 5, 7 and 8) and the result returns a relatively normal error of 2.7Ω ±2.0Ω. The implication of this investigation is that minimal error is expected in a real life application where the resistors (sourced from Mushin, Lagos South West Nigeria) are in use with higher reliability provided resistors of values above 100 Ω (in red) are not included. To this end the Test Circuit 1 involves two (2) 1 KΩ resistors incorporated in a capacitor charge and discharge circuit shown in Figure 2. The result of the empirical investigation was satisfactory as the outcome does not deviate significantly from the expected circuit behavior. But this is not a sensitive or precision circuit, it rather a simple illustration. The foregoing leads to a relatively complex circuit of Test Circuit 2 comprising a 1 KΩ resistor shown in the single stage amplifier circuit of Figure 2 alongside three (3) other resistors (480Ω, 6.8 KΩ and 15 KΩ) carefully selected from the lots. The output was monitored using portable dual channel oscilloscope to enable simultaneous display of both input and output. The gain was monitored and was satisfactory with 98.85% agreement with the expected outcome circuit performance. This translates to acceptable reliability. Note that the entries in serial 19 1nd 20, namely 560 KΩ and 100 KΩ nominal values, recorded rather high numerical differences (hence indicated in red) but statistically bearable errors as these error values (2.75% and 2.04%) are among the acceptable figures being within the 2.7Ω ±2.0Ω range. The difference column (2072Ω ±5364Ω) is greatly influenced by high valued resistor entries of serial 7 through 20 as recorded in Tables 2 and 3.

In a follow up study a number of high precision wire wound resistors were investigated. The resistors are in three categories, namely 0.1 Ω, 0.22Ω and 0.47Ω alongside with a number of 1Ω metal film resistors. Our result shows that only themetal film resistors have their values in ranges defined by the tolerance. The metal film resistors show marked deviations from the rated values. In order to ascertain if the results are consistent with practical reality various digital meters were used in turn to determine their values. The resistors marked 0.1 Ω gave 0.2 Ω, the ones marked 0.22Ω gave 0.4Ω while the ones marked 0.47Ω gave 0.6Ω on average. This goes to suggest that the reliability of this category of components in practical application is questionable.

5.1 Conclusion
Resistor reliability is empirically a function of a number of variables. Certain category of resistors seem to be technically dependable than other categories in terms of rated values. Reliability of a components as empirically determined by a researcher may necessarily be reported with remark on the type of measuring instruments used to ascertain the parameters that led to the reliability figure.

5.2   Recommendation
Copious practical investigation is recommended to establish some findings of this study. The rated values are hereby suggested not to be taken on the face value for practical applications or usage, especially where precision and accuracy are subject of interest.

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TOURISM DEVELOPMENT: A REVOLUTIONALISED SECTOR AS A PANACEA FOR DWINDLING HOSPITALITY BUSINESS IN NIGERIA

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ABSTRACT

Nigerian has abundant tourism components that could make her the leading provider in African. There are numerous attractions ranging from places of natural beauty to cultural and historical heritage. These papers identify the socio economic impact of tourism along the coastline of Lagos. Despite the fact that tourism is important in the development of Lagos, there are still problems encountered at the coastal line of Lagos like over-congestion during the holidays, pollution, solid waste disposal in the water by the residents which causes environmental problem, flooding etc. has constituted a major setback to the development of hospitality thriving business in Lagos State. The empirical part of this research work is the use of qualitative research method which include questionnaire, interviews and other observations.384 well-structured and validated questionnaires were distributed to the respondents out of which 375 were retrieved. The data collected from the respondents were analysed using Statistical Package for Social Science (SPSS). The result from the study reveals that a revolutionized tourism industry is a remedy for a thriving hospitality business in Lagos State (p < 0.001). The study recommends that government should pay adequate attention to coastal tourism as this will generate more revenue to the state through a thriving hospitality business.

KEYWORDS: Tourism, Hospitality, Panacea, Business, Revolutionalise, Job opportunity

Introduction

Tourism development is an element of economic growth that involves enlarging the ownership base such as people benefiting from the tourism industry through job procurement, skills development business and wealth creation and ensuring the geographical spread of tourism business all over the given destination. A very good and easy example of tourism development is the right to host a soccer event such as the "world cup". Tourism definitely takes place in such a country because many people coming from across the world to witness the event gives the host country advantage to open tourism businesses such as hotels, restaurants, car rentals, parks and all other businesses for the purpose of the visitors. For instance, the "BRAZIL 2014 world cup" hosted by Brazil was a revolutionized tourism sector which produced thriving hospitality business because people that came from all over the world to witness the event thereby generating revenue from tourism and hospitality business in the host country.

In 2006, the Nigerian Government instituted a new set of reforms in the tourism industry with the aid of the United Nations Development. This led to the creation of the "Nigeria Tourism Master Plan". The report identified amongst other things that the number of international visitors to Nigeria had been static over the last 15 years because of factors like stodgy entry visa processes, lack of information on Nigeria amongst tour operators in the west, bad road networks, and the dilapidated state of many of Nigeria's historic sites. Shamefully. Six years after the master plan had been drawn, the commentary on tourism industry will probably be worse. Though there has been a major influx of global hotel brands into Nigeria in the five

years, especially Lagos, the commercial capital of Nigeria, the average cost of these rooms puts it out of reach of the average holiday maker from Europe and America especially in these hard times. The tourism master plan advocated for partnership programs between the internationally operated hotels in Nigeria and tour operators in the west to use spare capacity in these hotels at favourable rates. Five years after, the tourism and hospitality industry still represents a meagre 0.5% of Nigeria's GDP.

As a matter of fact, tourism is developing at a faster rate globally and more countries are getting awareness about the need to develop tourism for socio-economic advantages. According to the United Nation World Tourism Organization (2006), tourism has grown in terms of destinations as there has been a widespread increase in the geographical expansion of tourism throughout the globe which has made it possible for many developing countries to develop tourism at their own pace for socio-economic advancement. However, it is a general phenomenon that tourism has a vital impact on the society, topography, environment and socio- economic aspect of any country. In the social terms, the immediate benefit of tourism industry is the ability to bring people out of the unemployment circle. In other words, it creates job opportunity and also caters for both skilled and unskilled employment and it is known to be a labour-intensive industry which provides job per unit of investment compared to any other industry. The industry gives room to partnership and entrepreneurship within the tourism business concept thereby creating an innovation and bringing about economic activity (Morrison, Rimmington and Williams, 1999).

Despite the fact that tourism is important today in the nation, the problem associated with Coastal tourism is quite enormous. In that case such problems are perceptive at the coastal line of Lagos. Being the industrial capital of Nigeria, Lagos has attracted millions of people to the area for business, leisure and other purposes. This resulted to the coastline being over congested during the holidays. The infrastructural facilities such as good road network and parking space are not enough to meet the demand of the Coastal region. The problem of pollution is one of the vital issues in contention. The Solid waste disposal in the water by the residents and visitors has posed potential environmental problem in the area and made the coastal region unattractive. Government is not paying adequate attention to coastal tourism and this contribute a major setback to the development of tourism along the coastal line of Lagos.

The idea of developing tourism in a particular area is encouraged by steady improvement in the creation of social amenities and basic infrastructures in the area in question. These creations, coupled with attraction in the destination bring about the development of tourism in the area. The idea of using infrastructure to develop tourism in a destination happened to be something of a gradual process. The physical improvement in the destinations' infrastructure would help to improve socio-economic relations among the local people. Community was revealed to be the major factor to modern tourism (Godfrey and Clarke, 2000).

In other words, communities were the basic element in the supply of accommodation, catering, information, transport facilities and service. As the interaction goes on, and the level of inflow of tourists continue to be on the increase, coupled with the fact that infrastructure is in place, the local people would start to bring up ideas of setting up hospitality businesses such as hotels, restaurants and the likes. Then, the destination becomes popular giving room to more tourism businesses which in turn encourages tourists to the area. As the process of tourism development continues, as a matter of fact, government and cooperate bodies would start to pick interest in the areas thereby investing a huge amount of money to maintain, sustain and retain the destination as a major tourist region (Godfrey and Clarke, 2009). This among others would lead to the creation of civic centre, parks, street improvement, good road networks and other facilities that will enable the area to be totally tagged as a tourist

destination region. The increase in all these facilities provides opportunities for even a small city to develop as a tourist destination. The following sub-headings explain tourism planning and tourism marketing as some of the major evidence towards enhancing tourism development.

Tourism in a revolutionized sector as panacea for thriving hospitality business development cannot be discussed without taking into consideration the planning of tourism. Tourism planning has recently been acknowledged from three different levels, namely the national, local and personal attractions. The central government coordinates and manages the tourist regions in the whole country, possibly through policy development, national standard and institutions. Also, it involves the developing and planning of individual tourist attractions, services and facilities to serve the tourists' need. At the local level, it equally involved the planning and management of tourist destination area and these factors are equally important to that of the national level (Godfrey and Clarke, 2009). Apart from that, the local government also involve themselves in the organization and development of visitors' attractions and services in and around destination regions. These regions are the basic element of tourism. They are the major point for the supply of tourism services such as accommodation, catering, tourist information, transportation and all other tourist services. These services are the reasons why national and local government focused attention on them in order to establish a maintainable tourism destination.

Five years after the tourism and hospitality industry still represents a meager 0.5% of Nigeria GDP.

The destination regions must have many values ranging from cultural, historical and even environmental in which it is necessary to be maintained in order to attract tourists. The majority of tourists are concerned about the destination in which they will spend their holiday. So, the natural environment of the host regions, their buildings and tourist institutions, their people, culture and history and other forms of tourist elements are what the tourists wanted to experience in the destination. (George, Mair and Reid, 2009)

The growth in tourism industry can also be attributed to the increase in tourism marketing. Tourism marketing is the method of applying the correct marketing concepts and ideology to planning a strategy to attract tourists to particular destinations which may come in form of resort, city, region or country. Marketing is a process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and services to create exchanges that will satisfy' individual and organizational goals. Referring to the definition in the concept of tourism marketing, it revolves around planning for tourism from the demand and supply concept in order to satisfy both the host communities (suppliers of tourism) and the visitors (Godfrey & Clarke, 2000). Marketing is a process of identifying customer's satisfaction, design appropriate product and design a market to convey it to the final consumer (Pierre, 2000). It can also be a way of executing the conception, pricing, promotion and distribution of ideas, goods and services to create an exchange that satisfied individual and organizational goals. Referring the definition in the concept of tourism marketing, it revolves around planning for tourism from the demand and supply concept in order to satisfy both the visitors and the communities (Kotler, 2006). The application of marketing in tourism industry is an equal focus on the "four Ps" (Product, Place, Price and Promotion). Product: the destination or region as a product can only be consumed by travelling to that region. Equivalently, the product is also the place and each tourist can consume or buy the product/place at different prices (Kotler. 2006). As a matter of fact, when marketing a city, price is the least of focus. This is because it discourages some tourists whose intention is to have fun without paying anything. Promotion is an awareness created by media and other advertising agents for the events. The promotion of socio-economic expansion by tourism was driven by the fact that, as an export industry, it encourages new spending within the local or

host communities. This spending creates job opportunities, socio-cultural interaction, pride and appreciation, understanding and respect, and even tolerance for each other's culture and norms (Kotler, 2006). In addition to the socio-economic benefits, tourism development tends to appreciate local cultures, promote solidarity from cultural exchange give rooms for comprehendible feelings of both the host communities and the tourists (Kotler, 2006).

However, based on the increase in tourism awareness all over the world, it has been a general notice that social and economic tourism play a vital role in the sustainability of the global tourism. While social tourism explains how satisfied a tourist is at any destination, economic tourism modifies the financial affordability of the situation. Therefore, social and economic tourism are directly the pillars of sustaining tourism in the world.

Tourism is a social vice that is established by the participating individuals either as travelers, hosts or employees. There is a growing effort of local communities to promote and improve social tourism. Destination regions are trying to attract the interest of visitors with their cultural heritage, natural beauty, norms and values and their contribution toward protecting biodiversity. Social tourism is a tourism initiatives comprise of programmes and projects aim at ensuring the right to holiday and access to tourism to all population groups, including poor children, low-income earners and individuals with limited capacities (Minnaert, Maitland& Miller, 2010). From that point of view, social tourism is for everyone in as much as there is an intention to travel. Social tourism is an interface for social and cultural exchange (Barkin, 2009). It facilitates the interaction between communities and tourists both on domestic and international level. Tourists want to interact with other cultures, want to learn more about their values, learn about traditions and even confront themselves with a new way of life and society. It has been revealed from research that travel is a means of discovering those things unknown or forgotten within oneself. Social tourism is

indeed an experience driven industry and local culture is a unique experience.

Moreover, local personality and hospitality bring about what tourists regard as built attractions whereby the more one learns about a particular destination, the more fulfilling the travel experience will be. Social tourism is an element for raising a social awareness, in the sense of creating awareness on local issues and needs thereby booming regional identity both nationally and globally. The globe is creating an investment trend towards interpreting natural and cultural resources. The attraction to natural and heritage values helps to generate revenue and provide opportunities to effect management in the sensitive and vital destinations. However, socio-cultural values of the destination that create attraction are not the only drive for attractions, but provide one of many experiences. In that case, social tourism is a factor for tourism development in any given destination region (Barkin, 2009).

Issues that must be addressed by Nigeria in meeting the challenges of climate change and to promote sustainable tourism development include the following:

- Lack of adequate political will to legislate and regulate human activities related to climate change, the environment and the tourism industry at large.
- Lack of adequate funding to address desertification and de-forestation in affected areas.
- Lack of rain causing drought and death of wildlife that in turn is resulting in the encroachment of herdsmen into game reserves and national parks.
- Flooding that is eroding road networks, and negatively affecting wild life and human socio-economic activities as experienced in Kano, Jigawa, Taraba, Nasarawa and Sokoto States.
- Mining activities and the emission of radioactive gases at the Jos, Plateau, Jagindi, Kaduna, Nasarawa, Eggon/Keana Nassarwa, Nkalagu, Enugu and Zamfara States.
- The dumping of toxic waste in Nigeria's sea ports and industrial cities including Lagos, Port Harcourt, Kano, Onitsha, Kaduna and

other capital towns. These have resulted in mysterious ailments proving difficult to cure.

- Business travel and movements by air and land emit high levels of carbons through aircrafts and automobiles.
- Tourist flows to Nigeria for ecotourism, safari and related activities is negligible compared to business travel.
- Nigeria's industrial cities such as Lagos, Kano, Ibadan. Aba, Onitsha, Port Harcourt and the cosmopolitan cities of Sokoto, Maiduguri, Lafia that utilize automobiles to the fullest constitute much of the air/smoke pollution.
- Insecurity through the activities of restive youth such as the Niger Delta Militants in the South-South and the Boko Haram Sect in the northern parts of Nigeria threatens the inflow of tourists.

Nigeria is blessed with rich and abundant natural resources that are mostly untapped. These can be seen from the rich coastal mangrove and rainforest to the savannah regions. There are also opportunities that abound in government efforts in the promotion of tourism at both domestic and international levels. Some of both the public and private sectors initiatives are as follows:

- The environmental and tourism policies of Nigeria give priority to ensuring environmental sustainability of the tourism resources.
- The establishment of the Climate Change Unit under the Federal Ministry of Environment at the federal level that oversees and regulates all industrial and rural development.
- Federal Ministry of Tourism and Culture that promotes the utilization of environmental resources for ecotourism.
- Federal Ministry of Agriculture and Forestry implementing reforestation and agricultural management programs, as well as park forestry reserve activities.
- Ecology funds being made available to States in billions of Naira on a yearly basis to combat erosion, desert encroachment, gullies, petroleum oil spills, etc.

- The World Wildlife Conservation Federation with their activities in the forest reserves and national parks.
- National Conservation Societies are in all States of the Federation coordinating environmental activities.

This study undertook to show that a revolution of the tourism industry would drastically lead to the growth of the hospitality business. Among the Specific Objectives are pursued were to promote tourism development in Nigeria and to assess the remedies of a change in the tourism sector in the hospitality industry, explore in details, the trends which impact both the hospitality industry as well as the tourism industry that makes up a wider travel experience and to carve out socio-economic roles for tourism providers and assess the socio-economic contribution of tourism development on the host community and to recommend a way forward towards the enhancement of coastal tourism in Nigeria.

Materials and Methods
The study explored conceptual, descriptive and review method of research paradigms in order to explore the objectives in the context of tourism as a panacea for a thriving hospitality industry. The research design was a sample survey, and the data were collected through observations, interviews and well-structured questionnaire. The questions were arranged round the objective with a focus on the research questions. Practitioners in the industry (384) were purposively selected from Lagos environment and interviewed employing the questionnaire designed for the purpose. The paper also draws largely on the use of post research findings and many academic literatures such as
(George, Mair and Rod, 2009), etc. The data obtained from the questionnaires were analysed with SPSS 20 using frequency distributions alone.
Results
The findings from the respondents about the revolution of the tourism industry being a remedy for a thriving hospitality business were analysed as follows. The gender analysis

indicated that majority of the respondent (78%) were females. The highest proportions of respondents (0.67) were between the age group of 21 and 30 years. This age range represents the individuals that are between the beginning of their career and mid stage of their career and so are financially stable. The occupational analysis indicates that the highest proportions of the respondents (53.3%) are civil servants and have good knowledge of the tourism industry. This may be because this category of individuals were elites and appreciate the significance of tourism.

Table 1: Frequency distribution of responses from practitioners

Issue	Agree /Strongly Agree (%)	Indifferent (%)	Disagree/ Strongly Disagree (%)
The availability of tourism enterprise creating job opportunities for the host communities	311 (83)	15 (4)	49 (13)
The presence of more hospitality business is a product of a revolutionized tourism sector	334 (89)	10 (2.7)	31 (8.3)
Hospitality and tourism industry are directly interdependent	263 (70)	24 (6.5)	88 (23.5)
A change in the tourism sector would have a positive or negative effect on the hospitality industry	319 (85)	11 (3)	45 (12)

A total of three hundred and eighty four questionnaires were distributed to the respondents and only 375 were retrieved. 311(83%) of the respondents agreed or strongly agreed on the availability of tourism enterprise creating job opportunities for the host communities, 15 (4%) were indifferent while 49(13%) disagreed or strongly disagreed. Also, 334 (89%) of the respondents also agreed or strongly agreed that the presence of more hospitality business is a product of a revolutionized tourism sector while 31(8.3%) disagreed or disagreed with the view and 10 (2.7%) were indifferent. Furthermore, 263(70%) of the respondents strongly agreed or agreed that hospitality and tourism industry are directly interdependent while 88(23.5%) disagreed or strongly disagreed to the proposition and 24 (6.5%) expressed no opinion. Lastly, 319 (85%) of the respondents agreed or strongly agreed that a change in the tourism sector would have a positive or negative effect on the hospitality industry, 11(3%) were indifferent, and 45(12%) totally disagreed or strongly agreed with that. Hence, majority of the respondents are positively disposed to the question asked and believed that the presence of more hospitality business is a product of a revolution of the tourism sector ($p < 0.001$).

Discussion

The research examined how a revolution of the tourism industry would be a remedy for a thriving hospitality business.
The research also showed that the recent tourism development in Nigeria has drastically reduced social unrest i.e. the establishment of tourism businesses such as hotels and restaurants which in turn employed the majority of the youth in the area helped in curbing the social evils (Godfrey & Clarke, 2000; Minnaert, Maitland& Miller, 2010).
The interviews were very intensive and non-biased and all the respondents have a broad knowledge about the interview themes and concepts. The reliability was further

reinforced by accurate personal observation combined with the raw information gathered from the interviews. Furthermore, most of the respondents were tourism experts who have spent some years in active tourism, hospitality and environmental research which directly indicate that information gathered from them are highly reliable, credible and dependable. Majority of the respondents have positive responses relating to the questions asked and believe that the presence of more hospitality business is a product of a revolution of the tourism sector (see table above).

According to the Tourism Master plan, while the incidence of domestic leisure travel may be low, the sheer size of Nigeria's population means that there is a significant contribution to the demand of tourism services from domestic travel activity. The revenue value of this impact is unknown but the sheer number

of Nigerians who travel to Ghana alone for Easter and Christmas holidays is a pointer to the lost income from domestic tourism agreeing with Kotler (2006). Holiday destinations like Cross River and states with slave routes need to do more to attract domestic holiday makers by increasing scale

which will serve to lower cost in the long run and increasing investments in recreational infrastructure. Government spending on travel has also helped to promote the hospitality sector.

There are prospects for a thriving hospitality business and a revolutionized tourism industry. However, the Nigerian tourism industry has to be well developed for it to be a panacea for a thriving hospitality business:

- The way to increase tourism traffic in Nigeria is to promote and deepen domestic tourism.

- Another way to cause a revolution of the tourism industry is to encourage members of the Nigerian diaspora back home for their holidays. This would cause a boom in the hospitality business.

- Tourism resources in Nigeria should be properly managed and sustained in other to meet the standard of the western world, and for that reason attract resident tourists as well as foreigners. Once they are attracted, they will require some of the services provided by the hospitality industry which would result in a thriving hospitality business.

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PHYTOCHEMICAL AND GCMS ANALYSES OF MEDICINAL PROPERTIES OF ETHANOL EXTRACT OF *Gossypium barbadense* LEAVES

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ABSTRACT

Medicinal plants are sources of important therapeutic aids for alleviating human ailments. The traditional use of medicinal plants leaf extract for diseases is quite common in developing countries like Nigeria. This research work is carried out to analyze major bioactive compounds present in the leaf extract of *Gossypium barbadense*. The Phytochemical analysis carried out indicated the presence of Terpenoids, Steroids, Saponins, Cardiac Glycosides and Flavanoids while the Gas Chromatography-Mass Spectrometer Analysis indicated twenty-eight compounds which possess many biological properties among which are Squalene(4.43%), Phytol(17.38%) and 9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z) (13.34%). The presence of some of these constituents in the plant extract may be responsible for the antimicrobial, anti-tumor, and antioxidant properties of the leaf. Therefore, the leaf is a good source of active phytochemicals and can be used for clinical trials which may produce positive results in future.

Key words: Medicinal Anti-microbial
Gossypium barbadense
Phytotherapy

INTRODUCTION

Traditional medicine is "the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, used in the maintenance of health and in the prevention, diagnosis, improvement

or treatment of physical and mental illness" (WHO, 2010). There are many different systems of traditional medicine, and the philosophy and practices of each are influenced by the prevailing conditions, environment, and geographic area within which it first evolved (WHO, 2005), however, a common philosophy is a holistic approach to life, equilibrium of the mind, body, and the environment, and an emphasis on health rather than on disease. Generally, the focus is on the overall condition of the individual, rather than on the particular ailment or disease from which the patient is suffering, and the use of herbs is a core part of all systems of traditional medicine. (Engebretson 2002; Conboy *et al*. 2007),

Over the past 100 years, the development and mass production of chemically synthesized drugs have revolutionized health care in most parts of the word. However, large sections of the population in developing countries still rely on traditional practitioners and herbal medicines for their primary care. In Africa up to 90% and in India 70% of the population depend on traditional medicine to help meet their health care needs. In China, traditional medicine accounts for around 40% of all health care delivered and more than 90% of general hospitals in China have units for traditional medicine (WHO, 2005).

Gossypium barbadense commonly called Cotton is the most important group of fibre plants in the world. The main fibres of cotton

plants are the longer seed hairs ('lint'), used for making yarn to be woven into textile fabrics, alone or in combination with other plant, animal or synthetic fibres. Cotton lint is also made into other products including sewing thread, cordage and fishing nets. The lint of *Gossypium barbadense* is especially valued for use in high-quality textiles, luxury fabrics, yarns and sewing thread. (Todou and Konsala, 2011).

Gossypium barbadense is widely used in African traditional medicine. In West Africa countries like Nigeria, Côte d'Ivoire, Senegal and Benin a leaf infusion is used as eyewash for the treatment of eye affections and wound dressing. In Mali the leaf juice diluted with water is used as eye drops for the treatment of conjunctivitis. The leaf juice is taken for the treatment of cough, dystocia and vertigo, and a decoction of the leaves with those of *Pergularia daemia*is taken against convulsions. In Cameroon a leaf decoction is taken for the treatment of jaundice, pounded leaves are used in poultices against stomach-ache and constipation, and seed oil is used against otitis. In Gabon, the leaf maceration is taken against gonorrhoea and as an emetic, while the sap is considered emollient and externally applied against itch. In Congo the leaf sap is instilled in the ear for the treatment of otitis, leaf decoctions are drunk against cough, the leaf is rubbed on the body to cure scabies. The leaf infusion is usually drunk for the treatment of colds, bronchitis, rheumatism and haemorrhoids. It is also kept in the mouth to treat dental caries and gingivitis. Pounded leaves are applied on cuts, abscesses and used for the treatment of leprosy. Pulped young shoots are used against palpitations, and the fibre in dressings on wounds. In Kenya the lint is used as dressing on sores. (Todou and Konsala, 2011).

In recent times, there has been an urgent need to develop safer and less expensive drugs for the treatment of various ailments. Hence, there is a growing interest in the pharmacological evaluation of various plants used in traditional systems of medicine. This research work is therefore carried out to elucidate the chemical composition of *Gossypium barbadense* to reveal its therapeutic properties which can be utilized in the development of modern drugs.

MATERIALS AND METHODS

Fresh leaves of *Gossypium barbadense* obtained from owu-ikija area in ogun state, Nigeria were cut and washed with water to remove all contaminants after being identified and authenticated at the department of Plant Science and Animal Physiology, Olabisi Onabanjo University, Ogun State. They were air dried under room temperature and ground to powder. The powdered leaves were extracted with ethanol using soxhlet extractor.

Phytochemical Screening:

Phytochemical compositions of the leaves were determined using the methods variously described by Trease and Evans (1996) and Sofowora (1993).

Gas Chromatography Mass Spectrometer (GC-MS) Analysis.

The plant powder was extracted with ethanol and analyzed using GC-MS analyzer. The data were obtained on an Elite-1(100% Dimethyl poly siloxane) column (300.25mm 1umdf). Helium (99.999%) was used as the carrier gas with flow rate of 1ml/min in split mode (10:1). An aliquot of 2ul of ethanol solution of sample was injected into the column with the injector temperature at 250° C.GC oven temperature stared at 110^oC and holding for 2mins and it was raised to 200^oC at

the rate of 10oc/min, without holding. Holding was allowed at 280^oc for 9mins with program rate of 5oc/min. The injector and detector was temperature was set at 250^oc and 280^oc respectively. Ion source temperature was maintained at 200^oc. The mass spectrum of compounds in sample was obtained by electron ionization at 70ev and the detector was operate in scan mode from 45-

459amu (atomic mass units). A scan interval of 0.5seconds and fragment from 45to 450 Da was aintained. The total running time was 27 minutes.

RESULT AND DISCUSSION

Table 1: Phytochemical Analysis of the ethanolic Extract of *Gossypium barbadense* Leaves

Tannins	–
Saponins	+
Flavonoid	+
Alkaloids	–
Steroids	+
Glycosides	–
Cardiac glycoside	+
Terpenoids	+

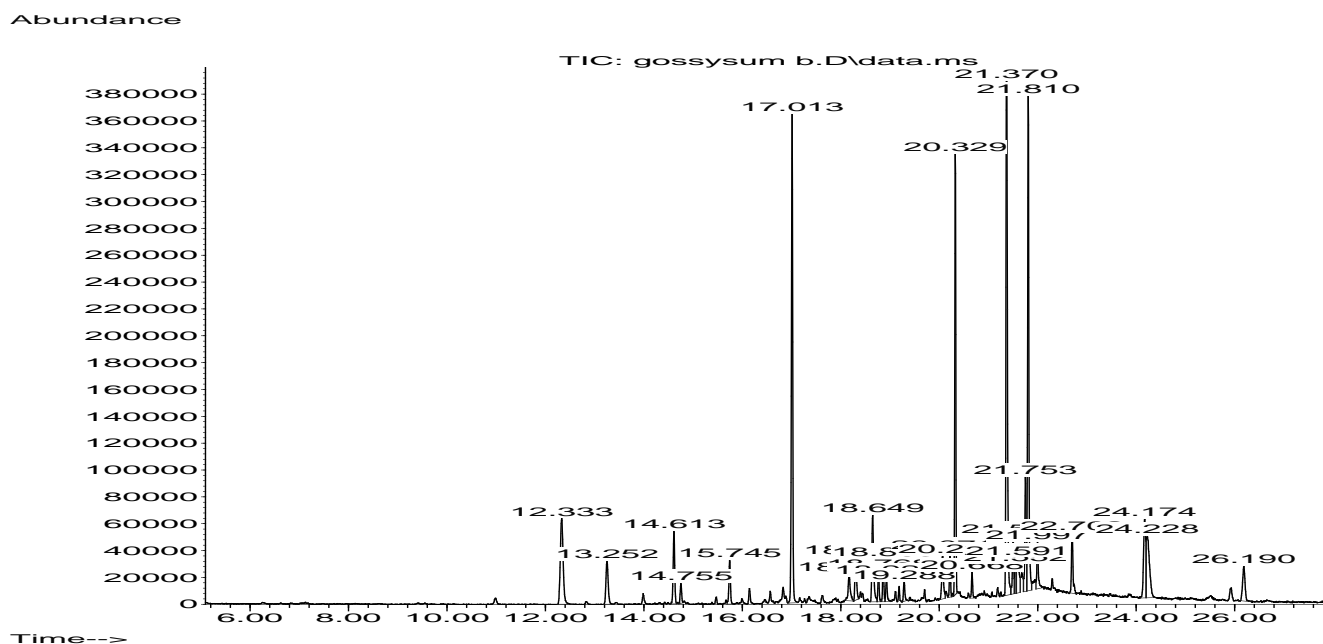Key.   + present   - Absent

Figure 1: GC-MS Spectra of ethanolic extract *Gossypium barbadense*

The spectra of the Gas chromatography-mass spectroscopy analysis of the ethanolic extract of *Gossypium barbadense* leaves is as shown in figure 1 above. Twenty five bioactive compounds were identified in ethanolic extract of *Gossypium barbadense* leaves**.** The identification of these compounds is based on the Peak Area (%), Retention time (RT), Molecular weight (MW), Molecular formular. The highest peak area(%) of 17.38 was obtained by Phytol with Retention time 21.372 and Lowest peak area (%) of 0.61 was obtained by Tetradecyl-Oxirane with Retention time 19.289.

Table 2: **Phytochemical component identified in the ethanolic leaf extract of Gossypium barbadense by GC-MS**

S/N	RT	Name of Compound	Molecular Formular	MW	Peak Area %
1	12.331	1,7-Octadiene, 2,7-dimethyl-3,6-bis(methylene)-	$C_{12}H_{18}$	162.27	5.23
2	13.252	.alpha.-Caryophyllene	$C_{15}H_{24}$	204.35	2.08
3	14.614	(Z,Z)-.alpha.-Farnesene	$C_{15}H_{24}$	204.35	2.44
4	14.757	Benzene, 1,4-diethyl	$C_{10}H_{14}$	134.22	0.61
5	15.747	1,3,6-Octatriene, 3,7-dimethyl-, (Z)-	$C_{10}H_{16}$	136.23	1.45
6	17.011	Bicyclo[3.1.1]hept-2-ene,2,6dimethyl-6-(4-methyl-3-pentenyl)-	$C_{15}H_{24}$	204.35	13.70
7	18.173	Cyclopentene, 1-(1-methylethyl)-	C_8H_{14}	110.19	1.25
8	18.305	3-Decen-2-one,3-methyl-	$C_{11}H_{20}O$	168.28	1.54
9	18.648	1,1,3-Trimethyl-1-silacyclo-3-pentene $C_7H_{14}Si$		126.27	3.29
10	18.768	1,1,1,5,7,7,7-Heptamethyl-3,3-bis(trimethylsiloxy)tetrasiloxane	$C_{13}H_{40}O_5Si_6$	444.97	0.83
11	18.865	Bicyclo[3.1.1]heptane, 2,6,6-trimethyl-	$C_{10}H_{18}$	138.25	1.08
12	18.928	Oxirane,[(hexadecyloxy)methyl]-	$C_{19}H_{38}O_2$	298.00	0.77
13	19.289	Oxirane, tetradecyl-	$C_{16}H_{32}O$	240.42	0.61
14	20.073	Phthalic acid, 5-methylhex-2-yl heptadecyl ester	$C_{32}H_{54}O_4$	502.77	1.71
15	20.221	3-Isopropoxy-1,1,1,7,7,7-hexamethyl tris(trimethylsiloxy)tetra siloxane	$C_{18}H_{52}O_7Si_7$	577.20	1.04
16	20.330	Hexadecanoic acid, ethyl ester	$C_{18}H_{36}O_2$	286.00	10.01
17	20.668	1,6,10,14-Hexadecatetraen-3-ol, 3, 7,11,15-tetramethyl-, (E,E)- $C_{20}H_{34}O$		290.48	0.69
18	21.372	Phytol	$C_{20}H_{40}O$	296.00	17.38
19	21.503	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetra siloxane	$C_{18}H_{52}O_7Si_7$	577.00	1.68
20	21.555	1-Tetradecyne	$C_{14}H_{28}$	196.00	0.87

21	21.589	1-Methyl-2-methylenecyclohexane	C_8H_{14}	110.00	1.90
22	21.755	9,12-Octadecadienoic acid, methyl ester,(E,E)-	$C_{19}H_{34}O_2$	294.00	3.14
23	21.812	9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)-	$C_{19}H_{32}O_2$	292.46	13.34
24	21.995	Octadecanoic acid, ethyl ester	$C_{20}H_{40}O_2$	312.53	1.49
25	24.227	Squalene	$C_{30}H_{50}$	410.00	4.43

DISCUSSION

Plants have provided mankind a large variety of potent drugs to alleviate suffering from diseases in spite of spectacular advances in synthetic drugs in recent years; some of the drugs of plant origin have still retained their importance.

The results obtained for the phytochemicals screening and the Gas chromatography- Mass spectrometer analysis of *Gossypium barbadense* are depicted in table 1 and table 2 above. The result obtained from the phytochemical screening shows the presence of Saponins, Flavonoid, Steroids, Cardiac Glycosides, and Terpenoids while the GC-MS analysis revealed the presence of twenty-five compounds which possess many bioactive properties. Phytol which is the major constituent among the twenty-eight compounds of this present possess some medicinal properties. Okiei *et al*., (2009); Kumar and Basu (1994) have suggested that phytol would be effective as an anti-inflammatory agent in such parts of the human anatomy. A concluding remark in the study states that reactive oxygen species-promoting substances such as phytol constitute a promising novel class of pharmaceuticals for the treatment of rheumatoid arthritis and possibly other chronic inflammatory diseases. It is therefore possible to infer that phytol and its isomers maybe the therapeutic constituent in the essential oil useful for the management of asthma.

Hexadanoic acid, ethyl ester, 9,12,15-Octadecatrienoic acid, methyl ester, Squalene,1-tetradecyne, 1-Methyl-2-methylenecyclohexane, Bicyclo[3.1.1]heptane, 2,6,6-trimethyl have been reported effective as an anti inflammatory, antioxidant, antibacterial, anti tumor, cancer preventive, hepatoprotective, nematicide, insectifuge, antihistaminic, antieczemic, antiacne, antiandrogenic and antiarthritic. (Devi and Muthu, 2014; Banu and Nagarajan, 2013).

During the past few years, squalene was found by some Researchers to have shownantioxidant and protective activities against several carcinogens. (Gunes ,2013; Kelly 1999)

Experimental studies have shown that squalene can effectively be utilized in cosmetics dermatology. (Zih-Rou *et al*., 2009).

In conclusion, ethanolic extract of *G.barbadense* leaves can be useful medically as an anti-inflammatory, antiezemic, anti tumor and cancer preventive agent. Therefore, leaves of *Gossypium barbadense* are good source of active phytochemicals and can be employed for clinical trials which may generate successful results in future

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