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ANALYSIS OF FOREIGN PARTICIPATION IN THE SHARE CAPITAL OF COMPANIES FROM THE COUNTIES OF NORTH-WEST REGION OF ROMANIA

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Abstract: Foreign investments represent a well known topic in the literature which has resulted from their economic, financial, technological, managerial and social contribution at the national and regional level of the receptive country. North-West region is part of the richer and more developed regions of Romania. Based on the statistical data provided by NTRO (2018, p.24), North-West region of Romania is ranked on the third position by the number of companies with foreign participation in the share capital and on the fourth position in terms of the value of the total subscribed capital in companies with foreign participation. The main objective of our study is to analyze the distribution of the number of registered companies with foreign participation in the share capital between the counties of North-West region of Romania and also to analyze the evolution of the value of subscribed capital in companies with foreign participation in the share capital within the counties of this region. We also analyzed the evolution of some selected indicators that we consider relevant for assessing the level of economic development of the counties located in North-West region of Romania. After pointing out the existing disparities in the level of development of the region's counties, an important finding of our study is that there are major intra-regional disparities regarding both the value of subscribed capital and the number of registered companies with foreign participation in the share capital. There is a clear separation between the counties Clui, Bihor and the rest of the region's counties. Between 1991 and 2017, Clui and Bihor counties attracted the largest number of foreign investors and recorded the highest values of the total subscribed capital in companies with foreign participation. At the opposite pole there are Bistrita-Năsăud and Sălaj counties. This paper also provides a ranking of North-West region's counties according to the two aspects regarding foreign participation. subject to analysis, i.e. the number of registered companies with foreign participation in the share capital and the value of subscribed capital.

Keywords: foreign subscribed capital, companies, Romania, North-West region of development, counties.

JEL classification: F21.

1. Aims and theoretical framework

Foreign investments represent a wellknown topic in the literature which has resulted from their economic, financial, technological, managerial and social contribution at the national and regional level of the receptive country. Due to the importance and positive effects of foreign investments, especially in the countries and regions engaged in the process of catching up the most developed economies, many researches have been conducted on this topic. Studies were carried out on the country level-basis but also on a regional-level basis. Otherwise, Sethi et al. (2003) stated that multinational enterprises often evaluate prospective FDI destinations at the regional level, rather than on a single-country basis.

There are a number of studies that found that FDI stimulate economic growth in the host country (Chan et al., 2014; Iamsiraro and Ulubaşoğlu, 2015; Pegkas, 2015). Alfaro et al. (2010) stated that FDI determines growth especially in the case of financially developed economies and, to a lesser extent, in under-developed ones. On the other hand, Carkovic and Levine (2002) found that FDI inflows have no influence on economic growth. Kapustina, Lipkova and Falchenko (2016) also found that FDI's impact on economic growth in the Sverdlovsk region and in the Russia is weak. Instead, they found that the most important factor that has a positive influence on the growth of gross regional product and gross domestic product is represented by domestic investment in fixed assets.

Kandogan (2012), referring to USA regions (states), revealed that FDI location at regional level is driven by strategic determinants such as search for market, efficiency, and to a lesser extent, by strategic assets, and that the most important factor is the agglomeration economies.

In China's case, Ouyang and Fu (2012), based on data regarding 277 Chinese cities over the period of 1996–2004, found that inter-regional spillovers from FDI concentrated in coastal cities of China are significant and have a positive effect on the growth of inland cities. Xu and Sheng (2012) revealed that China faces significant positive spillovers of FDI that are likely to be regional, so domestic firms benefit more from the presence of foreign firms in the same sector within the same region. Lessmann (2013) wrote about the fact that, in China, FDI has increased regional inequalities after the economic reforms in the 1980s, but, through the government intervention, the effect has vanished since the end of the 1990s. This finding is supported by Huang and Wei (2016) who found that the eastern (coastal) region dominates with regard of FDI, but the relative gap between this region and the rest of China is diminishing. Clusters of FDI spread from eastern region to central and western showing the trend of FDI convergence among regions. Using data on 244 Chinese cities for the period from 2004 to 2011, Wang, Ning and Zhang (2017) empirically showed that FDI spillovers have a positive effect on local technological upgrading in local and neighbouring cities.

Fallon and Cook (2010) found that, in UK, regional and national (not EU-level) factors, related to different strategic determinants, help determine the regional distribution of FDI inflows, and its inter-regional variation.

Using a data set of regional inequalities covering 55 countries with different stages of development, Lessmann (2013) found that FDI inflows increase regional inequality in low and middle income countries but not in high income economies. Maza and Villaverde (2015) proposed a new FDI Potential Index, in order to analyze the attractiveness at the EU regions in terms of foreign investitions. Based on factors like economic potential, market size, labour situation, technological progress, labour regulation and competitiveness, their analysis showed that the most attractive regions are located in the UK and the less attractive are in Greece. Along with most of the Greek regions, some regions in Polland, Bulgaria and Romania (South-East and North-East regions) are also less attractive.

In Spain, Gutiérrez-Portilla et al. (2016) showed that FDI flows at regional and sectoral level are marked by high volatility and are highly geographically concentrated. Also, they found as FDI determinants the market size, the level of human capital in interaction with wages and the own characteristics of Madrid capital.

Dorożyński, Świerkocki and Urbaniak (2015) studied the factors that attract foreign capital in the Province of Lodz in Polland and their results showed that the specific characteristics of the province aren't that important. Instead, foreign investors are interested in relatively cheap and skilful labour that will lower the production costs. They also found that investment incentives were less important in what concerns FDI inflows into the communes and counties of the Province of Lodz and that poor transport infrastructure and an uninteresting

social infrastructure descouraged foreign investments. They concluded that FDI inflows deepened intra-regional disproportions.

Concerning Romania, Sîrbu (2014) argued that it faces serious problems in reducing disparities between the richest and the poorest regions. Dornean and Oanea (2015) found that human capital and economic stability have the highest impact on FDI at the level of the regions of development. Other determinants are the total number of graduated persons, unemployment rate, GDP growth, net salary and kilometers of modernized road. Regarding North-West region of Romania, Sehleanu (2017b) identified the number of graduates, GDP and R&D expenditure as important factors of influence on the value of subscribed capital in companies with foreign participation in the share capital, while the influence of labour cost is moderate.

Romania comprises eight development regions, i.e. Bucharest-Ilfov, Center, West, North-West, South-Muntenia, South-East, South-West Oltenia and North-East. North-West region is part of the richer and more developed regions of Romania. This region includes six counties, namely: Bihor, Bistriţa-Năsăud, Cluj, Maramureş, Satu Mare and Sălaj. Based on the statistical data provided by Romanian National Trade Register Office (NTRO, 2018, p.24), North-West region of Romania is ranked on the third position by the number of companies with foreign participation in the share capital and on the fourth position in terms of the value of the total subscribed capital.

The objective of our study is to analyze the distribution of the number of companies with foreign participation in the share capital between the counties of North-West region of Romania and also to analyze the evolution of the value of subscribed capital in companies with foreign participation within this region. We intend to find the answers to the following questions: are there differences between the counties of North-West region of Romania concerning the ability to attract foreign investitions? is there a concentration of foreign participation in the share capital of companies or is the inter-counties distribution balanced? and which are the counties that enjoy the most foreign participation in the share capital of companies attract the largest number of foreign investors and which counties need more support from the authorities in order to become more desirable for investors.

Our research is based on a systematic analysis of the data provided by Romanian National Trade Register Office and Romanian National Institute of Statistics. We will undertake a comparative analysis of the statistical data in order to identify the level at which each county is positioned in terms of the variables considered, i.e. those reflecting the degree of economic development, respectively those reflecting the level of foreign participation in the share capital of companies.

2. The counties of North-West region of Romania – some data

The fact that Romania faces inter-regional economic and social disparities is no longer a novelty. There are disparities between the western part of the country and the eastern part of the country. Also, there is a gap between Bucharest-Ilfov region and the other develoment regions. Bucharest-Ilfov region, which dominates in all aspects, is the most developed one. But what is the situation at the intra-regional level, more precisely, regarding the counties of the North-West development region? Further, we will analyze the evolution of some selected indicators that are relevant for assessing the level of economic development of the counties located in North-West region of Romania.

The level of GDP is very important when analyzing the level of economic development of a region. If we look closely at Figure 1, we notice that in the North-West region, Cluj County has the highest GDP level (3062 millions of lei in 2000 and 31178.2 millions of lei in 2015), followed at a fairly large distance by Bihor County (2134.3 millions of lei in 2000 and 16218.9

millions of lei in 2015). The gap between Cluj County and the other counties has accentuated in the last decade. The difference between Cluj County, which has the highest level of GDP, and Sălaj County, which recorded the lowest level throughout the analyzed period (678.8 millions of lei in 2000 and 6087.1 millions of lei in 2015), is significant.



Figure 1: The evolution of GDP of the counties of North-West region of Romania, between 2000 and 2015 (expressed in millions of lei) Source: realized by the author based on INSSE statistics, [Online], Available: http://statistici.insse.ro:8077/tempo-online/.

When it comes to infrastructure, we can not underestimate its important role in attracting foreign investors. By realizing time and cost savings, a more developed infrastructure is an asset that investors take into account when they choose the area to invest in, as reflected in the literature (Dornean and Oanea, 2015; Sehleanu, 2017a). According to the data provided by Romanian National Institute of Statistics, the North-West region had 2412 kilometres of modernized road in 1990 (of a total of 10652 kms of road in the region), 3089 in 2000 (of the total of 11566 kms of region's road) and 4187 in 2017 (of the total of 12713 kms of region's road). Figure 2 shows that, between 1990 and 2017, Cluj and Bihor counties had the largest length of modernized roads, except for the period 2000-2007 when Satu Mare County registered a hirgher number of kms of modernized road. A real problem, both in the country and in the region, is represented by the small number of kilometers of the highway.



Figure 2: The evolution of the length of modernized public roads in the counties of North-West region of Romania, between 1990 and 2017 Source: realized by the author based on INSSE statistics, [Online], Available: http://statistici.insse.ro:8077/tempo-online/.

From the perspective of foreign investors, a higher unemployment rate may reflect some imbalances, but, at the same time, it may indicate the availability of the workforce. Figure 3 shows that, between 1991 and 2017, Bistriţa-Năsăud and Sălaj Counties recorded the highest unemployment rate at the level of the North-West region.



Figure 3: The evolution of the unemployment rate in the counties of North-West region of Romania, between 1991 and 2017

Source: realized by the author based on INSSE statistics, [Online], Available: <u>http://statistici.insse.ro:8077/tempo-online/</u>.

Until 2003, Cluj County also recorded relative high values of the unemployment rate, but subsequently decreased significantly, with the exception of 2009 and 2010. In fact, in 2009 and 2010 all the six counties recorded higher values of unemployment rate as a result of bankruptcy and decline in the activity of many companies after the outbreak of the global economic and financial crisis.

3. Foreign participation in the share capital of companies in the counties of North-West region of Romania

Foreign investments can help mitigate development gaps between regions, but it must be taken into account the fact that foreign investors are attracted by the level of economic development of an area, as they pay attention to the market size, purchasing power of consumers, level of education, infrastructure etc.

Figure 4 reveals the evolution of the value of subscribed capital in companies with foreign participation in the share capital in the counties of North-West region of Romania (the existing balance at December 31 each year). Data on subscribed share capital include capital underwritings at the time of registration of companies during the reference period, plus capital increases and minus the subscribed capital of the companies radiated from the Trade Register during the reference period. As can be seen, until 2009, Cluj County held the supremacy in terms of the value of subscribed capital. Instead, starting with 2010 and until present, Bihor County, which was placed second until then, recorded the highest values of the value of subscribed capital at the region level. In Cluj County, the value increased from 230531.1 thousand euros in 2001 (existing balance at 31 December) to 789095.4 thousand euros in 2017 (existing balance at 31 December). However, in 2010, the difficult economic and financial conditions led to a decrease of the existing balance of subscribed value and only in 2016 the value registered in 2009 was exceeded. In the case of Bihor County, we note that until 2009 there were no major increases, i.e. in 2001 the value of subscriptions recorded 208597.4 thousand euros (existing balance at 31 December) and in 2009 it increased to 335728.2 thousand euros (existing balance at 31 December). Instead, 2010 has generated a boost of the value of subscriptions that reached 948309.4 thousand euros (existing balance at 31 December). The rising trend has continued in the years to come. such as in 2017 the subscribed value reached 1295583.7 thousand euros (existing balance at 31 December).



Figure 4: The evolution of the value of subscribed capital in companies with foreign participation in the share capital in the counties of North-West region of Romania, between 2001 and 2017 (existing balance at 31 December each year, expressed in thousand euros) Source: realized by the author based on the statistical reports of Romanian National Trade Register Office, [Online], Available: <u>http://www.onrc.ro/index.php/ro/statistici?id=254</u>.

By analyzing Figure 4, we can observe a certain separation of the counties of the region in two groups: the leading group comprising the counties of Cluj and Bihor, and the group

comprising the other counties. Starting with 2010, we notice that a major gap has been formed between the two groups of counties in the North-West region of Romania. Thus, knowing that there are disparities between the regions of the country in terms of foreign investments attracted, we find that these disparities are also intra-regional. Bistriţa-Năsăud, Maramureş, Satu Mare and Sălaj have registered lower values of foreign subscribed capital compared to Cluj and Bihor counties, throughout the analyzed period.



Figure 5: The evolution of the number of registered companies with foreign participation in the share capital in the counties of North-West region of Romania, between 2001 and 2017 (existing balance at 31 December each year)

Source: realized by the author based on the statistical reports of Romanian National Trade Register Office, [Online], Available: <u>http://www.onrc.ro/index.php/ro/statistici?id=254</u>.

In terms of the number of companies with foreign participation in the share capital, we can observe the same gap between the counties Cluj, Bihor and the other counties (see Figure 5). Throughout the analyzed period, Cluj County was the leader that attracted the largest number of investors, which is no surprise since it represents a large university center that provides qualified labor force, it benefits from an appropriate infrastructure and the level of GDP is the highest in the region. If until 2001 there were 3382 registered companies with foreign participation in the share capital in Cluj County, until 2017, the number of companies registered reached 9627 (existing balance at 31 December for each year). Placed on the share capital registered until 2001 and 8695 until 2017 (existing balance at 31 December for each year).

During the analyzed period, Sălaj County attracted the fewest foreign investors, the number registered companies with foreign participation in the share capital being 268 until 2001 and only 1021 until 2017 (existing balance at 31 December each year). Neither Bistrița-Năsăud County can boast great performance in this respect. There were 476 companies with foreign participation in the share capital registered until 2001 and their number grew to just 1439 until 2017 (existing balance at 31 December each year). It seems that foreign investors are not very attracted by these counties. This makes it imperative for the authorities to make efforts in order to develop a strategy to increase the ability of attracting new investors. It is necessary to identify the factors considered important by foreign investors and to improve the aspects regarded by investors as weak points of the area.

Table 1: Companies with foreign participation in the share capital and the value of the subscribed capital in the counties of North-West region of Romania, between 1991 and 2017 (existing balance at 31 December 2017)

Regions of	Number of	The value of the	Hierarchy by:	
economic development	companies	(in thousands lei –national currency)	Number of companies	Value of the subscribed capital
Romania	215.651	168.877.712,1		
North-West	26.459	8.574.536,1		eap ital
Bihor	8.695	2.779.357,4	2	1
Bistrița-Năsăud	1.439	477.631	5	6
Cluj	9.627	2.737.651	1	2
Maramureş	2.869	1.487.798,6	3	3
Satu Mare 2.808		591.567,9	4	4
Sălaj	1.021	500.530,2	6	5

Source: realized by the author based on Romanian National Trade Register Office's report "Companies with foreign participation in the share capital. Summary statistics of the National's Trade Register's Data", October 2018 report, [Online], Available: http://www.onrc.ro/index.php/ro/statistici?id=254.

Between 1991 and 2017, Cluj and Bihor counties attracted the largest number of foreign investors and recorded the highest values of the subscribed capital in companies. There is a clear separation between the counties Clui, Bihor and the rest of the region's counties. Table 1 provides a hierarchy of the North-West region's counties according to the two aspects regarding foreign participation, subject to analysis, i.e. the number of registered companies with foreign participation in the share capital and the value of subscribed capital in companies with foreign participation.

Of the six counties of the region, Sălaj County attracted the smallest number of foreign investors. Regarding the value of the subscribed capital (existing balance at 31 December 2017). Bistrita-Năsăud County is on the last position of the ranking, but the difference from Sălaj County is very small.

4. Conclusion

This study analyzed, in the beginning, the evolution of some selected indicators that reflect, to a certain extent, the level of development of the counties of North-West region of Romania. The data indicate that Cluj and Bihor Counties are the most developed in the region, while, at the opposite pole, there are the counties of Sălaj and Bistrita-Năsăud. Further, we studied the distribution of the number of registered companies with foreign participation in the share capital between the counties of North-West region of Romania and the evolution of the value of subscribed capital in companies with foreign participation (which represents an important part of FDI inflows) within this region, between 1991 and 2017. By analyzing the data, we found that disparities concerning foreign investitions attracted exist also at an intra-regional level. It seems that foreign investors prefer especially certain counties of the region. Thus, we found that a gap has formed between the counties Clui. Bihor and the rest of the region's counties. In terms of the number of registered companies with foreign participation in the share capital, Cluj County is the leader, followed by Bihor County. The rest of the counties are placed at a great distance from the two leading counties. Of the six region's counties, Sălaj County is the least preferred by foreign investors. Of course, the number of companies with foreign participation in the share capital is an indicator of the attractiveness of the area for foreign investors. In terms of the value of subscribed capital in companies with foreign participation, Bihor County is placed on the first position, followed by Cluj County. As mentioned above, the difference from the rest of the counties is considerable for this variable too. Bistriţa-Năsăud County is placed on the last position regarding the value of subscribed capital in companies with foreign participation, but at a small difference from Sălaj County. It is obvious that the authorities must consider an efficient strategy to increase the attractiveness of the counties less desired by foreign investors. A detailed analysis can identify the aspects that matter the most in the decision of foreign investors to initiate businesses in a county and on which the authorities have to act.

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Bio-note

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OIL PRICE VOLATILITY AND INFRASTRUCTURAL GROWTH: EVIDENCE FROM AN OIL- DEPENDENT ECONOMY

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Abstract: Since the discovery of crude oil in Nigeria in 1957, the Nigerian economy has remained a mono-product economy largely impacted by the effects of oil price volatility with its attendant adverse consequences on the nation's revenue profile and infrastructural growth. Accordingly, this paper attempts to investigate the nexus between oil price volatility and infrastructural growth in Nigeria, utilizing cointegration and error correction modeling approach for the period 1981-2015. The data for this study were sourced from the Central Bank of Nigeria Statistical Bulletin, 2014 and 2016 editions. The results suggest that both oil price volatility and inflation rate tend to exert negative impact on infrastructural growth, while the appreciation of real exchange rate tend to trigger investment in infrastructure. Accordingly, we recommend, among others, the need to design and implement effective diversification policies with a view to raising the nation's revenue trajectory, while strengthening local crude oil refining capacity so as to minimize the adverse consequences of such external shocks on the domestic economy.

Key Words: oil price, infrastructure, ECM, economic growth, Nigeria.

JEL classification: H54, L72, Q32, Q43.

1. Introduction

For several decades running, crude oil has evolved and still remains one of the single most crucial defining forces of the global economy, with oil prices becoming increasingly volatile since the end of the Second World War. In recent times however, the volatility in oil prices has become even more serious. Such oil price shocks (defined as sudden changes) have severe implications for the economies of oil-exporting nations, especially oil-dependent countries like Nigeria.

Nigeria is an open economy that has no real influence on the world price of oil, but is largely impacted by the effects of oil price volatility; more so, as a net importer of refined petroleum products. As observed by Rentschler (2013), positive volatility in oil prices affects the economy via different channels. Such positive increases impact on the private sector by raising costs of production and minimize outputs, while the final consumers may end up bearing part of such increases by way of price increases. Such developments may negatively impinge on macroeconomic indicators like employment, inflation and trade balance, among others.

However, the recent volatility (that is, large fall) in crude oil prices, which started in mid-2014, has adversely affected Nigeria in diverse ways, especially in the areas of infrastructural development, foreign reserves, currency crisis, declining government revenue and increasing cases of the nation's inability to meet its financial obligations as at when due. This development has therefore triggered a number of empirical studies on the nexus between such crude oil price volatility and a number of macroeconomic aggregates in Nigeria. However, many of such studies have either investigated the macroeconomic impact of oil

price volatility (Omisakin, 2008; Ahuru and James, 2015), or examined the consequences of such oil price volatility on the growth of the Nigerian economy (Oriakhi and Osaze, 2013). Most of those empirical studies on the nexus between oil price instability and infrastructural growth have not only been outside the confines of the Nigerian economy, but also have been largely cross sectional in nature (Habibi, 1998; Hamdi and Sbia, 2013). One common problem associated with such cross sectional studies is that they tend to hide significant country specific features and dynamics. Second, the lumping of countries together in such studies (for instance, transition, developing, emerging, industrialized) with differing socio-economic configurations makes it difficult to understand the role of country-specific conditions across different time periods. Thus, replicating the policy recommendation(s) from such cross country studies for the Nigerian economy may be quite misleading.

Accordingly, this paper extends the current literature on oil price instability and its impact on infrastructural growth in a number of significant ways. First, unlike previous studies like Englama, Duke, Ogunleye and Ismail (2010) and Oriakhi and Iyoha (2013), which employed the standard deviation as measurement of oil volatility, this study uses the generalized autoregressive conditional heteroskedasticity (GARCH) measure of volatility with a higher predictive power. Second, this study utilizes data for a longer sample period than any other previous studies in this area, thus taking into consideration the various episodes of oil price shocks that have occurred over the years. Third, this study employs cointegration and error-correction methodology aimed at providing for both the long-run and short-run dynamics. Lastly, and to the best of the researcher's knowledge, this it he first attempt at specifically studying the link between oil price volatility and infrastructural growth within the Nigerian context.

The main goal of this research investigation is to empirically ascertain the linkage (if any) between oil price volatility and infrastructural growth in Nigeria with a view to providing informed policy prescriptions aimed at minimizing the perceived negative impact of such oil price variability on the nation's revenue trajectory and, by extension, on the projected level of infrastructural growth in the country.

The remainder of this paper is structured as follows. Section 2 provides a review of related empirical literature, while section 3 provides the methodological framework and data for the study. Section 4 presents the results and discusses the findings. Section 5 concludes the paper with relevant policy prescriptions.

1.1 The Dynamics of Oil Price and Infrastructural Growth

Over the years, the Nigerian economy has witnessed significant swings (fall and rise) in the prices of crude oil in the international oil market, with attendant consequences on the economy. According to Hamilton (1983) and Wakeford (2006), such fluctuations often result from changes in either the demand or supply side of the international oil prices. In all, the Nigerian economy has witnessed six (6) phases of oil price shocks. These are the oil price shocks of 1973-74; 1979-80; 1986; 2003-2006, 2008-2009 and 2014. Meanwhile, while those of 1973-74, 1979-80 and 2003-2006 were characterized by increases in the price of oil per barrel and, by extension, a rise in government revenue, those of 1986, 2008-2009 and 2014 were episodes marked by the plummentation of oil price. For instance, during the first oil price shock of 1973- 1974, the price of oil per barrel rose from \$2.19 in 1971 to about \$11.58 by the close of 1974, representing about 48 percent rise. The second oil price shock (rise) of 1979-80 period saw the price of oil per barrel rising from about \$14.12 in January 1979 to about \$38.82 by the end of 1980, a percentage increase of about 175 (Obadan, 2010).

Meanwhile, the other three episodes of oil price decline of 1986, 2008-2009 and 2014 were marked not only by huge fall in the price of oil per barrel (attaining its minimum level in

annual average term in 2016), but also in terms of exports receipts and fiscal revenue, with attendant consequences on the average growth of the economy.

On the other hand, Nigeria's level of infrastructure (measured by gross fixed capital formation, GFCF) has fluctuated widely over the years. For instance, the country's GFCF, which stood at N133.22 billion in 1981 declined to N40.93, N40.12 and N29.83 in 1985, 1990 and 1995 respectively. It however declined to its lowest level of N6.3 billion in 2001. Thereafter, it rose to N142.32 in 2014, before attaining its highest peak of N2608.06* in 2015 (Central Bank of Nigeria Statistical Bulletin 2014, 2016). The import of the foregoing is that both levels of oil price and infrastructure have experienced wide swings over the years, a development that has adverse consequences on the growth of the domestic economy.

Note: * Central Bank of Nigeria computed GFCF values from 1980 – 2014 using 1990 as its base year, while GFCF values from 2015 till date have 2010 as their base year.

2. Review of Related Literature

In economic literature, infrastructure (whether physical or social) has been indentified as a veritable ingredient in the development process of any nation. According to Ogbuozobe (1997), the term infrastructure describes a network of transport, communication and public (social) services all working as a system or as a set of interrelated beneficial services provided for the improvement of the general well-being of the population. Specifically, good and adequate infrastructure not only help to raise the level of productivity, facilitates the realization of potential human capital, but also improves safety and quality of human lives which, ultimately, helps promotes the overall growth and development of the economy.

As stated in the introductory section, there has been an avalanche of empirical studies linking oil price volatility to macroeconomic performance or some components thereof (e.g exchange rate, domestic price, investment), but only a handful of such studies directly regressed infrastructural growth/development on oil price volatility. In what follows, we briefly review some of such related studies (both country specific and cross-sectional studies).

Habibi (1998) investigated the impact of changes in oil revenue on budgetary decisions using a panel data for five (5) Middle-Eastern oil-exporting countries. His finding reveals that while budget shares of defence and economic affairs and services were positively correlated to oil export revenue, those of social expenditures were inversely correlated, suggesting that the latter, being important politically, is often protected against volatility in oil revenues.

El Anshasy (2009) examined the impact of oil price volatility on economic growth for a panel of fifteen (15) oil exporters during the period 1970-2004. The results reveal, among others, that oil price shocks are not harmful to the long-run growth of those economies after all.

In a related study, Akinlo and Apanisile (2015) investigated the impact of oil price volatility on economic growth in twenty (20) sub-Saharan African countries for the period 1986-2012, using panel data. The result revealed in part that, volatility of oil price has a positive and significant effect on the economic growth of those oil exporting nations.

Aziz and Dahalan (2015) on their part attempted to ascertain the asymmetric effects of oil price shocks on real economic activities in ASEAN – 5 nations for the period 1991-2014, using an unrestricted panel vector autoregressive (VAR) method. The result suggests that increases in oil price negatively affects economic activities in both the short and long-runs.

With reference to country-specific studies, Jawad (2013) analyzed the impact of oil price volatility on the economic growth of Pakistan for the period, 1973-2011, employing linear regression analysis. The result revealed that oil price volatility has insignificant impact on the level of economic growth during the period under focus. In another study, Hamdi and Sbia (2013) empirically examined the dynamic relationship between oil revenues, government spending and economic growth in Bahrain for the period 1960-2010, using a trivariate

cointegration and error-correction approach. The result indicates that, oil revenue remains the prime-mover of the economy, via government spending.

Oriakhi and Iyoha (2013) employed the VAR methodology to investigate the consequences of oil prices volatility on the growth of the Nigerian economy for the period 1970-2010. The result shows that changes in oil price tend to impact on the growth of the economy via government expenditure.

In a similar study, Donwa, Mgbame and Onobun (2015) examined the relationship between oil price volatility and the growth of the Nigerian economy. The results suggests that volatility in oil prices are the major cause of the nation's unstable growth rate over the years. Tehranchian and Seyyedkolaee (2017) studied the impact of oil price volatility on economic growth in Iran for the period 1980-2014, using the threshold regression model. The result indicates that oil price volatility tends to significantly impact on economic growth, even though such impact tend to diminish over time.

3. Methodological Framework and Data

3.1. Data

This study utilizes annual data covering the period 1981 to 2015 sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and the National Bureau of Statistics (NBS) (various issues). This period (1981-2015) was chosen because of the non-availability of data on some of the variables of interest. The variables are oil price volatility (OILPV), gross fixed capital formation (GFCF), inflation rate (INFL), real exchange rate (REXCH) and interest rate (INTR).

A measure of oil price variability was obtained by employing the generalized autoregressive conditional heteroskedasticity (GARCH) approach, which models volatility as conditional on past behaviour (see Bollerslev, 1986). The best fitting time series GARCH (1,1) model was determined on the basis of Akaike Information Criteria (AIC).

3.2. Theoretical Framework

Within the economic growth literature, there are quite a number of growth theories attempting to establish the relationship between oil price volatility and the macro economy or some parts thereof. In what follows, we attempt to briefly highlight three (3) of such theories, namely the Linear/symmetric relationship theory of growth, the Asymmetry-in-effect theory of economic growth, and the Renaissance growth theory.

The Linear/Symmetric relationship theory of growth posits that an inverse relationship exists between oil price volatility and the GDP growth within the US economy. Following the pioneering work of Hamilton (1983), others such as Hooker (1996) observed that 0.6% decline in GDP growth was associated with a 10% rise in oil price. Similar conclusions were arrived at for the US economy by Laser (1987) and Rotemberg and Woodford (1996). On their part Lee, Ni and Ratti (1995) submitted that such sudden and unanticipated oil price growth has had a highly significant and asymmetric effects not only on output but also on other macroeconomic variables, as well as on personal incomes and other forms of earnings.

The Asymmetry-in-effect theory of economic growth postulates that decreases in oil prices tend to have little or no appreciable effects on the economic activities in the US as well in some OECD nations. (Hanilton, 1996; Mork 1989; Mory, 1993; Ferderer, 1996 and Herrera, et al, 2010). Mork (1989) for instance investigated the asymmetric response of oil price volatility by decomposing oil price changes in real price increases and decreases. The result reveals that oil price decreases is significantly different and perhaps zero. Lee et al (1995)

study also confirmed the asymmetry in effects in the period before and after 1985, and the issue of whether or not such asymmetry effect is a function of their variables.

Ferderer (1996) in explaining the asymmetric mechanism between oil price volatility and economic activity considered three possible channels, namely, counter-inflationary monetary policy, sectoral shocks and uncertainly. He observed that asymmetric monetary policy responses partly explains the asymmetric oil price –output relationship.

The Renaissance growth theory was a by-product/fall-out of the symmetric and asymmetric effects of oil price volatility and the macro-economy. This theory attempts to establish the relative effects of oil price changes and oil price volatility on economic growth for a given period of time. In this regard, Lee (1998) revealed that though both effects impact negatively on economic growth, the effects of changes in oil prices tend to thin out after one year. As such, he submitted that, it is volatility in crude oil prices rather than prices in oil level that has a lasting and appreciable effect on economic growth on the long-run (Lee, 1998).

3.3. Model Specification

Drawing from the reviewed literature (such as Oriakhi and Iyoha, 2013) and the theoretical underpinnings, we hypothesize a simple model where gross fixed capital formation (GFCF), (a proxy for infrastructural development), is specified as a function of a number of relevant regressors, like oil price volatility, inflation rate, real exchange rate and interest rate. GFCF = $\lambda_0 + \lambda_1$ OLPV + λ_2 INFL + λ_3 REXCH + λ_4 INTR + α(1)

Where:

OLPV = Oil price volatility

GFCF = Gross fixed capital formation (a proxy for infrastructural development) REXCH = Real exchange rate

INFL = Inflation rate

INTL = Lending interest rate (a proxy for monetary lending rate).

The analytical tools used for this study include, correlation matrix, stationarity test, cointegration and error-correction mechanism, among others.

4. Results and Discussion

4.1. Descriptive Analysis

Table 1a presents the variables used in the estimation and their characteristics. The Jarque-Bera statistic rejects the null hypothesis of normal distribution for gross fixed capital formation (GFCF) and inflation (NFL). On the other hand, the null hypothesis of normal distribution is accepted for oil price volatility (OLPV), real exchange rate (REXCH) rate and interest rate (INTL). Also, while the distribution of GFCF INFL and INTR are leptokurtic, those of OLPV and REXCH are platykurtic in nature.

From the correlation matrix in *Table 1b*, GFCF shows a strong positive relationship with OLPV (64%) and EXCH (72%) but a negative correlation with INFL (-29%) and INTL (-0.09%). Oil price volatility (OLPV) shows a positive correlation with GFCF (64%) and EXCH (0.40%), but a negative relationship with INFL (-39%) and INTR (-54%). Similarly, INFL has a positive correlation with INTR (37%), but negatively correlated with GFCF (-0.29%) OLPV (-39%) and EXCH (-41%).

Metrics	GFCF	OLPV	INFL	REXCH	INTR
Mean	23031105	3462.245	19.71465	71.40880	17.80657
Median	2422563.	1893.981	12.21701	22.06540	17.79500
Maximum	1.36E+08	9607.157	72.83550	192.4405	31.65000
Minimum	87994.80	553.4797	5.382224	0.617708	8.916667
Std. Dev.	41747196	2781.638	17.93583	66.18510	5.038503
Skewness	1.739342	0.748135	1.626154	0.225740	0.174328
Kurtosis	4.329452	2.184212	4.372112	1.349790	3.426492
Jarque-Bera	20.22516	4.235492	18.17112	4.268583	0.442540
Probability	0.000041	0.120302	0.000113	0.118328	0.801500

Table 1a: Descriptive Statistics

Source: Author's Computation using E-view 8.0

Table 1b: Correlation Matrix

Metrics	GFCF	OLPV	INFL	EXCH	INTR
GFCF	1.000000	0.642335	-0.288207	0.718192	-0.088370
OLPV	0.642335	1.000000	-0.390758	0.400715	-0.537543
INFL	-0.288207	-0.390758	1.000000	-0.408312	0.369669
EXCH	0.718192	0.400715	-0.408312	1.000000	0.160573
INTR	-0.088370	-0.537543	0.369669	0.160573	1.000000

Source: Author's computation using E-view 8.0

4.2. Testing for Stationary

In economic literature, most macroeconomic time series data are non-stationary, and employing such non-stationary variables in empirical investigations might produce spurious results and, by extension, misleading policy prescriptions (Granger and Newbold, 1977). As such, we investigated the time-series properties using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, and the results are as presented in *Table* 2. The results shows that all variables used in the study are 1 (I) variables, that is, stationarity was attained after first difference in both the ADF and PP test procedures.

VARIABLES	ADF	CRITICAL PHILIPS		CRITICAL	ORDER OF
	STATISTIC	VALUE	PERRON	VALUE	INTEGRATION
GFCF	-4.588692	-2.954021	-4.562502	-2.954021	1/1
OLPV	-8.135257	-2.954021	-7.978101	-2.954021	1/1
INFL	-5.956310	-2.957110	-8.583237	-2.954021	1/1
EXCH	-5.219976	-2.954021	-5.217650	-2.954021	1/1
INTR	-6.415554	-2.954021	-6.425948	-2.954021	1/1

Table 2: ADF and PP Unit Root Tests

Source: Author's Computation using E-view 8.0

4.3. Testing for Cointegration

Basically, cointegration tests are designed to test for the existence of long-run equilibrium between the variables in the model, as this is vital for the purpose of policy making.

In order to ascertain the existence or otherwise of a stable long-un relationship among the variables under focus, this study adopts the methodology developed by Johansen (1988), and Johansen and Juselius (1990). This approach is expected to produce asymptotically optimal estimates because it incorporates a parametric correction mechanism, and it does not depend on the methods of normalization chosen.

Following the approach by Johansen and Juselius (1990), two likelihood test statistics, the Max-Eigen and Trace tests were utilized to derive the number of cointegrating vectors. The cointegrating tests were performed allowing the absence of linear trends.

From the cointegration results in *Table 3*, max-eigen and trace statistics reject the null hypothesis of no cointegration at the 5% level. Specifically both statistics confirm the existence of one cointegrating equation among the variables. This confirms the convergence property, hence an error-correction model is presented.

Null	Eigenvalue	Trace	Critical value	Max-Eigen	Critical value
Hypothesis		statistic	at 5 percent	statistic	at 5 percent
α = 0	0.749114	75.27957*	60.06141	45.63092*	30.43961
α ≤ 1	0.464559	29.64866	40.17493	20.61390	24.15921
α≤2	0.155737	9.034754	24.27596	5.586605	17.79730
α ≤ 3	0.087016	3.448148	12.32090	3.004222	11.22480
α ≤ 4	0.013362	0.443927	4.129906	0.443927	4.129906

Table 3: Johanson Co-integration Test Results

Notes: *α* Represents at most the number of cointegrating equations.

* Denotes significance at the 5% level.

Source: Author's Computations using E-view 8.0.

4.4. The Error Correction Model

Following Engle and Granger (1987), if cointegration exists between non-stationary variables, then an error-correction representation of the kind specified by equation (2) exists for these variables. Essentially, the error-correction term (ect) in equation (2) enables us to gauge the speed of adjustment of equilibrium once the equation is shocked or distributed. Below is the dynamic error correction formulation:

```
 \Delta GFCF_{t} = \varphi_{0} + \varphi_{1i} \sum_{i=0}^{1} \Delta GFCF_{t-1} + \varphi_{2i} \sum_{i=0}^{1} \Delta OLPV_{t-1} + \varphi_{3i} \sum_{i=0}^{1} \Delta INFL_{t-1} + \varphi_{4i} \sum_{i=0}^{1} \Delta REXCH_{t-1} + \varphi_{5i} \sum_{i=0}^{1} \Delta INTR_{t-1} \varphi_{6i}ect_{t-1} - \cdots 
 (2)
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Where:

ect is the error correction term, and " Δ " represents the difference of a series, $\varphi_0, \ldots, \varphi_6$ are parameters of the model to be estimated. The "i" represents the number of lags included for the first time difference of both the dependent variables while t represents the time period. All other variables are as previously defined in equation (1).

Table 4 contains the results of the estimated error-correction model. Following Enders (1995), ordinary least squares (OLS) will give consistent estimates, provided the variables included in the model are stationary.

Results contained in *Table 4* show that the coefficient of the error-correction term for the estimated infrastructural growth equation is correctly signed and statistically significant at 5% level of significance. The speed of convergence to long-run equilibrium is 76.92%. This result indicates that about 77 percent of the short-run disequilibrium in infrastructural growth (GFCF) is corrected each period (year). This high rate of convergence is of much practical use in policy analysis, and in decision making (Pesaran, 1997). Besides, this is vital for maintaining long-run equilibrium to reduce the existing disequilibrium over time.

Dependent Variable: (DGFCF)								
Sample (adjusted): 1982 2015								
Included observations: 34 after adjustments								
Variable	Coefficient	Coefficient Std. Error t-Statistic Prob.						
С	3695972.	1956124.	1.889436	0.0692				
DOILPV	-2355.986	1142.789	-2.061611	0.0486				
DINFL	-16531.53	7714.257	-2.142984	0.0473				
DEXCH	18460.99	6747.055	2.736155	0.0327				
DINTR	-96309.25	82764.93	-1.163648	0.4712				
ECM(-1)	-0.769251	0.374294	-2.055200	0.0493				
R-squared	0.891613							
Adjusted R-squared	0.865116							
Akaike info criterion	35.32450							
Schwarz criterion	35.59386							
F-statistic	2.305288							
Prob(F-statistic)	0.031216							
Durbin-Watson stat	1.990945							

Table 4: Estimated Short-run regression result for gross fixed capital formation

Source: Author's computation using E-view 8.0

The coefficient of oil price volatility is negatively and statistically significant at 5% level, confirming extant findings that crude oil price volatility (especially negative shocks) tend to inhibit infrastructural growth and, by extension, the level of investment in the domestic economy (Habibi, 1998; Farzanegan and Markwardt, 2009; Jbir and Ghorbel, 2009; Ebrahim and Mohammad, 2012; Dizaji, 2014). This calls for the need to implement policies aimed at stabilizing the effects of such negative shocks on infrastructural growth in the economy.

The coefficient of inflation is negative and statistically significant at 5% level. Thus, a one percent increase in inflation level will cause the level of infrastructure to decline by about 165 percent in Nigeria. This is not unexpected because high inflation, especially when associated with increased price instability, often raise the level of uncertainty about the future profitability of investment projects thereby lowering the overall level of investments especially in infrastructure. Similarly, the coefficient of interest rate is negative but statistically insignificant.

Finally, the slope coefficient of real exchange rate is positive and statistically significant at 5 percent level of significance. Specifically, a one percent increase in exchange rate will cause the level of infrastructure to rise by about 184 percent in Nigeria. Such real exchange rate appreciation may encourage investment in infrastructure (especially, fixed investment) by lowering the relative prices of imported machinery and equipment. The implication of such real exchange appreciation is to shift relative prices in favour of non-tradables, bringing about a reallocation of both labour and investment away from the production of tradeable goods and services.

4.5. Stability Test

In this study, we utilized the approach developed by Brown, Durbin and Evans (1975) to investigate the short-run stability of the parameters in the infrastructural growth model using the plots of the cumulative sum of the residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSq). It should be noted that, whilst the CUSUM test is particularly useful for dectecting systematic changes in the regression coefficients, the CUSUMSq test is significant in situations where the departure from the constancy of regression coefficients is haphazard and sudden. The results from the two tests are presented in figures 1 (A) and 1 (B) respectively. Essentially, the existence of parameter

instability is established if the CUSUM of the residuals and the CUSUM of squares of the residuals go outside the bands represented by the two critical lines (dotted lines). From the graphs in figures 1 (A) and 1 (B), the CUSUM remains within the 5 percent critical line throughout the period under consideration, thus indicating parameter stability throughout that period of estimation. The CUSUM of squares on the other hand is found to veer off the critical line between 1993 and 2013, indicating parameter instability within that period.



Figure 1(a): Cumulative Sum of Recursive Residual (CUSUM) Source: Author's computation, using E-views 8.



Figure 1(b): Cumulative Sum of Squares of Recursive Residual (CUSUMsq) Source: Author's computation, using E-views 8.

5. Conclusion and Policy Recommendations

This study investigated the nexus between oil price volatility and infrastructural growth in Nigeria within the context of Johansen cointegration and error correction framework, applying annual data from 1981-2015. Results from the study reveal that volatility in oil price is negative and statistically significant, while that of interest rate was also negative but statistically insignificant. Also, inflation exerted a negative and statistically significant impact on infrastructural growth. Specifically, a one percent-increase in inflation rate caused the

level of infrastructure to decline by about 165 percent. However, an appreciation in the level of real exchange rate tends to trigger investment in infrastructure, especially in fixed investment.

Based on the above findings, the work concludes that the quantum of investment in infrastructure development in Nigeria is not only low, but unstable, given the volatile nature of the price of the nation's foreign exchange earner (oil). Thus, if economic infrastructure is to adequately promote the growth performance of the economy, then complementary sources of finance must be identified and harnessed with a view to raising expenditure on infrastructure stock to the internationally recommended benchmark of 70 percent of the GDP as against the estimated 35 percent of GDP in 2018 (Centre for the Study of Africa (CSEA), (2018).

Àrising from the foregoing findings, we make the following specific policy recommendations. First, there is the urgent need to design and implement effective diversification policies aimed at increasing the production of exportable goods with a view to raising the nation's revenue profile and cushion the economy's vulnerability to oil price volatility, thereby engendering sustainable infrastructural growth in the country. Such policies should be complemented by strengthening local crude oil refining capacity, with a view to further minimizing the consequences of such external shocks, and partly by improving the requisite regulatory environment so as to promote more public-private partnership in the provision of economic infrastructure. Second, the relevant authorities should put in place policies aimed at maintaining low inflation rates in order to boost infrastructural growth and trigger higher economic growth. Lastly, given the likelihood that appreciation in real exchange rate may not significantly impact on all categories of infrastructure, the authorities concerned should put in place appropriate exchange rate regime aimed at promoting investment in infrastructure in the long-run.

6.Limits of the Research

- (a) Unavailability of up-to-date data for the research. For instance, data for 2016 and 2017 for some of the variables were not available.
- (b) The use of GFCF as a proxy for infrastructure is in adequate, considering the fact that the term infrastructure embraces a broad spectrum of facilities like (is GFCF a good proxy for infrastructure?)

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STRATEGIC DECISION-MAKING SUPPORTED BY TRADITIONAL FINANCIAL INDICATORS

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Abstract: Traditional financial indicators calculated from financial statements cannot provide adequate information for the management, do not support strategic decisions. The reason for this is the methodology used in producing financial statements and the operational logic of financial accounting. Financial accounting thinks in terms of business year that is 12 months. It deals with events of the past, more accurately, with so called economic activities. Financial accounting evaluates such economic activities in terms of monetary processes, which means that the traditional financial indicators have their limits in application. Could it mean that traditional financial indicators cannot be used in the long-term strategic decision making? In our study we point out two connections between financial indicators and strategic decision making. Firstly, we focus on financial indicators used in supported strategic decision making, in strategic indicator systems. Secondly, we focus on cases in which financial indicators complement the methods of strategic decision making, add something to the tools available in strategic management.

Keywords: financial statement, financial indicators, strategy, strategic decision making, Balanced Scorecard.

JEL classification: C80; G30.

1. Introduction

Financial statements, their content and layout are regulated by legal norms. Such norms ensure that financial statements provide information for all stakeholders on the assets, liabilities, equity, revenues, expenditures, financial results, cash-flow, financial performance, changes in equity of organizations falling under the legislation. This information shall be made available and applicable in making economic decisions. Financial statements ensure that financial accounting is an important – but not exclusive – provider of information for the players of the market. According to the legislators' concept, nowadays financial accounting shall provide useful and reliable information mostly for the players of the market (i.e. for the seller and the buyer, and/or for the owner, the representative of the owner, the investor – that is external stakeholders).

The primary purpose of the Financial Statements is to inform stakeholders. At the same time it is questionable how the Financial Statements are able to help the internal stakeholders within the company, especially in case when the long-term work of internal stakeholders has to be supported.

This paper is looking for an answer to the question of whether the Financial Statements and financial indicators derived from them appear in the methods of strategic decision making. Regarding the methodology, it follows the following logic: The second chapter presents the

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theoretical background of the Financial Statements and Financial indicators calculated from the statements. The third chapter firstly introduces how financial indicators are included in the support of strategic decision making with particular emphasis on the role of BS and secondly it looks for the supporting methods that of strategic decision making. Based on the most important international literature the paper gives answers to the research questions.

2. Source and critic of traditional financial indicators

Financial statements are a structured representation of the financial position and financial performance of an entity. The objective of general purpose financial statements is to provide information about the financial position, financial performance and cash flows of an entity that is useful to a wide range of users in making economic decisions. Financial statements also show the results of management's stewardship of the resources entrusted to it. To meet this objective, financial statements provide information about an entity's:

- assets;
- liabilities;
- equity;
- income and expenses, including gains and losses;
- other changes in equity; and
- cash flows.

This information, along with other information in the notes, assists users of financial statements in predicting the entity's future cash flows and, in particular, their timing and certainty" (International Accounting Standard 1: 7. par(hereinafter IAS1)).

As the demand for information by some stakeholders only partially aligns with the information given readily by the business entity; the legislators, in order to resolve the conflict of interest, formulated guidelines and/or rules.

The IAS 1. Presentation of Financial Statements sets out the requirements for the components of financial statements as follows:

- balance sheet,
- income statement,
- statement of changes in equity
- cash flow statement,
- Notes (comprising a summary of significant accounting policies and other explanatory notes) (IAS1, 8. par.).

Balance sheet is a statement of financial position at the end of a period (end of the business year) in terms of assets and financing (liabilities and ownership equity). Current and non-current assets shall be separated just like current and non-current liabilities. IAS1 does not prescribe the format of the statement of financial position but regulates the minimum information that shall be included. Besides the minimum, entities may add additional line items, headings and subtotals if they are relevant to the understanding of the financial situation of the entity.

The income statement presents the results at the end of a period of activity. It presents information on the profit and loss and other comprehensive income. Similar to the balance sheet, the income statement does not have a standardized format. The IAS1 prescribes the minimum line items and it gives the entity a choice in presentation.

Statement of changes in equity, analysis of other comprehensive income and statement of cash flows are also required by the IAS 1 standard.

These statements are not enough to inform stakeholders though. Further numerical and verbal additions are required. These additions make up the notes, the content of which is regulated by the standard in the forms of general and specific rules (e.g. the notes must

present information on the specific accounting policies used) and also by the entity that decides upon other disclosures it wishes to present.

Traditional financial indicators provide information about property, financial and profitability situation. We can get a picture including:

- Structure of assets and liabilities,
- Asset efficiency,
- Debts,
- Liquidity,
- Profitability compared to various projection bases.

Traditional financial indicators used by organizations for performance evaluation are not able to provide adequate information to management. This is mainly due to financial accounting itself. Financial Accounting:

- Thinks in business years, typically one year,
- Processes most of the events that have taken place more precisely, some of the events, so-called economic events,
- Evaluate events in monetary terms,
- It is a closed system.

Accordingly, the limitations of traditional financial indicators used in performance measurement are as follows:

- traditional financial indicators reflect on the past, they are not connected to the future, to the strategy of the entity,
- their focus is short-term so they do not support long-term strategic goals,
- because of their fiscal nature they cannot reflect qualitative factors, even though performance analysis requires the review of both quantitative and qualitative elements
- as traditional financial indicators take the effect of past activities and consumer decisions into account, they are not fitting to prevent problems
- they are not of diagnostic nature, which means they reveal problems but not their causes (Demény and Musinszki, 2016; Fenyves et al., 2018).

3. The role of financial indicators in supporting strategic

3.1. The inclusion of financial indicators in methods supporting strategic decisions In today's highly competitive environment the financial indicators alone are not able to give direction for the future; typically they can give a view about some actions of the past, and so are retrospective, post factum indicators. Based on theoretical and practical experience, both financial and non- financial indicators need to be reflected in the benchmark.



Figure 1: Relationship between financial statements and Balanced Scorecard Source: Own edition

The balance between them has to be created and they have to be united in a complex indicator system. This is achieved by the Balanced Scorecard (BSC). The BSC is a balanced, performance indicators-based strategic evaluation system. Balanced as:

- it is trying to create a balance of the viewpoints in it,
- it takes into consideration objective, easy to quantify outcome indicators and also subjective performance indicators slightly depending on an individual opinion.
- it creates balance between the short- and long term purposes.

Performance indicators-based and strategic: cause the strategic aims and initiatives are translated to actual index-numbers by BSC, and as a result of this method the strategy takes place.

Evaluation system: because the target value is continually matched with the real achievement by BSC, the feedback can be feasible based on the gap analysis.

The viewpoints of the basic model are the financial, the customer, the internal processes, and the learning and growth viewpoint (Kaplan and Norton, 1992).

However, the basic model was not regarded as a definite model by the model creators. Over the last two decades different types of the basic model have been revealed taking different factors into consideration. The range of the stakeholders has expanded; the supplier, the future, social responsibility and sustainability have become independent viewpoints (Butler et al., 2011; Hágen and Borsós, 2015; Maltz et al., 2003; Veresné, 2013).

In time, all these thoughts have gained ground in legal norms as well. In accordance to the 2013/34/EU directive, besides financial processes of the entity, financial statements shall also reflect environmental and social aspects of business processes. The foremost aim of the directive is to ensure sustainability, to present environmental and social aspects of activities and performance. Namely, in order to achieve a sustainable global economy long-term profitability shall go hand in hand with social justice and environmental protection (Demény and Musinszki, 2016; Molnár, 2016; Molnár and Tumik, 2017).

How are the financial statements and the Balanced Scorecard linked? Let's briefly review each viewpoints. Based on the content of the viewpoints, we want to point out where and how the relationship between the financial statements and the BSC can be observed.

The key point of the financial perspective is the following: How do the owners judge the position of the company? Indicators of the financial perspective express how the strategy

and its implementation contribute to the financial position of the organization, most often to its profitability. Financial targets are mainly related to profitability, return on assets or increase in sales. Here, there are classic financial indicators such as sales, costs, profit, working capital. All of these indicators appear directly in income statements. However, revenue, cost, and profit are just the starting point. Based on these, a multitude of indicators can be defined. Including but not limited to:

- Sales Growth Rate,
- Operating Profit Margin,
- Incremental Fixed Capital Investment,
- Incremental Working Capital Investment,
- Earnings Before Depreciation, Interest and Taxes,
- Earnings Before Interest and Taxes,
- Return on Investment,
- Return on Assets,
- Return on Sales,
- Return on Equity.

For all indicators, the common feature is that the data needed for the calculation can be found in the financial statements (Tóth and Zéman, 2018).

The key point of the customer perspective is: How do customers judge the performance of the organization? When designing a customer perspective, it is necessary to identify the customers, market segments where the organization wants to compete. Financial goals can only be met by the organization if it produces products or services that enhances customers' value. We are not able to satisfy every customer's needs, so it is advisable to set target values by segment. Thus, the customer aspect basically focuses on the long-term relationship with the customers being fruitful and durable. Based on Kaplan's and Norton's recommendations (Kaplan and Norton 1992), the market share, product range, customer satisfaction, complaints, returns, customer group profitability, retained and new customers, etc. are the related indicators. The balance sheet shows customers, and customers can be evaluated (eq notes). Analytical records behind the financial statements include, among others, the number of old and new customers, and the profitability of customers / customer groups. At the same time, we do not receive information on market share or customer satisfaction. That is, financial statements and traditional financial indicators appear in the customer's perspective of the BSC, but they cannot fill the customer's point of view with content alone.

The key issue in the operational process perspective: Which processes should be provided by the organization with an outstanding performance? In this perspective, processes need to be defined where the organization has to deliver outstanding performance in order to meet its financial and customer goals. Earlier approaches focused on existing processes, not those that are relevant to the implementation of the strategy. Another novelty of Norton's and Kaplan's approach is the incorporation of the innovation process into operational processes. Long-term success requires future orientation, future consumer demand mapping, and what (new) products and services will be expected to meet expected needs (Kaplan and Norton, 1996). Includes indicators on supply chain management, organizational innovation, and process regulation. Typical indicators of the operational process perspective are product / service quality, efficiency, lead times. Financial accounting can only partially trace the organizational processes and thus the production processes. Accounting is suitable for tracking resource usage (cost accounting). Partially suitable for monitoring quality processes (eg scrap, scrapping). However, these capabilities in the accounting system only cover a few indicators. Financial accounting can therefore typically only support the BSC indirectly.

The key question of the learning and development perspective: How can the ability to develop and change be preserved? The learning and development perspective creates the backdrop to the success of the previous three perspectives. The short-term financial approach can easily result in the organization not paying enough attention to its employees, employees' capabilities, and information system. The organization can only achieve its strategic goals if it invests in people (trainings), systems (information systems) and procedures (information technology) and encourages its employees to work in line with organizational goals. So the three pillars of the viewpoint are:

- Employee skills,
- Information system capabilities,
- Consistency of motivation, authority, individual and organizational goals.

Measuring employee skills and motivating is not a classic accounting task. Financial accounting - like the previous point of view - can only support this viewpoint by building on the database of analytical records. For example, the simplest, most common indicator of productivity is the revenue per employee or to measure employee retention, most often the (key) fluctuation rate is quantified.

3.2. Financial indicators complementing supporting methods of strategic decision making

Another utilization of financial indicators is if they are not taken into account in themselves but are complemented by or combined with systems supporting strategic decision making. Nowadays several support systems exist that foster strategic decision making. Their categorization may be carried out as follows: on the basis of the aim of use (status analysis, strategic directions and goals, strategy execution, strategy follow-up); on the basis of the level of business environment analyzed (micro-, industrial market-, macro), on the basis of the entities status vs. analyzed environment or rather of the potential influence (tools analyzing internal and external environment) and also on the basis of the complexity of the methods applied (simple and complex systems).

Regarding strategic management and strategic decision making in a process approach, Laáb (2012) distinguishes four steps:

1. Situation Analysis: Here we can find assets that support the analysis of micro and macro environment.

2. The second step of the process is the design of strategic directions and goals. Among other things, it is developing future vision, defining strategic directions, as well as outlining the strategic target map.

3. The next step in the process is to break down the above outlined strategic directions. This includes, among other things, breaking down the institutional strategy into strategic actions, defining part and functional strategies, taking into account individual goals and implementing individual performance evaluation.

4. The fourth step of the process although the last one, is not the end of the decision making process, as the preparation of the reports of the top management reports, dashboards, and customer and supplier reports is a complete process, serving as a feedback on the correctness of the decisions.

In order to identify the main characteristics of the companies under investigation, it is necessary to carry out various micro and macro environmental surveys for entities, including:

- PEST (EL) / STEEP model
- Diamond model
- Porter's 5-factor model
- Industry lifecycle model
- Strategy group analysis

• SWOT analysis.

The most important method for analyzing macroenvironment is the PEST (EL) or STEEP model, which mosaic words have been created to shorten the use of the environmental element in English (Political, Economical, Social, Technological, Environmental, Legal and Social, Technological, Economical, Ecological, Political)

Although companies have no impact on these factors, the analysis is of paramount importance, as they can help determine the operating framework of companies (Ansoff, 1957; Levitt, 1965).

Among the sector specialities the most relevant is that affect financial indicators and liquidity because without it correct conclusions cannot be concluded (Rastogi and Trivedi, 2010).

The name of the Diamond Model is given because of its graphic appearance. The model is grouped around four factors of the national economy: quality of production factors, the relationship between company strategy and competition, local demand factors, and creation of related and supporting industries (Porter, 1990).

The industry is called a group of companies that produce the same or directly substitutable products/services (Porter, 1979). Mapping the boundaries of the industry contributes to mapping the structure.

An interesting point in the study of a particular group of entities is to answer the question how to interpret competitors in a given industry - for example natural monopolies, should or have to talk about substitute products. In assessing and defining this situation, Porter's 5-factors (force) model can provide a framework that takes into account the following factors: threat of new entrants, bargaining power of suppliers, threat of substitution products, customer bargaining power, intensity of industry competition. Reflecting on the framework can provide additional information to examine the profitability situation of entities in the industry, as it can provide explaination why certain industries are more profitable than other industries (Porter, 2008).

When analyzing the management of companies the target is to recognize Strategic Groups - companies that broadly follow a similar strategy - as this can help in comparing performances. In the design of strategic groups it is necessary to select classification characteristics of the strategy and to define the methods of group formation, which can be done with the application of two-dimensional nets and multidimensional analysis (Rastogi, Trivedi, 2010).

The biggest influence of the company is related to the microenvironment. The most diverse and colorful tools in this field are not accidentally created and applied:

- SWOT analysis for linking external and internal environmental elements
- (Product) Life-cycle analysis
- Widespread portfolio models for analyzing the market position of business units and products, and formulating strategic recommendations from these:
 - o Ansoff matrix
 - o BCG matrix
 - o GE-McKinsey model
 - o Hofer model
 - o Shell matrix
 - o ADL matrix
- Suitable for identifying corporate capabilities:
 - o VRIN analysis
 - o VRIO analysis framework.

SWOT analysis creates a link between external and internal environmental elements. Watkins (2007) stated that this is a method suitable for evaluating external and internal factors together (Watkins, 2007).

This procedure can be a useful as an organized summary of examinations, e.g. in the context of due diligence, environmental analysis, activities and sub-activities (Porter, 2008). Based the traditional four-factor SWOT analysis - (internal) Strengths, (internal) Weaknesses, (external) Opportunities, (external) Treats - the eight-factor analysis is also increasingly used, which simultaneously characterizes the present and future expected situation. With this analysis the followings will be implemented:

- Alignment of external (macro + micro) environmental factors and internal company characteristics;
- Coordination of the present and future situation;
- Matching results and strategic recommendations (Rastogi, Trivedi, 2010).

Traditional financial indicators calculated from financial statements cannot provide adequate information for the management, do not support strategic decisions. The reason for this is the methodology used in producing financial statements and the operational logic of financial accounting.

4. Conclusion and further research plan

The study dealt with two of the relationship between Financial Indicators and Strategic decisions and examined the appearance of financial indicators in BSC (not only in the BSC Financial perspective). Furthermore, the study also analyzed the way how financial indicators complement to the strategic environmental methodology

The specific relationship between financial indicators and support systems of strategic decision making comes from the fact that financial indicators not only complement measurement and analytic tools of environment and strategy but are necessities in an exact and complex analysis of strategy and business environment (good examples are the tools measuring and analyzing business life cycle, product life cycle, industrial trends).

The research has shown, based on the relevant literature and examples, how relevant financial indicators are reflected in the strategic decision-making methods, and provides a good basis for developing industry-based models in the future.

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IMPACT OF COMMERCIAL BANKS' CREDIT TO THE REAL SECTOR ON ECONOMIC GROWTH IN NIGERIA

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Abstract: The study examined the effect of commercial bank sectorial credit to the manufacturing and agricultural sub-sectors on economic growth in Nigeria with time series data from 1981 to 2015, using co-integration and error correction mechanism for the empirical work. A three equation model was specified to analyze this study, and the variables include; real GDP, bank sectorial credit to manufacturing and agriculture subsectors, monetary policy rate, financial market development, sourced from CBN statistical bulletin and also the interaction variables. The variables were tested for unit root using the Augmented Dickey Fuller approach and were found to be stationary. The empirical result revealed that commercial bank credit to the manufacturing and agricultural subsectors significantly affects economic growth in Nigeria both in the short run and in the long run. Furthermore, development of the financial sector enhances the growth effects of commercial banks credit to the manufacturing should encourage banks via deliberate policy to increase credits to these subsectors of the economy.

Key words: financial development, real sector, economic growth, commercial banks credits, agricultural sector, manufacturing sector.

JEL classification: E44, Q14.

1. Introduction

Nigeria is an oil rich country with an estimated proven oil reserve of 35 billion barrels and 100 trillion cubic feet of natural gas. The country depends heavily on this oil sector for both foreign exchange and government revenue. Hence, shocks in the oil price influences activities in the economy greatly. With the recent glut in the global oil market coupled with the activities of the Niger delta militants, the country slid into a deep recession in 2015. According to the National Bureau of Statistics (2016), the decrease in the growth rate of Nigeria has been as a result of fewer sectors experiencing rapid growth as well as the crude oil production seeing a decline.

On this basis, there has been a renewed call for the diversification of the productive base of the economy from crude oil. In this direction, the agricultural and manufacturing sub-sectors have come under focus. Undoubtedly, some attentions have been given to the manufacturing and agricultural sub-sectors in Nigeria by providing them with funds through various banking agents other than the deposit money banks in recent times. Among these agencies are the bank of industry (BOI), bank of agriculture, and the Nigeria Agricultural and Cooperative Bank (NACB). It is therefore appropriate to assume that high productivity in these sectors will translate into significant contributions to economic growth through the efforts of these agencies. However, research has shown that a number of small and medium

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scale manufacturing firms and agriculturist in developing countries including Nigeria, are faced with the challenge of accessibility to bank credits which can be attributed to the underdeveloped structure of our financial system, as compared with their counterparts from other parts of the world with well-defined and developed financial structure (Loening, Rijkers, and Soderbom, 2008). Hence, one constraint identified in the literature hindering agricultural and manufacturing sub-sectors is poor access to bank credits. This goes further to show that there is a vital missing link between the financial sector and the real sector of the economy. In view of the importance of stimulating growth in the real sector, monetary authorities around the globe strive to focus on ensuring a sound, reliable and stable financial system which can impact on the real sector growth to a larger extent. Indeed, it is has been argued that a well-developed, dynamic, well-functioning, and vibrant financial sector will lead to improved economic outputs performance (Levine, 1997; Demirguc-Kunt and Levine, 2008). This observation and findings prompted this study which is aimed at investigating the impact of deposit money bank credit to the real sector economy in Nigeria. The study seek to ascertain if financial sector development (financial deepening) enhances the growth effect of bank credit to the real sector in the Nigerian economy. The study is therefore an empirical verification of the finance-growth theory as posited by Goldsmith 1969 using time series data from Nigeria.

The general hypothesis tested in the study is given as:

H₀: Financial sector development does not enhance the growth effect of commercial credit to the real sector in the Nigerian economy.

The study is structured into five sections. Apart from section one which deals with the introduction, section two covers the review of relevant literature. The theoretical framework and model specification are contained in section three, while the empirical results are resented in section four. The conclusion and policy recommendations are presented in section five.

2. Review of literature

Several empirical examinations have been done in the area commercial bank sectorial lending and economic growth. However, the studies came up with mixed results.

Fredrik, Katarzyna and Sonja (2016) using Granger Causality test, examined the performance of the different types of finance institutions' credit on the manufacturing sector output of china for the period between 1997 and 2008. The analysis revealed that the state owned banks and rural credit cooperatives has a negative effect on manufacturing sector growth and also does not granger cause growth in the sectors. Policy banks and joint stock commercial banks was found to promote growth.

Avinash and Mitchell-Ryan (2009) employed vector error correction modelling technique to investigate the impact of sectorial distribution of commercial bank lending on economic growth in Trinidad and Tobago. They noticed that deposit money banks' credit play a significant role in the way households and corporate firms finance economic transactions. From their result it was revealed that there is a supply leading relationship between credit and growth within key sectors of the nonoil economy.

In Nigeria, several studies have been done on sectorial allocation of commercial banks credits and its impact on economic growth. Some of the studies including Adeyinka, Daniel and Olukotun (2015), Ogar, Nkamare and Effiong (2014), Ebi and Nathan (2014), Ebele and lorember (2016), Toby and Peterside (2014), Bada (2017), Uzomba, Chukwu, Jumbo and Nwankwo (2014), and Hassan (2016), found a positive and significant relationship between commercial bank to various sectors and economic growth in Nigeria for deferent time periods. The studies of Obilor (2013), Yakubu and Affoi (2014) and Anyiwe (2003) examined the impact of commercial banks credits (in aggregate terms) on economic growth in Nigeria.

They also found a positive and significant relationship between commercial bank credits and economic growth in Nigeria.

However, the study of Sogules and Nkoro (2016) which analyzed the influence of bank credits to agricultural and manufacturing sectors on economic growth in Nigeria for period of 1970 to 2013 found a negative relationship. While the impact of credit to agriculture was insignificant even at 10%, the impact of credit to the manufacturing sector on economic growth was significant. Similarly, the study of Imoughele and Ismaila (2013) on the impact of commercial bank credits to agricultural on economic growth in Nigeria revealed that the impact of credit to agricultural sector is statistically insignificant in Nigeria in the short run. From the above review, it shows that there is no consensus on the impact of commercial banks credit to the real sector on economic growth. Moreover, none of the studies considered the role of financial deepening (financial sector development) in enhancing the economic growth potential of commercial banks credit to the real sector of the economy. This is the area this study seek to address.

3. Theoretical framework and model specification

3.1.Theoretical framework

The study relied seriously on the finance-growth theory for its theoretical underpinning of the link between the financial sector and the real sector. The finance-growth theory is built on the traditional financial intermediation function of banks which enables banks to intermediate not only between the surplus and deficits units, but also between the financial sector and the real sector of the economy. The finance-growth relationship motivated the novel research of Goldsmith (1969) to validate the exact influence of finance on economic growth so as to improve upon the traditional banking theory that fosters the relationship between the various sectors in the economy.

This theory asserts a direct relationship between the financial sector and the real sector through the size of the financial sector. That is, as the financial system becomes more developed in terms of size and scope of activities, its contributions to economic growth increases through the provision of sophisticated debt instruments which enhances financing. The financial intermediation and growth theory rest on three pillars, known as the transformation mechanism which is determined by interest rate and the intermediation ability of deposit money banks. They are size transformation mechanism, maturity transformation mechanism.

According to Dewatripont, Rochet and Tirole (2010), these transformation mechanisms are basically the banks' ability to annex savings, pool it, and aggregate loans to the deficit sector; create liquidity by borrowing short and lending long; and also reducing both the cost of information and transaction cost, (finance collection, and investment sourcing), hence limiting the risk faced by individual creditors.

3.2.Model specification

The model is a modification of Goldsmith (1969) finance-growth model. According to the model as explained in the theoretical framework above, economic growth is a function of bank credit to the real sector. Also, the growth benefits of the credit to the real sector is enhanced by the development of the financial sector. In this study, the real sector is captured by agriculture and manufacturing sectors. The role of the financial sector development is examined using the interaction variable technique. The econometric form of the models for estimation are given as:

 $RGDP_{t} = \beta_{0} + \beta_{1}BCAGR_{t} + \beta_{2}BCMAN_{t} + \beta_{3}FINM_{t} + \beta_{4}MPR_{t} + \alpha_{1}e_{t-1} + U_{t}$ (1)

 $RGDP_{t}=\beta_{0}+\beta_{1}BCAGR_{t}+\beta_{2}BCMAN_{t}+\beta_{3}FINM_{t}+\beta_{4}MPR_{t}+\beta_{5}(BCAGR^{*}FINM)_{t}+\alpha_{1}e_{t-1}+U_{t} (2)$ $RGDP_{t}=\beta_{0}+\beta_{1}BCAGR_{t}+\beta_{2}BCMAN_{t}+\beta_{3}FINM_{t}+\beta_{4}MPR_{t}+\beta_{5}(BCMAN^{*}FINM)_{t}+\alpha_{1}e_{t-1}+U_{t} (3)$ Where;

RGDP = Real Gross Domestic Product of Nigeria (Proxy for economic growth) BCAGR= Total Commercial Bank Credit to Agricultural sector in Nigeria.

BCMAN = Total Commercial Banks Credit to Manufacturing Sector in Nigeria.

FINM = Ratio of M2 to RGDP (Proxy for Financial Development)

MPR = Monetary Policy Rate of the Central Bank of Nigeria

(BCAGR)*(FINM) = Interaction Variable for Agricultural Sector and Financial Development (BCMAN)*(FINM)=Interaction Variable for Manufacturing Sector and Financial Development The study employed the co-integration and error correction modeling technique to estimate the short run and long coefficients of the variables.

4. Presentation and Interpretation of Empirical Results

4.1.Unit Root Test:

The Augmented Dickey Fuller (ADF) test was adopted to test for stationarity. The result is presented in the table below:

Variables	ADF Test Statistic	ADF Critical Values (5% level)	Remark
RGDP	1.2545	2.9540	Non – stationary
DRGDP	3.1102	2.9540	Stationary
BCMAN	1.2861	2.9810	Non – stationary
DBCMAN	3.5477	2.986	Stationary
BCAGR	3.7633	2.9762	Stationary
FINM	3.5894	2.9511	Stationary
MPR	3.0346	2.9511	Stationary

 Table 2: Unit Root Test of Variables

From the above result, financial development, monetary policy rate and commercial banks credit to agricultural sub-sector were integrated of order zero, while real GDP, and commercial banks credit to the manufacturing sector were integrated of order one.

The above results implies that not all the variables are stationary at levels. Regressing non stationary variables may lead to spurious regression. However, non-stationary can only be regressed if they are co-integrated. Hence, the next step of the analysis is to test for co-integration.

4.2.Co-Integration Test

In order to test for co-integration among the variables, the Johansen Co-integration test was used. The test was based on trace statistics at 5% level. The result is presented in the table below:

Hypothesized No. of co-integrating equations	Eigenvalue	Trace Statistics	Critical value at 5% level	Probability
None*	0.876	122.488	69.818	0.000
At most 1*	0.505	53.551	47.856	0.013
At most 2*	0.448	30.309	29.797	0.043
At most 3	0.275	10.669	15.494	0.230
At most 4	0.002	0.078	3.8414	0.779

Table 3: Johansen Co-integration Test

*denote rejection of the hypothesis at 0.05 level

From the trace statistics in the above table, compared with its critical value at 5%, three co-integrating equations can be observed. This implies that the variables are co-integrated.

4.3. Short Run Error Correction Representation

Since the variables are co-integrated, it is safe to estimate the specified model. In order to examine the dynamic stability of the model the error correction representation model was estimated. The error correction representation was conducted based on the R-Bar squared criterion. In this case the lagged is selected automatically and redundant lagged values are omitted from the final parsimonious estimates. The error correction result is presented in the table below:

Variables	Equation 1	Equation 2	Equation 3
dRGDP(1)	0.631*	-	-
	(3.222)		
dBCAGR	12.815***	1.012*	2.384**
	(1.748)	(3.411)	(2.372)
dBCAGR(1)	-	-	1.030**
			(2.972)
dBCAGR(2)	-	-	6.501**
			(2.208)
dBCMAN	3.533***	1.295*	2.851**
	(1.725)	(11.953)	(2.380)
dBCMAN(1)	3.278**	6.258*	1.580
	(2.536)	(3.047)	(0.600)
dBCMAN(2)	3.278*	1.005*	5.459**
	(2.869)	(2.964)	(2.744)
dFINM	8.987**	4.158	2.900
	(2.118)	(0.776)	(0.556)
dFINM(1)	1.940***	5.531*	3.176**
	(1.931)	(3.150)	(2.243)
dFINM(2)	2.152**	6.816*	3.837**
	(2.301)	(3.021)	(2.607)
dMPR	17.464	-8.340	26.631
	(0.461)	(-0.206)	(0.769)
dMPR(1)	-	-	45.964
			(1.217)
d(BCAGR)*(FINM)	-	3.956	-
		(1.307)	
d(BCAGR)*(FINM)(1)	-	2.328**	-
		(2.685)	
d(BCAGR)*(FINM)(2)	-	1.723**	-
		(2.585)	
d(BCMAN)*(FINM)	-	-	9.7510**
			(2.225)
d(BCMAN)^(FINM)(1)	-	-	2.921**
10	0570.0	4045.0	(2.437)
dC	2573.3	1245.6	2746.1
	(1.641)	(0.854)	(2.120)
	-0.175	-0.108"""	-0.281
	(-1.769)	(-2.110)	(-2.884)
	0.878	0.910	0.946
	13.016[0.000]	11.805[0.000	15.034[0.000]
	2.439	1.978	
	KGDPG	KGDPG	KGDPG
IN	32	32	32

Table 4: Error Correction Representation

*significant at 1% ** significant at 5% ***significant at 10%

In the result above, Column 1, shows short run estimates of the specified model with the interaction variables. In Column 2, interaction variable of Commercial Banks Credit to the agricultural sub-sector and financial development was introduced. In Column 3, Commercial Banks credit to the manufacturing sub-sector and financial development was introduced. In all the estimates, the error correction terms (ECM) were properly signed with a coefficient of -0.175, -0.108 and - 0.281 for column 1, 2 and 3 respectively. Also, they were all statistically significant. This shows that the model is dynamically stable.

4.5.Long run coefficients of variables

The corresponding long run coefficients are presented in the table 5 below:

Coefficient	Equation 1	Equation 2	Equation 3
BCAGR	4.204*	7.910*	2.747***
	(3.285)	(2.737)	(2.118)
BCMAN	2.157**	7.930*	8.204**
	(2.192)	(2.487)	(2.130)
FINM	1.284**	5.985*	1.384**
	(2.460)	(2.974)	(2.317)
MPR	99.249*	3.805*	5.051**
	(4.616)	(2.370)	(3.149)
(BCAGR)*(FINM)	-	1.363*	-
		(10.907)	
(BCMA)*(FINM)	-	-	5.915*
			(3.149)
С	14623.9*	11462	9744.4*
	(4.161)	(1.724)	(4.132)

 Table 5: The Long Run Coefficients of Variable

*sig at 1% ** sig at 5% ***sig at 10%

The estimated long run coefficients of the selected variables using the autoregressive distributed lagged approach based on r-bar square is presented in the table above. In column 1 the growth model without interaction variable was estimated. In column 2 the interaction variable was introduced, in this column the interaction of credit to agricultural with financial development was introduced. In column three, the variable to capture the interaction between credit to manufacturing sector and financial development was introduced. All the variables including the interaction variables had positive sign and their impact were statistically significant.

4.6.Policy Implications of Findings

Following the results above these are some of the implications of the findings:

- i. Commercial bank credit to the agricultural sector has a positive and significant impact on economic growth in Nigeria both in the short run and in the long run. Hence the more credit the commercial banks grant to the agricultural sector, the more vibrant the economy will become.
- ii. Commercial bank credit to manufacturing sector has a positive and significant impact on economic growth in Nigeria both in the short and the long run. Hence, the more credit commercial bank grant to the manufacturing sector the more rapid the economy will accelerate.

- iii. The impact of monetary policy rate on economic growth is not statistically significant in the short run but highly significant in the long run. This shows that the relationship between monetary policies and economic growth is long run phenomenon.
- iv. Development of the financial sector has a positive and significant impact on economic growth in Nigeria both in the short run and in the long run.
- v. The growth potentials of the credit allocated to the agricultural sector and the manufacturing sector by commercial banks is greatly enhanced by development of the financial system of the economy.

Flowing from the above, the null hypothesis which state that financial sector development does not enhance the growth effect of commercial banks credit to the real sector in Nigeria is rejected while the alternative hypothesis is accepted.

5. Policy Recommendation and Conclusion

5.1.Policy Recommendation

In the light of the analysis and findings, this study therefore validated the hypothesis which state that financial sector development enhances the growth effect of commercial banks credit to the real sector in the Nigerian economy. The following recommendations are therefore considered necessary for short and long term implementations. They are:

1. The Nigerian apex financial authorities CBN, should encourage bank credits to these two sectors (agriculture and manufacturing) because it has incentives of boosting economic growth both in short and long run. Thus the more credit channeled to these sectors through government policies, the more vibrant the economy will become.

2. Also very important, is the impact of monetary policy rate (MPR) on economic growth, which was found to be significant in the long run. This shows that MPR has a delayed effect on savings and investment which may affect banks' ability to grant credits. CBN should put in place other measures that can respond quicker to get the desired result.

3. It is also worthy to note the key role of a well-developed financial system and its supplementary role to bank credit to the manufacturing and agricultural sub sectors. Development of the financial sector has a positive and significant impact on economic growth in Nigeria both in the short run and in the long run. Government should as a matter of deliberate policy ensure a well-developed financial system. This is because growth potentials of the credit allocated to the agricultural sector and the manufacturing sector by commercial banks is greatly enhanced by development of the financial system of the economy.

5.2.Conclusion

This study investigated the impact of commercial banks' credit to the real sector on economic growth in Nigeria with a major focus on the agricultural and manufacturing subsectors during the period 1981-2015, using data from the CBN bulletin. Following the objectives of the study, real GDP was estimated as a function of, bank credits to the subsectors, financial development (ratio of broad money supply to GDP), monetary policy rates, and the interaction variable (product of bank credit to subsectors and financial development). The empirical results confirmed the existence of both short run and long run effects of the aforementioned variables on real GDP except for MPR with only long run effects. This is an indication that the variables are consistent and hence robust.

The study therefore revealed that financial development has played a significant role in economic growth in Nigeria during the period covered by the study. The findings therefore, validate the hypothesis which states that financial sector development enhances the growth effect of commercial banks credit to the real sector of the Nigerian economy. The implication

of this is that government should be proactive and devise means to boost the Nigerian financial system so as to be able to attract not only local investments, but also foreign financial investments.

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CHANGES OCCURRED IN A PORCELAIN FACTORY DUE TO QUALITY MANAGEMENT SYSTEM IMPLEMENTATION

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Abstract: The issues approach in this research show the benefits of the implementation of ISO 9001 standard in different companies as well as the importance of certain criteria with respect to customer satisfaction and confidence. This standard specifies requirements for a quality management system and it is based on a number of quality management principles including a strong customer focus, the motivation and implication of top management, the process approach and continual improvement. The criteria taken into account help to improve the quality management system of the organization. The purpose of this paper is to identify the changes due to the implementation of a guality management system based on ISO 9001 standard in a porcelain factory, named S.C. Apulum S.A. and to analyse the customer satisfaction and confidence within the company considered through the implementation of the standard mentioned above. The analysis of customer satisfaction and confidence was achieved by taking into account certain measurable criteria established in the company considered, criteria that have been introduced into a formula. In conclusion, it is obvious that after the implementation of the requirements of ISO 9001 standard the situation regarding the quality process and product has been improved considerably. Also, the results show that there were several variations in the period considered (2010-2017).

Keywords: Quality Management System, ISO 9001, customer satisfaction, porcelain factory.

JEL classification: L00, L15.

1. Introduction

According to BS EN ISO 9000:2015 (The British Standards Institution, 2015) we can retain a definition for quality management system (QMS) as "QMS can be considered as a set of Policies, Procedures, Processes and resources used to achieve the organization objectives and desired results, by manages the interacting processes, resources required and inter-related parts of the business, which enables top management to best use the available resources considering the long and short term consequences" (Refaat and EI-Henawy, 2018). A QMS covers a broader range of activities than quality control and quality assessment by including both technical and management requirements (Carey, 2018). Also, it is an imperative of progress and a tool for the development of any factory, regardless the field of activity. Companies "have been forced" to open their doors to the culture of quality,

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which is often associated with the international management standard - ISO 9001 (Santos et al., 2012).

ISO 9001 describes the requirements of a QMS that needs to be implemented consistently so that the companies can produce the products according to customer's requirements, achieve customer's satisfaction, and achieve continual improvement on the effectiveness of their QMS (Sumaedi and Yarmen, 2015). It can be applied in different kinds of organizations all over the world (Ingason, 2015).

There are lots of benefits resulting from the implementation of a QMS based on ISO 9001 in a company. The most important are: the opportunities for infiltration in new markets; global deployment; increase exportation; increase productivity; improve the company's image in the market; improve the quality of the products and/ or services; reduction of defective products; cost reduction and reduction of the customer audits. Also, there are other important aspects, such as: decrease the rate of incidents; non-conformities and complaints; increase the profitability; improve the use of time and resources; clear definition of responsibilities; improve the work environment; increase customer's satisfaction and confidence; improve the understanding of customer's needs and expectations; increase sales (Santos et al., 2012; Priede, 2012; Aggelogiannopoulos et al., 2007).

In order to evaluate the effectiveness of the QMS and to gather information about working processes and how the organization accurately applies the policies and procedures, audit activities have to be applied. Also, they are useful to identify opportunities for improvements, which are critical to the success of an organization. During the audit tangible and intangible evidence needs to be collected, in addition, corrective and preventive actions can be taken according to the evidence gathered, therefore the quality audit can be consider as a key element and an important part of applying QMS.

We can define quality audit as systematic, independent and documented process of examining the QMS. These processes can be done by an internal or external quality auditor or by an audit team according to the organization size (Refaat and El-Henawy, 2018).

According to the International Organization for Standardization (ISO), as shown in Figure 1. there are seven Quality Management Principles (QMP) which are: QMP1: Customer focus, QMP2: Leadership, QMP3: Engagement of people, QMP4: Process approach, QMP5: Improvement, QMP6: Evidence-based decision making, QMP7:Relationship management. These principles are not listed in priority order. The relative importance of each principle will vary from organization to organization and can be expected to change over time (Refaat and EI-Henawy, 2018).





ISO 9000 series of international standards introduced the process approach as the base for better understanding requirements and to assist organizations in establishing their QMS. To have a clear understanding, it is recommended to define a process which is known as a set of interrelated or interacting activities, which transforms inputs into outputs. These activities require allocation of resources such as people and materials. In Figure 2 ISO 9000 illustrates a generic process for further understanding. The model of a process based QMS shown in Figure 2 illustrates the way organizations should manage numerous linked activities in order to function effectively to produce the required output (Magd and Nabulsi, 2012).



✓ Value-adding activities
 ✓ - - - ► Information flow

Figure 2: Model of a process – based Quality Management System Source: SES Quality

This paper approaches a study case which contains in the *first stage* the changes occured as a result of implementing the requirements of a QMS in accordance to ISO 9001 in S.C. Apulum S.A. and in the *second stage* the degree of customer satisfaction and confidence in the company considered.

2. Presentation of the S.C. Apulum S.A. Company

The company considered in the case study is S.C. Apulum S.A., it was founded in 1970 in the city of Alba Iulia. It is the largest porcelain manufacturer in Romania and also in South-Est Europe, with a variety of production:

- household and HoReCa articles on porcelain;
- decorative objects;
- frills.

Credibility of the "Apulum" results from the main strengths of the company, such as:

- quality of raw materials;
- modern technology used to manufacture different products;
- staff structure;
- the price-quality ratio perfectly adapted to the customer's requirements;

• modern and dynamic management, adaptable to the changes that may occur in the internal and external business environment.

Sustainable development of the company and its competitiveness are directly dependent on the proper functioning of the QMS. Certification of QMS according to ISO 9001 can help to maintain a long trusting relationship with consumers (Lukichey and Romanovich, 2016). Therefore, S.C. Apulum S.A. has implemented, certified and maintained, since 1998 until now, a QMS according to ISO 9001:1994. In 2017, the company was recertified in accordance to ISO 9001:2008 and in 2018 took place the surveillance audit with transition on ISO 9001:2015.

The requirements of the QMS reflect in the entire activity of the company, respectively logistics, production, quality control and commercial department (Apulum porcelain factory).

3. Case Study

The purpose of this research is to identify the changes occurred within the porcelain factory due to implementation of a QMS standard and in the same time to identify the degree of customer satisfaction and confidence in the company considered by using specific criteria in the activity field of S.C. Apulum S.A.

Following the implementation of ISO 9001 in the company considered, the company's problems regarding both the quality processes and products have been improved. Figure 3 shows the situation before and after implementation of ISO 9001.



Figure 3: The situation before and after implementation of ISO 9001 in S.C. Apulum S.A.

Figure 3 illustrates that the changes occured after the implementation of the requirements of ISO 9001 standard have led to the improvement of the QMS in the organization. Therefore, defining processes and developing work instructions have caused the elimination of unnecessary stages from the processes, saving time and reducing costs within the company. Also, employee training was one of the measures implemented to reduce the defects of the products manufactured in the organization. Therefore, the improvement of the product quality is reflected in the company's economic situation, which has increased considerably with the implementation of the QMS.

The company's clients are both internal and external (Table 1), aiming their satisfaction and confidence during 2010 - 2017. The criteria taken into account in order to identify the degree

of customer satisafction and confidence in the company considered, as well as their posibilities of interpretation are presented in Table 2.

External clients	Internal clients
IKEA	S.C. Servcom Imp. Exp.
Rody Time Italy	S.C. Prod Gabi 2000 S.R.L.
Fiskars Finland Oy	S.C. Metro Cash&Carry
Villeroy & Boch Germany	S.C. Selgros Cash&Carry
Befas Greece	S.C. Dany S.R.L.
Borras Spain	S.C. Pm Com S.R.L.
Porsgrund Norway	S.C. Elemar Cadia S.R.L.
Rosendahl Denmark	S.C. Sologvg S.R.L.
Mimco	S.C. Maramold
Ceramica Sant Pankrac Spain	S.C. Scodef Impex S.R.L.

Table 1: The most important clients of S.C. Apulum S.A.

The research methodology is based on brainstorming technique. It is one of the techniques for fostering group creativity by which ideas and thoughts are shared among members spontaneously in order to reach solutions to practical problems (Hosam & Shuhaila, 2018). The term was popularized by Faickney Osborn in 1953 in the book titled "Applied Imagination" (Litcanu et al., 2015). Some researchers questioned the effectiveness of comparing group brainstorming technique with individual idea generation. However, to generate ideas solidarity is a challenging task because of the limit of individuals' experiences, knowledge and perspectives (Hsu et al., 2018).

In group creativity, the unique brainstorming rules introduced by Osborn are: the quantity is desirable, there is no criticism and the wildest ideas are welcomes, because combining them can lead to optimal solutions in order to solve problems. In this case, personality traits are one of the diversity that should be explored in group creativity (Zainol et al., 2012). Also, the essential ingredient to start brainstorming is that all comers have an equal input to the session (Krone, 2017).

The criteria applied in the study case as well as their possibilities of interpretation were chosen by using brainstorming technique. For this purpose, the moderator – C.A. chosen by the manager described the problem. Also, the manager selected the following participants: quality manager:I. L., production coordinator: C.A., chief of technical department and development:G. A., mills responsible: O. I., forming responsible: B. P., firing responsible: B. S., packing responsible: N. C. They received an invitation that contained the name of the meeting, the issue to be discussed, the date, the time and the place. Also, the moderator led the meeting and he ensured compliance with the rules established by Faickney Osborn. Table 2 shows the results obtained following the application of brainstorming technique.

Table 2: The criteria taken into account in order to identify the degree of customer satisfaction and confidence and their possibilities of interpretation

Critorio	· · · · · · · · · · · · · · · · · · ·	Possibilities of	
Criteria		interpretation	
Evolution of c	lients business	∆>0	
		∆≈0	
		Δ<0	
Duration of colaboration		Over 10 years	
		Over 7 years	
		0 years	
Questionaire	Relationships with competing firms	Yes	
		No	
	Weight value of Apulum's products/ client	100%	
	business	75 ÷ 100%	
		50 ÷ 75%	
		25÷ 50%	
		0÷ 25%	
	Client forecasts (Collaboration with S.C. Apulum S.A.)	Very good	
		Good	
		Weak	
		Very weak	
		Without collaboration	
	Advertising for S.C. Apulum S.A.	No	
		Yes	
Complaints		No	
		Yes	
Constant orde	ers	monthly	
		Over 8/ year	
		Over 4/ year	
		Over 1/ year	
		0	
Usage of Apu	lum`s brand	Apulum	
		Apulum + other brand	
		Other brand or without	
		brand	

Every possibility of interpretation had a unique score. In order to find the customer satisfaction and confidence degree, the criteria mentioned in Table 2 were applied for all (internal and external) customers, individually, obtaining a score for each criterion, for each customer. Then, an average for each criterion was calculated for all internal and external customers considered in the case study. After that, the average obtained was used in a formula in order to calculate the degree of customer satisfaction and confidence. Figure 4 presents the results of the research.



Figure 4: The degree of customer satisfaction and confidence (2010-2017)

The results shows that in the mentioned period the satisfaction and the confidence of the internal clients was higher than from the external clients, this may be due to the adaptation of the organization to the new customers' requirements, as well as on the strength of increasing the image of the organization on the internal market. The highest score obtained for external clients was 6.75 in 2014 and 8.43, also in the same year for internal cliens. The internal score was higher with 1.68 than the external score. This difference may be due to the evolution of clients business and duration of colaboration, because in the period considered the company won new external clients. The lowest value was 4.56 in 2017 for external clients and 5.34 in 2016 for internal clients. In this situation, the external score was lower with 0.78 than the internal score.

In terms of the evolution of the external score during 2010-2012 there was a decrease, followed by an increase between 2013-2014 and another decrease in the last three years of the period considered. Regarding the internal score among 2010-2012 there was a growth, then in 2013 there was a fall, followed by an increase in 2014. In 2015-2016 there was a decrease of the internal score while in the last year there was a rise. These variations depend on the criteria considered. For example, if the external clients had relationships with other competing companies the score for this criterion was lower. Also, another criterion referred to the constant orders. It took into account only the frequency of orders and not the quantity of products ordered. Therefore, the external score was influenced by this criterion, because the external clients ordered a larger quantity of products with a lower frequency, while internal clients ordered a smaller quantity of products with a lower frequency. Also, another cause of the difference between the external and internal score was due to the fact that 100% of the internal clients used Apulum's brand, while only 10% of the external clients used Apulum's brand and others brands.

4. Conclusion

The purpose of this paper is to identify the changes appeared in S.C. Apulum S.A due to the implementation of a quality management system based on ISO 9001 and to analyze the customer satisfaction and confidence.

The situation shows that after the implementation of ISO 9001 the quality of the products and processes developed in the compay has increased considerable, thus influencing the overall success of business activities by improving the economic effects associated with quality.

The customer satisfaction and confidence analysis was obtained by applying the brainstorming technique in order to establish the criteria taken into account and the formula used to calculate the internal and external score. The results of the study indicate an irregular variation of customer satisfaction and confidence. Considering the criteria used in order to identify the internal and external score, it is normal to have different variations between the scores. Also, before the implementation of a quality management system in the company there was no situation regarding the customer satisfaction and confidence.

Likewise, there is a biunique relationship between improving the quality management system and assessing the customer satisfaction and confidence, because they are mutually conditioned. Also, the annual customer satisfaction and confidence assessment allow toidentify the quality management system processes that need to be improved.

5. Acknowledgements

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MOBILE APPLICATIONS AND YOUTH INVOLVEMENT IN FARMING

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Abstract: According to the UN forecasts, by 2020 the world population will be over 9 billion people, to feed this huge amount of people the food production should grow by 70%. It means that the number of farmers, who are the main suppliers in food production, should be increased. How to enlarge the number of rural farmers? By getting young people interested in farming and agriculture. But nowadays young people are prone to move to big cities. Why young people are not involved in agriculture, what initiatives are being taken to support youth in agriculture and what recommendations can be given, so that young people stay in it? Using the potential and energy of youth in agriculture, comprehensive and integrated policies, programs for markets and trade should be available with special attention to promotions and conditions for young people, who are going to be farmers. In this paper we propose mAgriculture tools such as mobile phones and its applications from throughout the world as an instrument to draw attention of young people to agriculture, showing useful and best examples how farmers could increase their profit and yield through them. These applications help to display information about current prices of agricultural products, historical charts and future prices, comparing the prices of products at different intervals, helps to find significant trends and correlations, also farmers receive information on contracts and the latest news from the agricultural area etc.

Keywords: growth, innovation, farmers, technological change, economic development, yield.

JEL classification: O3.

1. Background

By 2030, nearly 60% of the world's population will live in urban areas, which will transform the shape of consumer demand and increasing pressure on land and other resources (FAO, 2017). The proof for this statement is shown in the figure below, where we can see that in 2030 the urban population will be five billion people in the world:





In other words, the entire expected population growth - from 7 billion to 10 billion - will be associated with the growth of the urban population and a stable decreasing number of the rural population. The overwhelming majority of immigrants are young people aged 15-35 years. Such age qualification is due to the fact that people of more solid age prefer to stay in rural areas where they were able to arrange and are afraid to change something in life, valuing the acquired social status. Why do young people immigrate to big cities? Sociologists call the search for a better life is the main reason for urbanization. Indeed, with each new generation, life in rural areas become less and less profitable, especially against the background of the lifestyle of citizens who are not burdened with heavy physical labor. What should be done to make it interesting for them to live and work in the countryside? What will be the situation in 2050 when the demand for food is projected to be 70% higher? Motivation is a stimulus that produces action and directed action is a primary function of management (Barnard et al., 2013). Atkinson et al. (1978) referred motivational factors as one of the important determinant of aspirations and further added that a person with motive of success have higher aspirations than the person with motive to avoid failure. As shown in the figure below, what can be a bold motivation for decreasing number of young people which growing at a geometric rate in agriculture to stay in rural places and be involved in agriculture around the world?



Figure 2: Youth involvement in agriculture in the world (1991-2017) Source: Worldbank.org (2018) World Population Prospects

One of the answers is mAgriculture, which is a subset of eAgriculture, referring to the delivery of agriculture-related services via mobile communications technology (Brugger, 2011). Mobile communication technology includes all kinds of portable devices like basic mobile phones, smartphones or tablet devices and etc. In many countries, there is a projected shortage of skilled young workers. Despite the fact that young people are often considered as "digital natives" and the most of them has access to the Internet and mobile devices, however many of them do not have the necessary digital skills to work in a particular sectors of the economy (Theguardian, 2014). Governments, social partners, private sector, academia, civil society and other key stakeholders should ensure that young people can improve their digital skills so that they need to take advantage of employment or business opportunities and build an open digital economy and society. Young people with advanced digital skills have the opportunities to earn more and contribute to the prosperity of the digital economy. Digital skills are increasingly needed in various workplaces around the

world, because information communication technologies are rapidly transforming jobs in various sectors, including agriculture, the entertainment industry, financial services, health care and transport etc.

2. Usefulness of mobile applications in agriculture and its positive effect on yield and income of farmers

Mobile phones can provide better access to farmer advisory services directly on-farm and facilitate information sharing on a large scale, improve farmer's decision-making processes (Payene and McCarthy, 2010). Nowadays, more and more farmers on their gadgets running Android or iOS are installing specialized applications that focus on the agricultural industry. Positive correlation revealed between the benefits of mobile applications (but not implementation level) with the material wealth and education level of farmers. As in the case of specific technologies (e.g use of high-yielding seeds), probably the use of mobile applications will bring great benefits to farmers with a higher level of education and the best material wealth (Cole and Fernando, 2012). Let's monitor some useful applications around the world. Such as,

- Agrowdata (USA). This mobile application displays information about current prices for agricultural products. The application has an user-friendly interface that can demonstrate historical charts and future prices of products. Comparing the prices of products at different intervals helps farmers to find significant trends and correlations.
- 2) Agrivi (Europe) is one of the most successful startups in Europe. This platform was created to manage modern vertically integrated agriculture. Using Agrivi applications, farmers can monitor product quality, track all work, and also follow generally accepted standards and the owner of any agribusiness can get both a complete and simplified aggregate analysis of the activities of his enterprise. The software package consists of applications that are suitable for both small farms and cooperatives, and even large agro-industrial enterprises.
- Cocoalink (Ghana) connects cocoa farmers with information about good farming practices. Evoucher (Zimbabwe) helps cash strapped small scale farmers' access agricultural inputs.
- 4) Green Way (Myanmar) application is one of the one game-changer among agricultural apps which was launched in 2016. The platform provides farmers with up-to-date information on everything from weather and climate change to crop prices and advice on pesticides, fertilisers.
- 5) The Agronomist's Diary (Russia) is a simple and convenient application for keeping an electronic book on the history of crop rotation fields. It can work with an electronic map of the fields, keep a history of the location of crops, a diary of technological operations and see the consumption of materials in each field, the farmer can save time on the exchange of information between company employees working in the fields and in the office.

ICTs also have a noticeably positive effect on income growth in developing and developed countries (Roller and Waverman, 2001; Waverman et al., 2005). Mobile phones are being used to help raise farmers' incomes, making agricultural marketing more efficient, lowering information costs, reducing transport costs, and providing a platform to deliver services and innovate (Kevin, 2011; Sife et al., 2010; Donner, 2007).

According to research conducted by Oracle, 32% of the representatives of the new generation said that in the successful implementation of tasks are helped by "working applications". Today, our mobile devices are not different from a PC. They have all the same familiar applications to PC. A personal computer is simply more powerful, its screen is larger

and the keyboard is more convenient. But after 5-10 years, coming home or to the office, smartphones will be connected to the big screen, and this design will replace familiar computer. That is, mobile devices will not be complementary, but the backbone of society. A good example can be given by Daniel Nshimiyimana, who is a tech-savvy Rwandan young farmer who turned his grandparents' godforsaken land into a thriving farm producing bananas. "The mobile applications help by telling me about the quality of seeds I have to plant, the quantity of fertiliser to use the distance between the trees. One bunch of (my) bananas used to weigh 30 kilos. Now they are 40, 50 kilos," Nshimiyimana said proudly, pointing at the trees planted on his farm (Win, 2018). There are a bunch of examples when farmers receive positive effect on yield and income using mobile applications in their farms. The two examples (Mexico and Kenya) can be raised up below regarding the usefulness of the mobile applications.

First, Rezatec, a leading provider of geospatial data analytics to the Infrastructure, Forestry and Agribusiness sectors in the world, has launched a new mobile application aimed at helping Mexican farmers improve crop (wheat and sugar) productivity and stabilise their incomes to facilitate rural community economic development. Wheat farming in the Yagui Valley in Mexico is at the forefront of cutting edge technologies for wheat compared to other parts of the developing world. Average wheat yields are currently around 6.2 tonnes per hectare, with considerable variability every year (Haskell, 2018). Annual profits from wheat production in the Yaqui Valley varied by 60% per tonne from 2009 to 2017, with a steady rise in the total cost of production over time. Better management practices by smallholder farmers for nitrogen application, irrigation and weeds would help to improve yields and productivity (Haskell, 2018). The sugarcane industry also currently generates more than 930,000 direct jobs and employs another 2.2 million people directly, contributing approximately US \$2.5 billion per annum to the Mexican economy (Haskell, 2018). The average yield is currently close to 70 tonnes of cane per hectare however smallholder farmers have below average productivity partly because they have not adopted modern methods of agriculture. Second, ICow, the best mobile application in Africa, is intended to remedy the plight of Kenyan farmers. More than 20,000 dairy producers use information services to efficiently and economically manage their farms, reducing operating expenses and increasing profits by twice. ICow application concluded that the majority of dairy farmers receive only a small part of the possible income because they use outdated methods and inefficiently manage their farms. Technologies are developing by leaps and bounds, Africa is the second largest region in terms of subscribers after Asia. Despite the fact that in many places there is not even light, every fourth Kenyan uses mobile services. Therefore, should not occur.

3. Significance and importance of mAgriculture tools and its impact on getting young generation interested in farming

In agriculture, as in other areas of the economy, the innovation process is characterized by consistency, cyclical nature, probability, social and environmental importance. Innovation, according to many academic economists and others, is the end result of the innovation process and finds expression in the form of a new or improved product or technology that is marketed and used in practical activities. Several studies (Selassie, 2001; Oladele, 2006; Adesope et al., 2007; Salau et al., 2008) have pinpointed the importance of information in agricultural development and its potential in improving the effectiveness of rural development in general.

May et al. (2007) and Yekini et al. (2012) also identified that ICT had the potential to reduce poverty and improve livelihoods by empowering users with timely information and knowledge, reducing transaction costs, and appropriate skills for increasing productivity.

Tabla	1	A ariaultura	aaniaaa	and r	raianta	around	the world
I able	1. 111/	Agriculture	Services	anu p	JUJECIS	arounu	the world

Internet platforms: many governments and research institutions offer or work towards				
comprehensive internet	platforms that provide access to all relevant information.			
Philippines:	Government-operated platform that provides comprehensive			
e-extension	information. The innovative features are online training courses on			
	a broad range of different topics.			
India: Agropedia	Agropedia also offers a crop-specific library, blog and chat.			
Pakistan:	Pakissan.com is the first and largest agricultural web portal in			
Pakissanvii	Pakistan, providing a platform where the entire agri-community can			
	connect with each other, sharing ideas, experiences and			
0	Information.			
Call center approach	: on their mobiles, farmers can call a tele-center where agents –			
usually agronomists –	answer their questions and provide vital information on cultivation			
The agente also answe	anung, imgation, disease treatment and other input-related issues.			
Bangladosh	Launched by the second biggest mobile operator Ranglalink in			
ligyasha 7676	December 2008 as the first mobile-based agroup for service in			
Jigyasila 7070	Bandladesh			
Kenya: Kenya	KEHL started in Sentember 2009 and provides agricultural and			
Farmers' Helpline –	horticultural information, advice and support. The service primarily			
m-Kilimo	targets individual farmers and will also be accessible to agriculture			
	extension facilities.			
SMS and voice messa	ige delivery (push and pull).			
SMS and voice messa Thailand: *1677	ge delivery (push and pull). Subscribers receive free information on market trends, commercial			
SMS and voice messa Thailand: *1677 Farmer Information	Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important			
SMS and voice messa Thailand: *1677 Farmer Information Highway	ge delivery (push and pull). Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions.			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools	Ige delivery (push and pull). Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009.			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & 			
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SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend Chile: Mobile	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend Chile: Mobile Information Project	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. The MIP platform organizes searchable content and passes it to farmers via SMS. 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend Chile: Mobile Information Project (MIP) / DatAgro	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. The MIP platform organizes searchable content and passes it to farmers via SMS. 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend Chile: Mobile Information Project (MIP) / DatAgro Mexico: DigitalICS /	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. The MIP platform organizes searchable content and passes it to farmers via SMS. It was developed together with a Mexican coffee cooperative to manifer compliance with fair trade requirements. The configuration 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend Chile: Mobile Information Project (MIP) / DatAgro Mexico: DigitalICS / CAMRANDI	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. The MIP platform organizes searchable content and passes it to farmers via SMS. It was developed together with a Mexican coffee cooperative to monitor compliance with fair trade requirements. The application premets inspectors through every step of the survey precess. 			
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SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend Chile: Mobile Information Project (MIP) / DatAgro Mexico: DigitalICS / CAMRANDI	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. The MIP platform organizes searchable content and passes it to farmers via SMS. It was developed together with a Mexican coffee cooperative to monitor compliance with fair trade requirements. The application prompts inspectors through every step of the survey process, with both text and audio. The latter option compensates for the small screen on the phone, and helps farmers with literacy problems to the standard screen and the phone. 			
SMS and voice messa Thailand: *1677 Farmer Information Highway Nokia Life Tools Uganda: Farmer's Friend Chile: Mobile Information Project (MIP) / DatAgro Mexico: DigitalICS / CAMRANDI	 Subscribers receive free information on market trends, commercial crops (rice, vegetable and fruit), livestock and fisheries, important news updates and warnings on weather conditions. Launched in India in 2008, Indonesia and China in 2009. Information related to commodity prices, commodity news, agri-inputs prices, weather forecasts and agricultural tips & techniques. Farmers can search for agricultural tips through an SMS-based database, covering crop and livestock, pest and disease control information, planting, storage and harvesting tips, as well as regional weather forecasts. The MIP platform organizes searchable content and passes it to farmers via SMS. It was developed together with a Mexican coffee cooperative to monitor compliance with fair trade requirements. The application prompts inspectors through every step of the survey process, with both text and audio. The latter option compensates for the small screen on the phone, and helps farmers with literacy problems to follow the process. 			

Source: Mobile applications in agriculture. Fritz Brugger, 2011

A combination of mAgriculture services and projects from Asian, African and Latin American countries are represented in the figure above due to an increasing number of population and need on food in these continents. The functional essence of the development of innovation is to eliminate the difference between the state of the latest scientific, technical knowledge and production practices. Adoption of innovation contributes:

- the intellectualization of labor in agricultural production, increasing their knowledge-intensiveness;
- achieving a high technological level of production;
- expanding the range, improving the quality and competitiveness of products;
- efficient use of all types of resources;
- improving working conditions;
- reduce environmental pollution;
- impact on the structure of reproduction in agriculture in accordance with the changing needs and the external environment.

Nowadays the mobile phones as one of the mAgriculture tools has become a symbol of prestige, social positions and fashion trends. The latest mobile phone model has certainly impressed others, especially young people. And why we can not getting interested young people in farming with what they are so impressed?



Figure 3: Mobile subcriptions to outnumber the World's Population Source: Ericsson. United Nations

From the figure above, we can draw the following conclusion: in near future mostly all of us will be an active and modern users of more than one mobile devices. Advantages of mobile devices in agriculture are huge (FAO, 2011):

- 1. It will help to be in touch: among other things, the main advantage of mobile phones is that the farmers can always contact extension workers anytime wherever they are.
- 2. It will help to improve the farm's performance: a mobile phone will become an indispensable assistant in farmer's business. With it, they will constantly be in touch with employees and will be aware of their activities in their absence.
- 3. Simple accessible navigation system: the latest models have a navigation function and a GPRS system. If a mobile phone is equipped with a navigation system, it gives them an opportunity to receive information about its location.
- 4. Data transfer: modern mobile phones are created using Infrared technology and Bluetooth which allows users to exchange information in seconds.

5. Modern mobile phones are equivalent to minicomputers. Phones have access to the global Internet and telephones are adapted for different operational systems such as Windows etc.

4. Conclusion

On the threshold of the 21st century, the most important key condition for accelerated progress in socio-economic development is an effective innovation policy - an activity whose ultimate goal is to introduce new, advanced equipment and technologies, forms of labor and management organizations based on the achievements of scientific and technological progress. The dynamic social and economic development of many countries in the world should be based exclusively on innovations, the consequences of which have become strategically important. Due to increasing number of young people and their obsession with the devices, such as mobile phones, we can draw their attention to the agricultural sector. They may enlarge the number of small-scale, middle-sized and large farmers, who are ready to help with the food production, which growing exponentially in the world. From aforementioned study we discovered several types of mobile applications throughout the world in Asia, Europe, Africa and the USA. These applications vary from each other in different parameters; guickly and accurately calculate the amount of medications required for the preparation of plant and meat products; offer owners of agribusinesses to discover new methods of growing crops and highly efficient methods of harvesting; provide techniques for controlling all pests, including insects and weeds; the utilities which able to accurately identify various plant and animal diseases, etc. Attracting youth to agriculture is crucially important in all countries around the world - labor resources in agriculture are aging, all fewer people go to work in this sector. According to the Food and Agriculture organization, there are very few young specialists in the agricultural sector, especially in Europe: in 2013 from 10.8 million farm managers only 6% were younger 35 years. A survey of farmers conducted by Eurostat, showed that more than half EU farm managers reached age 55 years and older. We should take into consideration these simple and cheap applications in helping to engage the younger generation in agriculture before switching to robots, artificial intelligence and machine learning. In order to raise the motivational level of youth to stay in countrysides and be involved in farming, we can use a few methods, for example: motivational trainings, young farmers forums, internships, field trips, dual trainings, etc. In addition, many organizations can be involved directly in the implemention of motivational tools, the only question is literacy and systematic work of staff services. In conclusion, it is worth noting that if the objective parameters of the external environment not conducive to motivation for agricultural occupations, effectively implementing these tools will be problematic. So, while the highest growth rate will demonstrate average wages in the "finance" and "public administration" is not possible speaking about any significant motivation for young people of their involvement in the agriculture. Digital technologies has already become part of our lives. New ideas and startups from our youth, as well as from organizations, universities and companies around the world will help unlock the potential of food and agriculture to reduce poverty, as well as to empower young people and ensure equal opportunities to obtain information, technology and markets. Today our common task is to provide the new generation with the most intuitive and problem free user experience in farming sector. Indeed, despite the general idea that young people can make any kind of work, Generations X and Y also prefer to avoid inconvenience in their lives at all costs.

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Bio-note

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MOBILE BROADBAND AND ECONOMIC GROWTH IN NIGERIA

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Abstract: The scale of diffusion of mobile wireless broadband technology and its transformational effect across all sectors of the economy cannot be over emphasised. It enables the creation of new business processes/product innovation, thereby boosting job creation. as well as raising economic growth and productivity. This suggests that the mobile broadband is a general-purpose technology capable of producing a protracted critical mass effect at a certain threshold of penetration. It is against this backdrop that this paper examines the impact of mobile broadband on economic growth in Nigeria. Using the Endogenous Growth Model, we employ ARDL Bounds Testing Approach and Toda Yamamoto Granger Causality test on guarterly data from 2001 to 2016, to estimate the growth effect of mobile broadband. The findings show that mobile broadband is impacting economic growth positively in the Nigerian economy. It is therefore imperative for policymakers to design policies that will increase access to broadband infrastructure to both the unserved and underserved. It is also imperative to enact policies and regulations that can stimulate the economic impact of mobile broadband technology by strengthening the capacity of the economy to fully absorb the transformational benefits and make productive use of it as a General-Purpose Technology.

Keywords: mobile broadband; economic growth, ARDL model, Toda-Yamamoto Granger Causality test, Nigeria.

JEL classification: O31, O33, O47.

1. Introduction

There is a growing recognition of the transformational role mobile internet broadband play in enabling economic development among academics and policy makers around the world (World Bank, 2016; UNDP, 2016). The United Nations and the World Bank have both identified internet broadband as very crucial in empowering people, lifting people out of poverty through job creation, and creating a conducive environment for business and technological innovation as well as enabling developing countries to achieve the targeted Strategic Development Goals. This growing recognition of the economic impact of broadband penetration has spurred massive investment and deployment of broadband infrastructure in both developed and developing countries over the last decade (Minges, 2015).

Mobile wireless broadband deployment in most developing countries have witnessed unprecedented rapid growth in the last decades. This is largely due to a number of factors such as privatization and trade liberalization policies, as well as advances in telecommunication technology. All these have given rise to lower network installation cost and greater service affordability (GSMA, 2014; Minges, 2015). The scale of diffusion of

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mobile wireless broadband technology and the transformational effect it continues to have across all sectors of the economy cannot be over emphasized. It enables the creation of new business processes/product innovation and thereby boosting job creation. It also raises economic growth and productivity. This suggests that the mobile broadband is a general-purpose technology capable of producing a protracted critical mass effect at a certain threshold of penetration (Bresnahan and Trajtenberg, 1995; Roller and Waverman, 2001; Koutroumpis, 2009).

Investments in mobile wireless broadband infrastructure and its corresponding adoption have witnessed exponential growth rate in Nigeria over the last decade following the liberalisation policy reforms of the Nigerian Telecommunication industry in 2001. With the poor state of the fixed wire/wireless internet infrastructure deployment in Nigeria, mobile broadband continues to be a major source of internet access for the majority of the citizens accounting for over 95% of total internet connections in the country and estimated to have contributed over \$6 billion to national GDP in 2016. The mobile broadband market grew from less than 400,000 active subscribers in 2001 to approximately 92 million active subscribers in the last quarter of 2016. This account for a penetration rate of 48% of the total population, which is well above the 20% threshold level that is required for countries to achieve the critical mass that will enable economic benefits of broadband investment (Nigerian Communications Commission, 2016).

Even though the social and economic importance of mobile broadband has now been recognized by policymakers and researchers, a thorough survey of the extant literature reveals that there is a paucity of empirical studies on the long-term effect of mobile broadband network penetration on economic growth in Sub-Saharan Africa (Minges, 2015). Most of the existing studies have focused either on developed countries in the European Union and OECD countries (Waverman, Meschi and Fuss, 2005; Qiang and Rossotto, 2009; Koutroumpis, 2009; and Czernich et al., 2009) or developing countries in Latin America and the Caribbean (Garcia Zaballos and Lopez-Rivas, 2012). Out of the few studies that have investigated the long-term effect of mobile wireless broadband on economic growth in Sub-Saharan Africa, a great number of them have been panel studies plagued with issues of oversimplification of heterogeneity across countries giving rise to biased coefficient estimates (Waverman et.al., 2005; Deloitte 2012). In Nigeria, the study by Olusola and Christianah (2013) listed the benefits of broadband penetration to the Nigerian economic development. Thus far, no known country specific time series empirical study has been carried out in Africa, to understand the relationship between mobile broadband network penetration and economic growth. Therefore, this study attempts to fill this research gap.

2. Overview of Mobile Telecommunication in Nigeria: Stylized facts

Nigeria has one of the largest mobile telecommunication industries in Africa, worth over USD 60 billion, and contributes an average of 8% to GDP over the last decade and estimated to contribute 25% of GDP by 2025 (Nigerian Communications Commission, 2016). The industry provides mobile voice and text message communication services on one hand and provides mobile broadband services on the other hand. With rising but relatively low mobile voice and broadband penetration rates of 81.43% and 49.29% respectively, there is growth potential and thus the sector continues to attract considerable investment into the country (GSMA, 2014).

The aggregate investment into the Nigerian telecommunication industry grew from US\$50 million in 2001 to US\$ 68.2 billion in 2016. For instance, out of the total investment flow into the telecommunication sector in Sub-Saharan Africa between 1998 and 2008, estimated to be US\$ 5 billion a year, it was reported that Nigeria and South Africa alone accounted for over 60% of the investment. The remaining 40% was distributed among all the other

countries in the sub region (Foster and Briceño-Garmendia, 2011). Indeed, over 75% of the Foreign Direct Investment capital stock invested in the Nigerian Telecommunication sector has concentrated in mobile network operations, although fixed-line networks have started to experience an upsurge in investments as well. It is also worthy to note that most of the investments have been green-field investments rather than the acquisition of existing networks (National Bureau of Statistics, 2016).

The mobile telecommunication sector in Nigeria is classified into two categories according to technology type; Global System for Mobile Communications Technology (GSM) and Core Division Multiple Access Technology (CDMA). GSM Mobile connections are by far the most dominant form of mobile subscriptions and accounted for 99.09% of the total telecommunication subscribers in the country as at December 2015, up from 98.45% a year before, leaving CDMA with only a marginal share of the total telecom subscriptions. The share of GSM subscriber market continues to grow over the past year in contrast to a corresponding decline in the market share of CDMA from 1.46% subscriptions to 0.79% between March 2015 and March 2016. The dominance of GSM over CDMA is not unique to the Nigerian mobile telecom industry alone but it is rather due to the flexibility it offers subscribers to switch networks as well as roaming accessibility (Nigerian Communication Commission, 2016).





Source: National Bureau of Statistics (Nigeria), 2016.





3. Literature Review

3.1. Theoretical Framework: Endogenous Growth Model

The theoretical foundation underpinning the relationship between mobile broadband network penetration and aggregate economic growth is the endogenous growth theory due to its emphasis on both technological effects and network externalities on the economy. The technological effects of mobile telephony are concerned with improving cost efficiency and thereby increasing productivity through product and process innovation, while the network externalities is concerned with the indirect non-compensational marginal benefits that subscribers derived from being on the network at a certain subscription percentage threshold (Katz and Shapiro, 1985; Capello and Nijkamp, 1996). The most important innovation in the endogenous growth model over the Solow model was suggested by Paul Romer (1986) who not only emphasised the endogeneity of the productivity function and its implication on economic growth but also the ability of capital to enjoy an increasing return to scale depending on the scale of net investment employed. In other words, growth is a function of investments in physical and human capital resulting from a profit-maximising agent's deliberate decisions. Lucas (1988) and Grossman and Helpman (1991) also contributed in developing and testing the endogenous growth model known as New Growth Theory. The theoretical model adopted in this paper is a simple AK endogenous growth model based on its aggregate production function that incorporate technology, and in this case mobile technology:

$$Y_t = A_t \left(K_t \right) \tag{3.1}$$

Where Y_t represents the real aggregate output of goods and services in the economy, and K_t , represents a broad aggregate measure of capital stock (physical capital, human capital, public infrastructure) in the economy. At represents endogenous technical change (A>0). Capital ($K_t = \infty$) assumes an increasing return to scale depending on the level of net investment employed (Barro and Sala-i-Martin, 1992).

$$Y_t = f(K_t, L_t, Mobile \ teledensity_t)$$
3.2

The aggregate production in equation 3.1 can be expanded into equation 3.2 where aggregate economic growth $(GDP_{t,,})$ is a function of physical capital $K_{t,}$, labour $L_{t,}$ as well as the stock of mobile broadband internet telecommunication infrastructure approximated by *Mobile Broadband internet teledensity*_t, where $GDP_{t,}$, represent GDP at time t. Following Gruber and Koutroumpis (2011), the role of stock of mobile broadband internet telecommunication infrastructure is deliberately acknowledged in the model in line with the objective of the study which focuses on the effect of mobile broadband internet telecommunication infrastructure on economic growth.

3.2. Transmission Channels through which Mobile Broadband stimulates Growth

Review of literature reveals the transmission channels through which mobile wireless broadband leads to economic growth; Employment generation; Productivity gains; Consumer surplus; improved market efficiency and financial inclusion (Bhavnani et.al, 2008; Gruber, Hatonen and Koutroumpis, 2014; GSMA, 2015).

International Telecommunications Union (ITU, 2012) categorise the transmission channels of broadband on the economy into four stages. The first stage has to do with the deployment of broadband infrastructure. This creates output and generates employments in many sectors of the economy, with a multiplier effect. The output is created in manufacturing and construction, and employment is generated in engineering, high-tech, and communication

services sectors during the build-up of these networks and well after their completion. The second stage is through the improvement in the general infrastructure level in the country, this improve service delivery, which is the spill-over effect. The development in broadband infrastructure lead to the development in other infrastructure such as electricity. Broadband infrastructure cannot operate where there is no electricity, to develop broadband infrastructure will stimulate the development of electricity infrastructure among others. The third stage effect is actually the usage of the broadband which brings about increase in the production efficiency, and market access, this leads to increase in income, and aggregate demand. The fourth and final stage transmission channels is the consumer surplus, which has to do with the difference in what the household would be willing to pay and what they are actually paying for increase access to information, entertainment, public services etc. The impact of broadband on the economy can be summarised into:

- i. Contribution to employment and output of broadband deployment
- ii. Improvement in firms' efficiencies and market access
- iii. Contribution to economic growth and productivity gains (spill over effect or positive externality)
- iv. Creation of consumer surplus, which also add to income gains

4. Research Methodology: Model Specification, Data, and Estimation

4.1. Model specification

This study adopted a simple endogenous technical change model proposed by Barro (1991) to analyze the aggregate impact of mobile phone penetration on economic growth, as follows:

$$Y_t = f(K_t, L_t, Mbb_t, X_t, \varepsilon_t)$$

$$4.1$$

Where Y is production output represented by a change in economic growth (GDP per capita) i.e.

$$Y_t = (\Delta rgdppc_t)$$
 4.2

Incorporating (4.2) into (4.1) gives the model specifications, hence:

$$Y_t = (\Delta rgdppc_t) = f(K_t, L_t, Mbb_t, X_t, \varepsilon_t)$$

$$4.3$$

Expanding equation 4.3 gives:

$$l_n[rgdppc_t] = \alpha_1 + \beta_1 l_n[\Delta rgdppc_{t-1}] + \beta_2 l_n[\Delta Mbb_t] + \beta_2 X_t + \varepsilon_t$$
4.4

Where,

Rgdppc = growth in real GDP per capita (dependent variable) Mbb = growth in mobile broadband network penetration (variable of interest) X is a set of growth determinants as control variables (aggregate investment, labour force, human capital).

 ε_t denotes the error term in period *t* respectively.

4.1.1. The Autoregressive Distributive Lag Model

This analysis would be employing a robust econometric technique of Autoregressive Distributive Lag (ARDL) model to test both the long- and short-run relationship between the

economic growth and the mobile broadband network penetration in Nigeria. The main reason why this method was preferred to others was its unique feature of not requiring that the variables be integrated of the same order pretests for the unit roots (Hamuda et.al., 2013), however, it is weak when the variables are greater than order one i.e. I(2). Also, ARDL estimations is robust in the presence of small sample size, it also allows for variables to have different optimal lags, and endogeneity is less of a problem in the ARDL technique because it is free of residual correlation. Therefore, the following basic model of ARDL model was estimated:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^n \beta_i \Delta y_{t-1} + \sum_{i=0}^n \delta_i \Delta x_{t-1} + \varphi_1 y_{t-1} + \varphi_2 x_{t-1} + \mu_t$$

$$4.5$$

Where:

B_i and δ_i are the short run coefficients, with Δ as the first-difference operator. The φ_1 and φ_2 are the ARDL long run coefficients and μ_t is the error term. Y_t is the dependent variable which in this case is the real GDP per capita, and X's are the independent variables which in this case are the Mobile broadband subscription per 100 (Mbb), Gross fixed capital formation as a share of GDP (GFCF), inflation rate (CPI), and Adult literacy rate as a ratio of the total population (Adultlit). It should also be noted that ARDL model includes the same lagged terms as would be done in an Error Correction Model (ECM), but without restricting the coefficients.

4.1.2. Toda and Yamamoto approach to Granger causality test

We employed a modified Wald test as proposed by Toda and Yamamoto (1995), for the causality test. This test avoids the problems associated with the ordinary Granger causality test by ignoring any possible non-stationary or cointegration between series when testing for causality. The Toda and Yamamoto (1995) approach fits a standard vector autoregressive model in the levels of the variables, as against the case with the first difference fit with Granger causality tests. This minimize the risks associated with the possibility of wrongly identifying the order of integration of the series (Mavrotas and Kelly, 2001). The application of the Toda and Yamamoto (1995) procedure ensures that the usual test statistic for Granger causality has the standard asymptotic distribution where valid inference can be drawn.

The Toda and Yamamoto (1995) version of the Granger non-causality test for Mobile broadband network penetration-GDP per capita model we employed, is represented in the following VAR system:

$$Y_{t} = \alpha_{0} + \sum_{i=1}^{k} \alpha_{1i} Y_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} Y_{t-j} + \sum_{i=1}^{k} \emptyset_{1i} M b b_{t-i} + \sum_{j=k+1}^{d_{max}} \emptyset_{2j} M b b_{t-j} + \lambda_{1t}$$
 4.6

$$Mbb_{t} = \beta_{0} + \sum_{i=1}^{k} \beta_{1t} Mbb_{t-1} + \sum_{j=k+1}^{d_{max}} \beta_{2j} Mbb_{t-j} + \sum_{i=1}^{k} \delta_{1i} Y_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} Y_{t-j} + \lambda_{2t} 4.7$$

From Eq (4.6), Granger causality from Mobile broadband network penetration (Mbb_t) to GDP per capita (Y_t) implies $\emptyset_{1i} \neq 0 \forall_i$; similarly, in Eq (4.7), Y_t Granger causes Mbb_t, if $\delta_{1i} \neq 0 \forall_i$. the model is estimated using Seemingly Unrelated Regression (SUR) (see, Rambaldi and Doran, 1996).

4.2. Data Description

Table 1: Variables employed to measured Mobile broadband network penetration impact on
Economic Growth and sources

Variable	Period: 2002Q1-2016Q4	Sources	Data frequency	Rationale	A priori expectation
Economic growth	Real Per capita GDP (constant LC)	Central Bank of Nigeria	Quarterly	Depende nt variable	
Mobile broadband network penetration	Mobile Broadband Subscription per 100	Nigerian Communicati on Commission	Quarterly	Variable of interest	β>0
Physical stock of capital	Gross fixed capital formation as a share of GDP	Nigerian Bureau of Statistics	Quarterly	Control variable	β>0
Consumer price Index	Inflation rate	Nigerian Bureau of Statistics	Quarterly	Control variable	B<0
Human Capital	Adult Literacy as a percentage ratio of total population	UNESCO Statistics	Quarterly	Control variable	β>0

Source: Computed by the authors

5. Estimation Result Analysis

5.1. Unit Root Test

The results of the stationarity test are presented in Table 2 using the Augmented Dickey Fuller and Philip Peron test. It shows that all the variables used in the analysis were not stationary at level, with the exception of GDP per capita and consumer price index. They became stationary at the First difference. Due to the presence of a stationarity problem, we decided to use ARDL since it allows the analysis of variables that became stationary at first difference and does not discriminate against the combination of I(0) and I(1). We are applying ARDL bounds testing approach to test the existence of cointegration among the variables for the establishment of a long run relationship.

Variables	ADF	Philip-Peron	Decision
Lnrgdppc	0.0481	0.0024	I(0)
	-2.9287**	-4.033	
D(InMbb)	0.0000	0.0000	l(1)
	-7.2908***	-7.2738***	
D(Inadultlit)	0.0285	0.0162	l(1)
	-3.1414**	-3.3626**	
D(Lngfcf)	0.0000	0.0000	l(1)
	-5.6837***	-5.6837***	
Lncpi	0.0904	0.0000	I(0)
	-3.2182*	-6.7790***	

Table 2: Stationarity test results

Source: Computed by the authors

Endogenous variables: I NRGDPPC I NMRB I NADI II TI IT

5.2. Lag Selection Criteria

In using ARDL, we start with the selection criteria in which final prediction error, Akaike information criteria, and Hannan-Quinn information criteria chose maximum lag of 8.

Lindog				DOLIEN		
LNGFCF LNCPI						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	10.74632	NA	5.60e-07	-0.205226	-0.024391	-0.135116
1	317.0234	546.9234	2.44e-11	-10.25084	-9.165827*	-9.830180
2	359.3588	68.03900	1.34e-11	-10.86996	-8.880772	-10.09875
3	385.0385	36.68529	1.39e-11	-10.89423	-8.000873	-9.772483
4	409.0104	29.96483	1.61e-11	-10.85751	-7.059979	-9.385217
5	460.2779	54.92955*	7.62e-12	-11.79564	-7.093931	-9.972798
6	494.9821	30.98584	7.38e-12	-12.14222	-6.536333	-9.968827
7	543.7267	34.81759	5.22e-12	-12.99024	-6.480180	-10.46630
8	599.7665	30.02132	3.88e-12*	-14.09880*	-6.684570	-11.22432*

Table 3: VAR Lag Order Selection Criteria

* indicates lag order selected by the criterion

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

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Authors' computation.

5.3. ARDL Bound Testing Approach to cointegration

Table 4 present the result of the ARDL bounds test. The F-statistic valued as depicted in the diagram is compared to the upper I(1) and lower I(0) critical bound so as to determine the presence of cointegration among the variables. If the F-statistic is lower than the lower critical bound I(0), we can conclude that no presence of cointegration among the variables exists. In the same vein, if the F-statistic value is greater than the upper critical bound I(1), we conclude that the variables are co-integrated, and if the value falls between the lower I(0) and upper I(1) bound, the conclusion for cointegration is inconclusive and we may have to consider alternative measures to determine the presence of cointegration. Our analysis showed that the F-statistic value is greater than the upper critical bound of both Pesaran and Narayan at 2.5% and 1% levels respectively. Thus, we conclude that a unique long-run relationship exists between the variables.

Test statistic	Value	K
F-statistic	4.5996	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49***
1%	3.74	5.06

Table 4: ARDL bounds test approach to cointegration.

*** denote cointegration at the 1% significance level based on Pesaran critical bounds table. Source: Authors' computation.
5.4. The Association between Mobile Broadband Internet and Economic Growth

Long Run Coefficients								
Variable	Coefficient	Std. Error	t-Statistic	Prob.				
LNMBB	0.155841	0.051763	3.010681	0.0041				
LNADULTLIT	-0.158338	0.480947	-0.329220	0.7434				
LNGFCF	-0.132678	0.094438	-1.404928	0.1665				
LNCPI	-0.087515	0.063889	-1.369790	0.1771				
@QUARTER=2	0.214753	0.098582	2.178425	0.0343				
@QUARTER=3	0.385558	0.120793	3.191896	0.0025				
@QUARTER=4	0.333734	0.094867	3.517919	0.0010				
С	30.967724	1.954849	15.841494	0.0000				

Table 5: ARDL Long Run Cointegration Result.Dependent Variable: Real GDP Per Capita

R-squared	0.843604	Mean dependent var	30.33792
Adjusted R-squared	0.804505	S.D. dependent var	0.183926
S.E. of regression	0.081323	Akaike info criterion	-1.994228
Sum squared resid	0.317442	Schwarz criterion	-1.544370
Log likelihood	73.82395	Hannan-Quinn criter.	-1.817924
F-statistic	21.57614	Durbin-Watson stat	1.846692
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.Source: Author's computation

Table 6: ARDI	_ Short Run	Cointegration	Result.
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Short Run Cointegrating Form								
Variable	Coefficient	Std. Error	t-Statistic	Prob.				
D(LNMBB)	0.079484	0.032191	2.469143	0.0172				
D(LNADULTLIT)	0.923061	0.717334	1.286795	0.2043				
D(LNGFCF)	0.025066	0.216727	0.115657	0.9084				
D(LNGFCF(-1))	0.190601	0.305457	0.623988	0.5356				
D(LNGFCF(-2))	-0.261937	0.203254	-1.288718	0.2037				
D(LNCPI)	-0.044636	0.033775	-1.321550	0.1926				
D(@QUARTER = 2)	0.109531	0.034708	3.155756	0.0028				
D(@QUARTER = 3)	0.196648	0.032176	6.111667	0.0000				
D(@QUARTER = 4)	0.170216	0.030212	5.634122	0.0000				
CointEq(-1)	-0.510034	0.109993	-4.636971	0.0000				
Cointeq = LNRGDPC - (0.1558*LNMBB -0.1583*LNADULTLIT -0.1327								
LNGFCF -0.0875	LNCPI + 0.21	148*(@QUAR	TER=2) + 0.3	856				
(@QUARTER=3) +	0.3337(@0	QUARTER=4)	+ 30.9677)					

Source: Author's computation

5.5. Interpretation of Results

The long- and short-run analysis using the ARDL cointegration model (1,0,1,3,0), selected automatically by applying Akaike Information Criterion (AIC) out of 6561 models are presented in table 5 and 6.

Based on the long- and short-run ARDL analysis, the result shows that mobile broadband internet penetration is positively associated with economic growth in the Nigerian economy. The long-run result indicates that a unit change in mobile broadband internet penetration will

lead to a corresponding 0.16 percent change in the GDP with a one percent level of significance. Similarly, the short-run analysis also shows a positive relationship mobile broadband penetration and economic growth suggesting that a 1 percent mobile broadband penetration could boost economic growth by 0.08 percent at 5 percent significance level. The magnitude of the error correction term at 51 percent suggest an average speed of adjustment to the equilibrium in the event of any exogenous shock. The adjusted R-Squared of 0.81 shows that the model can explain 81% variation in the GDP. The results are also consistent with other country-specific empirical evidence from across the world which reported a positive effect of mobile broadband internet on economic growth using both aggregate time series and panel data (Katz and Koutroumpis, 2012a; Katz and Koutroumpis, 2012b; Katz and Koutroumpis, 2014; and Katz and Avila, 2010).

5.6. Test for Serial Correlation

We move on to test for serial correlation amongst the variables so as to avoid running a spurious regression, using Breusch-Godfrey serial correlation LM test. We concluded that our model is a good fit and satisfies the serial correlation test criteria at 0.694 which is high and above the recommended 0.05 value for the null-hypothesis to be rejected.

Dicuscii Obulicy Och							
F-statistic	0.156411	Prob. F(1,47)		0.6943			
Obs*R-squared	0.202328	Prob. Chi-Squ	uare(1)	0.6528			

Table 7: Breusch-Godfrey Serial Correlation LM Test

Source: Authors' computation

5.7. Test of Causality using the Toda-Yamamoto Approach in VAR

In order to capture the direction of causality between the variables, the Granger Causality/Block Exogeneity Wald Tests were carried out, using the Toda Yamamoto approach in VAR. The result presented in table 8 indicates that there is two-way causality between mobile broadband and the GDP. At 10% level of significance, mobile broadband is granger causing GDP. Also, at 5% level of significance, GDP is granger causing mobile broadband.

 Table 8: Granger Causality/Block Exogeneity Wald Tests

Dependent variab	Dependent variable: LNRGDPC							
Excluded	Chi-sq	Df	Prob.					
LNMBB	14.08817	8	0.0795					
LNADULTLIT	14.16290	8	0.0776					
LNGFCF	44.12819	8	0.0000					
LNCPI	15.09859	8	0.0573					
All	102.8498	32	0.0000					
Dependent variab	le: LNMBB							
Excluded	Chi-sq	Df	Prob.					
LNRGDPC	19.97733	8	0.0104					
LNADULTLIT	16.42536	8	0.0367					
LNGFCF	45.40619	8	0.0000					
LNCPI	9.019224	8	0.3407					
All	110.3699	32	0.0000					

Source: Author's computation.

6. Conclusion and Policy Implications

This paper focuses on the causational dynamics between mobile broadband network penetration and aggregate economic growth. The study adopts the ARDL estimator in order to control for the endogenous relationship between growth and mobile broadband infrastructure. Empirical evidence on this causational dynamic is guite recent as most extant literature on this relationship tend to focus on a broad categorization of telephony infrastructure networks and not specifically on mobile broadband infrastructure per se. This is certainly the case for empirical studies emanating from Sub-Saharan Africa in general and Nigeria in particular. The result of the current paper suggest that mobile broadband network penetration is positively significant in boosting economic growth. The findings specifically indicate that there is a 0.16% growth effect for every 1% increase in mobile broadband network penetration in the long run and a corresponding 0.08% growth effect in the short run. These findings are within expected range for developing economies and are consistent with the results obtained by Deloitte, GSMA and Cisco (2012) which found that a 10% expansion in mobile penetration in developing markets boost productivity by 4.2%. If this trend is maintained, it implies that we should expect a higher increase in productivity due to mobile broadband network penetration in the near future.

The policy recommendation of this paper can be categorized into policies addressing both the demand- and supply-side constraints to mobile broadband network penetration. The demand-side policy implication entail formulating policies targeted towards addressing the issue of affordability by subsidizing mobile broadband services and devices particularly to rural areas currently unserved and/or underserved. Furthermore, policymakers should consider addressing issues of information asymmetry surrounding mobile broadband adoption not only by raising public awareness but also by building public confidence in the technology as an early adopter. Government can promote number of pro-adoption policy initiatives such as digital financial services, digital tax payment schemes as well as electronic cash transfer system via mobile broadband network platform.

On the supply-side, policymakers should further deepen regulatory reforms aimed at encouraging both local and foreign participation in the deployment of mobile broadband network infrastructure across the country. Policies aimed at promoting investment in support infrastructure such as electricity and transportation as well as promoting interoperability amongst mobile network operators is crucial towards achieving maximum network effects and thereby strengthening the absorptive capacity of the economy to fully benefit from the transformational effects of mobile broadband technology. Furthermore, policymakers should also consider enacting regulatory policies designed towards creating an enabling and competitive business environment for mobile network operators to thrive.

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PRINCIPAL COMPONENTS TO OVERCOME MULTICOLLINEARITY PROBLEM

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Abstract: The impact of ignoring collinearity among predictors is well documented in a statistical literature. An attempt has been made in this study to document application of Principal components as remedial solution to this problem. Using a sample of six hundred participants, linear regression model was fitted and collinearity between predictors was detected using Variance Inflation Factor (VIF). After confirming the existence of high relationship between independent variables, the principal components was utilized to find the possible linear combination of variables that can produce large variance without much loss of information. Thus, the set of correlated variables were reduced into new minimum number of variables which are independent on each other but contained linear combination of the related variables. In order to check the presence of relationship between predictors. dependent variables were regressed on these five principal components. The results show that VIF values for each predictor ranged from 1 to 3 which indicates that multicollinearity problem was eliminated. Finally another linear regression model was fitted using Principal components as predictors. The assessment of relationship between predictors indicated that no any symptoms of multicollinearity were observed. The study revealed that principal component analysis is one of the appropriate methods of solving the collinearity among variables. Therefore this technique produces better estimation and prediction than ordinary least squares when predictors are related. The study concludes that principal component analysis is appropriate method of solving this matter.

Keyword: principal components, multicollinearity, variance inflation factor.

JEL Classification: C01, C02.

1. Introduction

Advancement of science and technology raised attention to make proper decision on several critical matters facing different sectors. Attentions to make right decision have increased a need for utilizing realistic information. With the presence of multidimensional data across the world, managers, planner and policy makers are facing challenges of managing huge data set from different sources that may produce little information due to presence of some redundant information. Accordingly the information obtained from huge numeric data set is important for practical investigation. This is directly linked to the application of linear regression model where by a relationship among predictors can be handled as redundancy. In both social and scientific researches, a need may raise to build a model for studying the relationship between two or more variables so as to measure the internal influence of one variable on others. In such kind of situation it is required to select appropriate technique that fits the interest of the research. There are different statistical techniques that measure relationship, among them includes path analysis, structural equation model, discriminant analysis and linear regression model. However the easiest and popular techniques of studying relationship among variables is linear regression model which focus on treating one variable as "dependent variable" in such way that its change is influenced by the changes of independent variables.

Linear regression model is one of the methods of analyzing relationship between variables which is widely applicable in many researches of different disciplines. Ordinary Least Square procedures of estimating linear regression model assume the predictors are uncorrelated. Violation of this assumption implies that the predictors are correlated, the situation which bring about large standard error, reduce precision of results and weaken statistical power (Gujarati, 2004). The existing literature emphasis that the consequences of the multicollinearity are: large standard error of the estimated coefficients, large probability values with low test statistic that result into unbiased estimates which lastly mislead interpretation and conclusion (Mason ,1987; Mela and Kopalle, 2002; Hoffman, 2010). In some situation, quantitative variable may be predicted based on several independent variables so as to examine the significance influence of each explanatory variable. One of the appropriate approaches in such case is employing multiple linear regressions to assess how well it fits the actual phenomenon. According to Gauss - Markov theorem, when all assumptions of the classical linear regression model are met, the model will produce unbiased estimates that have minimum variance compared to the rest of unbiased linear estimators (Kutner, et al., 2005). When the predictors are correlated their influence on the main model is overlapped. Despite the fact that the multicollinearity does not harm the goodness fit of the model, it results into wrong conclusion when the target is to predict the effect or contribution of each explanatory variable to the model. This hinders the interpretation of coefficient of predictor as a measure of degree of change of predicted variable with a unit change of predictor holding other variables constant. As a result of this problem, the contribution of each predictor can be unrealistic due to overlapping of variables. Since presence of multicollinearity may mislead the analyst and fall in wrong conclusion of the results, it is imperative to present solution to this problem. While other methods of solving multicollinearity are well documented, there is scarce of literature on how principal components methods can be utilized to eliminate multicollinearity. The key objective of this study was to investigate the application of principal components in handling multicollinearity. In the situation where multicollinearity cause problem on estimating parameters of linear regression model, the Principal components can be applied to reduces the dimensions of parameters into small number of parameters while retaining the maximum variance of the original data. Instead of running model with original correlated variables, the Principal components are then used as new independent variables that eliminated the interdependency of variables among predictors.

2. Literature review

Multicollinearity is a problem which is associated with high relationship among explanatory variables where by specific effect of the correlated variables on dependent variable cannot be separated. According to Wooldridge (2010) ,quick judgment of the existence of multicollinearity when running multiple regression model lies on several observations; (1) high value of coefficient of determination (R-square) which measures the proportion of the explained data in the model ; (2) high sensitivity of the estimates where by small change in data bring about large changes to the estimates of the population parameters ;(3) high value of standard error of estimated coefficients with low value of test statistic (t-values) and high p-values ;(4) overall significance of the overall model while individual variables are insignificant. With these impacts, the estimates of the parameters in the classical model will vary from one sample to another when the analysis is repeated with series of samples.

The concept of multicollinearity some time can be explained with a concept of "orthogonality" which means independence among variables. This condition can be attained when the eigen values have length one (1). Presence of dependence among predictors affects the ability of the model to estimate the actual phenomenon. This is due to presence of redundant

information in some explanatory variables where by more than one variable can provide similar information on predicting response variable. In this situation, redundant variables are not realistic in such a way that one coefficient of variables can measure the influence of such variable to the response variables, and the same influence goes to other variable. In actual practice it may be observed that some predictors are correlated and this does not harm the analysis due to fact that multicollinearity is a matter of degree of relationship that exist among variables and not the absence of relationship at all. While the relationship between variables may exist, the key point is to observe the degrees of multicollinearity that cannot affect the results of estimated parameters. At population level independent variables constructs are not collinear thus the multicollinearity problem happen due to technical expertise of the researcher particularly in sampling process (Kmenta ,1997). In behavioral research that involves estimation of behavioral constructs it is very rare to find the multicollinearity is either originated from sampling error or true population, it can be detected during data analysis. There are two types of multicollinearity:

Perfect/exact multicollinearity: the relationship between variable are said to be perfect if the value of correlation coefficient is exactly 1 or -1. When there is a perfect multicollinearity, the data matrix does not exist and thus the inverse of matrix formed as a result of cross product between the data matrix and transposed matrix will not exist. In practice, there is no situation where correlation coefficient between variables can exactly be one (1). In the linear regression model having several explanatory variables (say k), a linear relationship between explanatory variables may exist if the following condition is satisfied:

$$\alpha_0 + \alpha_1 x_{i1} + \alpha_2 x_{i2} + \dots + \alpha_k x_{ik} = 0$$
⁽¹⁾

Where: α_0 , α_1 ,, α_k are constants and cannot all be zero at the same time

 x_{ii} = stands for the ith observation on the jth explanatory variable

Equation one (1) can be expressed as:

$$x_{i1} = \frac{1}{\alpha_1} \left(\alpha_0 - \alpha_2 x_{i2} - \dots - \alpha_k x_{ik} \right)$$
(2)

Equation (2) implies that x_{i1} is linearly related with $x_{i2}, x_{13}, \dots, x_{ik}$

Near multicollinearity. This happens when the predictors are highly related as indicated by correlation coefficient values being closer to one. The inverse matrix of the cross product of the data matrix and its transposed matrix exist, implies that the determinant matrix is not zero. The common situation is when one predictor is either highly or lowly correlated with another one. There is no uniform definition and agreement on degree of correlation suitable for judging the presence of high correlation. That means at what value the variables can be considered as highly related. In practice the value of correlation coefficient greater than or equal to 0.5 is considered as high correlation. If the explanatory variables are highly related with each other but not perfect relationship, the near multicollinearity can be expressed as follows:

$$\alpha_0 + \alpha_1 x_{i1} + \alpha_2 x_{i2} + \dots + \alpha_k x_{ik} + \varepsilon_i = 0$$
⁽³⁾

Where: $\alpha_0, \alpha_1, \dots, \alpha_k$ are constants and cannot be zero at the same time. ε_i is the error term.

Equation (3) can be expressed as follows:

$$x_{i1} = \frac{1}{\alpha_1} \left(\alpha_0 - \alpha_2 x_{i2} - \dots - \alpha_k x_{ik} - \varepsilon_i \right)$$
(4)

Equation four (4) implies that x_{i1} is not exactly linearly related with $x_{i2}, x_{13}, \dots, x_{ik}$ The principal component technique is one of the remedial solutions to multicollinearity. The technique was presented by Pearson (1901) and Hotelling (1933), which is based on finding the possible combination of merging the correlated variables into new few uncorrelated variables by reducing the original matrix of high dimension into low dimension whose rows and columns are independent of each other. It is multivariate statistical method which is applied in different disciplines where there is a need to reduce multidimensional data set from huge attributes to a reasonable composite attributes. It reduces the complexity of information which is hardy to be interpreted into easier and meaningful interpretation. This procedure is done by transformation of large dimension of interrelated variables into smaller set of uncorrelated variables knows as principal components (PCs). Each Principal component is a linear combination of the original attributes with their coefficients indicate the relative importance to the component. The PCs are listed in order of preference where by only few of them are retained under condition that they account to a maximum variability of the original data set.

3. Material and methods

3.1. Problem formulation

3.1.1. Multiple linear regression

Different social and scientific phenomenons are complex to be understood that need several variables for demonstration. There are different methods of studying relationship based on whether the data are categorical or numeric in nature. Regression analysis refers to a statistical technique for studying relationship among variables and influence of one variable over the others (Montgomery, Peck and Vining, 2012). Thus the multiple linear regression model is a statistical technique which is applicable when someone needs to study the relationship between dependent variable and at least two independent variables. It requires the condition that the dependent variable to be numeric in nature while independent variables may either be numeric or a mix of both categorical and numeric data. The model can be described as follows:

$$y_{i} = \beta_{0} + \beta_{1}x_{i1} + \beta_{2}x_{i2} + \dots + \beta_{p}x_{ip} + \varepsilon_{i} \qquad i = 1, 2, \dots, n$$
(5)

Equation (5) can be presented in simplified form as:

$$y_i = \beta_0 + \sum_{j=1}^p \beta_j x_{ij} + \varepsilon_i \tag{6}$$

Where:

 β_0 is a constant coefficient which is also referred to as y- intercept in the first order classical line regression model. It is the value of "y" when the explanatory variables are zero.

 β_i is the coefficient of the 'i'th variable which indicates the significant change of y_i for a unit change of x_i keeping other variables constants

P is the number of predictors.

The multiple linear regression models can also be presented in matrix form:

$$\begin{bmatrix} y_{1} \\ y_{2} \\ \vdots \\ y_{n} \end{bmatrix} = \begin{bmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1p} \\ 1 & x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n1} & x_{n2} & \cdots & x_{np} \end{bmatrix} \begin{bmatrix} \beta_{0} \\ \beta_{1} \\ \vdots \\ \beta_{p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1} \\ \varepsilon_{2} \\ \vdots \\ \varepsilon_{p} \end{bmatrix}$$
(7)

The main feature in running regression model is to find the goodness fit of the model in a given dataset. The Ordinary Least Square Methods is used to obtain the estimates that minimize the sum of total squared error as described in equation (8).

$$\sum_{i} (y_{i} - \hat{y}_{i})^{2} = \sum_{i} (y_{i} - [\hat{\beta}_{0} + \hat{\beta}_{1}x_{i1} + \dots + \hat{\beta}_{p}x_{ip}]) \quad i = 1, 2, \dots, n$$
(8)

Where by: \hat{y}_i stands for predicted model

Like any other statistical model, the first step in fitting linear regression model is to assess the significance of the overall model, checking on whether model assumptions are met or not.â

3.1.2. Assumptions of the model

It is obviously that statistical techniques are based on several assumptions that need to be tested to guarantee further analysis. If it happens that any of the suggested assumptions have been violated, the results can be characterized with unbiased and inconsistent estimators unlike the robust assumptions which do not bring effects to the results.

Residuals are independent and follow normal distribution. This assumption can be tested by observing histogram or predicted probability (p-p) plot. Violation of this assumption does not lead to bias or inefficiency of the estimators. It only harms calculation of probability (p) values useful for checking the significance However; this assumption can be met by ensuring the sample size is large enough. Central limit theorem implies that as the sample size increases, the sampling distribution of the mean can be approximated by a normal distribution. This assumption is robust and there is no need of testing this assumption when running linear model from reasonable large sample.

Linearity assumption among variables .The model assumes an existence of linear relationship between predictor and predicted variables. This assumption can be checked by using scatter plot where by the distribution of patterns can give a clear picture of linearity. When variables have linear relationship, the model can easily estimate the degree and magnitude of the relationship, but in different situation some variables are not linearly related, for this kind of situation the model may underestimate the true relationship which results into wrong conclusion

Homoscedasticity assumption. This implies that variance of the residual is constant and does not varies across predictors. If the variances of the errors are not the same around regressions, it indicates presence of heteroscedasticity. This assumption can be examined using scatter plot between residuals and predicted variables. Violation of this assumption harm analysis and lead to possibility of omitting type one error, the situation occurs when null hypothesis is wrongly rejected while it is true.

Mutlicollinearity assumption. Multiple linear regression models assume that the independent variables are not highly related with each other. This assumption can be tested using different indicators including correlation matrix, Eigen values and Variance Inflation Factor (VIF). Presence of this problem weakens the precision of estimated coefficients of the model since the standard errors were enlarged which result into low values of test statistic with high probability values(p-value). Hence reduction of statistical power of the test.

3.2. Diagnostic of multicolinearity

There are different ways of observing collinearity among predictors such as the use correlation matrix, eigen values and Variance Inflation Factor (VIF). How ever only VIF was considered in this study. The justification of using this method is due to fact that the computation and result can be interpreted easily and clearly. The other methods namely correlation matrix and eigen values can give highlights of presence of multicollinearity but cannot give a clear estimate of the degree of multicollinearity (EI-Dereny and Rashwan, 2011).

3.2.1. Variance inflation factor

Presence of collinearity among explanatory variables leads to increase in its standard errors as a result of the variance of coefficients of explanatory variables being inflated. The Variance Inflation factor gives the degree to which the variance was inflated.

The variance inflation factor for predictor k is given by:

$$VIF_k = \frac{1}{1 - R_k^2} \tag{9}$$

Where R_k^2 stands for the coefficient of determination when Predictor X_k is treated as dependent variable and regressed on other predictors.VIF gives an index which measures the degrees of increase of variance of regression coefficient with the increase of multicollinearity. As a rule of thumb, multicollinearity is considered a problem when $VIF \ge 10$ (Cohen et al, 2004)

3.3. Principal components analysis

Principal component analysis is the multivariate statistical technique that transforms a set of p-variables which were related into new small dimension of independent variables without much loss of information (Johnson and Wichen, 2007). Principal component analysis provide a unique procedure of handling multicollinearity with its procedure of obtaining new independent variables from original data set of interrelated variables. Principal components analysis involve rotation of huge multidimensional data from one point to another point of orthogonal linear axes known as Principal components (PCs). Thus the first linear combination is the principal component that explains the most variability of the original data set. Similarly the second Principal component is orthogonal to the first PC and accounts for the most of the remained variance of the observation.

Suppose a random vector $X' = [X_1, X_2, \dots, X_o]$ have covariance matrix Σ with eigen values $\lambda_1 \ge \lambda_2 \ge \lambda_3 \ge \dots \ge \lambda_p \ge 0$, then consider the following linear combination:

$$Y_{1} = l_{i}'X = l_{11}X_{1} + l_{21}X_{2} + \dots + l_{p1}X_{p}$$

$$Y_{2} = l_{i}'X = l_{12}X_{2} + l_{22}X_{2} + \dots + l_{p2}X_{p}$$

$$\vdots$$

$$Y_{p} = l_{i}'X = l_{1p}X_{p} + l_{2p}X_{2} + \dots + l_{pp}X_{p}$$
Then
$$Then$$

 $Var(Y_i) = l' \Sigma l \qquad i = 1, 2, ..., p$ $Cov(Y_iY_k) = l'_i \Sigma l_k \qquad i.k = 1, 2, ..., p$ (11)

Thus the principal components are the linear combinations in equation (10) whose variances are as large as possible. The ith principal component is the linear combination l'_iX that maximizes $Var(l'_iX)$ subject to $l'_il = 1$

The procedures of principal components analysis are; (1) checking the key assumptions of the model; (2) exploration of the preliminarily components followed by extraction of the significant components that have maximum variances to be retained in the model;(3) smoothing data through rotation of variance covariance matrix for easy interpretation; (4) the final procedure is interpretation of the outputs. The main issue in principal components analysis relies on decision of which eigen value to be retained for further analysis. The maximum variation can be achieved by selecting the significant eigen values which exceed one while at the same time ignoring insignificant eigen values whose values are lower than one. As documented by Farebrother (1999), the principal components analysis merge related variables into small dimension of variables, then these principal components can be treated as explanatory variables to run regression model by predicting dependent variable on these new variables.

4. Application

4.1. Detecting multicollinearity

In assessing the effectiveness of Principal components in overcoming multicollinearity, determinants of student satisfaction were analyzed with a representative sample of 600 students from one of the public University in Tanzania. Students were requested to rate their perceived satisfaction on different items. The multiple linear regression model of predicting determinants of student satisfaction was formulated as:

 $Y = \alpha_1 X_1 + \alpha_2 X_2 + \dots +, \alpha_{14} X_{14} + \varepsilon \dots$ (12)

Where: Y stands for satisfaction. X_1, X_2, \dots, X_{14} are predictors, ε is the error term.

The results from table 1 indicate that the overall model is significant (F-value, 51.888, p-value, 0.000). Specifically, an assessment of statistical significance of individual predictors indicates that some predictors are significant while others are insignificant. The major reason is presence of collinearity among predictors. The value of Variance Inflation Factor above 10 indicates presence of multicollinearity except for variable number five and six only whose values are less than 10.

Variables	Unstandardized		Standardized	Т	Sig.	Collinearity Statistics		
	B	Std.	Beta			Tolerance	VIF	
		Error						
Constant	.782	.167		4.699	.000			
Lighting in class rooms	.515	.124	.405	4.139	.000	.079	12.640	
Appearance of the buildings	029	.102	031	281	.779	.064	15.734	
Comfortable temperature in class rooms	.594	.083	.812	7.125	.000	.058	17.121	
Internet accessibility	867	.118	784	-7.372	.000	.067	14.882	
Efficiency of registration	469	.141	274	-3.320	.001	.111	8.989	
Efficiency of records keeping	.491	.081	.514	6.039	.000	.105	9.550	
Availability of the channels for complains	748	.159	730	-4.715	.000	.032	31.553	
Efficiency in dealing with queries	.507	.128	.609	3.972	.000	.032	30.984	
Staffs interaction with students	771	.236	717	-3.273	.001	.016	63.251	
Proficiency of Lecturers for teaching and research	.576	.156	.794	3.686	.000	.016	61.148	
Availability of personnel to help students	057	.069	080	832	.406	.083	12.050	
Availability of Lecturers for consultation and assistance	069	.134	048	514	.607	.085	11.716	
Management focus on students	1.654	.208	1.766	7.937	.000	.015	65.180	
Availability of private study rooms	-1.080	.152	-1.625	-7.126	.000	.015	68.480	
	F-valu	ue= 51.88	38, p-value	e=0.000				

5. Principal component analysis

In principal components method, new artificial variables may either be considered as significant to be included in the model or insignificant to be excluded in the model based on several criteria. There is no agreed limited number of principal components to be retained due to fact that the number varies since different criteria can be employed for such decision. The popular and easiest way of deciding maximum number of principal components to be retained is through observing cumulative variance. Another rule of determining the number of components to be included in the analysis is based on assessing the eigen values as proposed by Kaiser (1960). The rule suggests that significant components are considered as

important when the eigen values are either greater than or equal to one. Another important useful criterion for deciding the number of PCs to be retained is based on observation of visual appearance of scree plot. The arrangement of eigen values are arranged in descending order from largest to lowest values which are presented on y-axis against number of PCs. The break of the plot is the key point which determines the maximum number of PCs to be retained. The significant components are those listed on the left side before the break point of the scree plot, while insignificant components are those appeared on the right hand side of the break point where the plot flattens out. Determining the maximum eigen values based on scree plot is subject to researcher judgment and some time the break point cannot seen clearly. However this criterion is considered useful in providing accurate result when the sample size is large enough and recommended over 200 observations (Stevens, 2012). Despite of the uniqueness of these criteria, it is recommended by Jolliffe (2002) that combining more than one rule is better than sticking on a single rule. This paper utilized the rules of judging significant PCs based on observing the eigen values and cumulative variance indicated by eigen values. Thus interpretation of the principal components results depend on several set of attributes to be studied, variety of entities. degree of relationship among interrelated variables, and the criteria used in judgment Table 2 presents principal components together with its corresponding eigen values and total variance explained. The principal components in this attributes of satisfaction are uncorrelated attributes in the original data set. The eigen values were listed in descending order from largest to smallest value. The eigen values of the most of principal components decrease downwards and many PCS have small values. Each of the extracted principal components presents the maximum portion to the total variability of the original dataset. Insignificant components with eigen values <1.0 represent relatively low variance than significant components with eigen values \geq 1. The first principal component (PC) has largest variance that account for 32.8% of the total variance. This PC has comparatively largest eigen value of 4.6 which is equivalent to the eigen values of four variables. The second PC has an eigen value of 3.4 that accounts to 24.5% of the variability of the data. The third PC explains 11.9% of the total variance of the original data. Fourth and fifth PCs explain 9.9% and 9.5% of the total variance respectively. As a rule of thumb, the first five components each have eigen value greater than one and collectively account to 88.5% of variability of the original data set losing only 11.5% of the information .Therefore only five PCs are extracted and retained from fourteenth PCs without much loss of information. This implies that the original information was reduced from 14-dimension of data set into a minimum size (5-diemension) while at the same time maximizing the variability of the original dataset .The rest remaining 9 PCs are considered as insignificant and redundant since they have eigen values <1.0 and contributes to a small portion of the total variance of the original data set. In other word, the Principal components with smallest eigen values are treated as observational error, hence they are removed from analysis.

lent	Initial Eigenvalues			values Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
DO L	Total	% of	Cumulative	Total	% of	Cumulative	Total	% of	Cumulative
d u		Variance	%		Variance	%		Variance	%
ပိ									
1	4.587	32.762	32.762	4.587	32.762	32.762	3.028	21.629	21.629
2	3.427	24.476	57.239	3.427	24.476	57.239	2.790	19.932	41.561
3	1.658	11.846	69.085	1.658	11.846	69.085	2.202	15.726	57.286
4	1.386	9.898	78.983	1.386	9.898	78.983	2.196	15.685	72.971
5	1.327	9.480	88.463	1.327	9.480	88.463	2.169	15.492	88.463
6	.834	5.956	94.419						
7	.511	3.652	98.071						
8	.098	.698	98.769						
9	.060	.427	99.195						
10	.044	.313	99.508						
11	.035	.252	99.760						
12	.017	.123	99.883						
13	.011	.080	99.963						
14	.005	.037	100.000						

Table 2: Total variance explained

The findings from Table 3 indicate the outputs of varimax methods of rotation which is used to smooth the loadings and hence simplify interpretation. In this study the dimension of data set is large enough, thus observing the high loading of eigen vectors to a particular PC is subject to error and need much attention since none of the vectors are zero. The remedial solution is to rotate the vectors so as to make clear interpretation of the data. After utilizing this method it is therefore seen clearly that each variables map into a particular PC that presents composite variable. The outputs of varimax provide clear interpretation of the PCs in a way that only high loadings are retained to specific components and the low loadings are minimized. This improves impression of output by identifying the variables that are highly related to a corresponding PC.

Table 3: Rotated Component Matrix

Variables	Component				
	1	2	3	4	5
Lighting in class rooms (X ₁)		.671			
Appearance of the buildings(X ₂)		.666			
Comfortable temperature in class rooms(X ₃)		.927			
Internet accessibility (X ₄)		.920			
Efficiency of registration(X_5)	.928				
Efficiency of records keeping(X ₆)	.920				
Availability of the channels for complains(X7)					.943
Efficiency in dealing with queries(X ₈)					.927
Staffs interaction with students (X ₉)				.954	
Proficiency of Lecturers for teaching and research(X ₁₀)				.960	
Availability of personnel to help students (X ₁₁)			.933		
Availability of Lecturers for consultation and assistance(X ₁₂)			.944		
Management focus on students(X ₁₃)	.786				
Availability of private study rooms (X ₁₄)	.794				

Thus the five selected principal components are the linear combination of the original variables that contribute much to the total variance. Thus the fitted PCs are: $Z_1 = 0.928X_5 + 0.920X_6 + 0.786X_{13} + 0.794X_{14}$(13) $Z_2 = 0.671X_1 + 0.666X_2 + 0.927X_3 + 0.920X_4$(14) $Z_3 = 0.933X_{11} + 0.944X_{12}$(15) $Z_4 = 0.954X_9 + 0.960X_{10}$(16) $Z_5 = 0.943X_7 + 0.927X_8$(17)

The first principal component is the linear combination of four variables which are related namely variable 5, 6, 13 and 14. The second principal components composed of variable 1, 2, 3 and 4 which are highly related. The third PC is formed by variable 11 and 12 while fourth PC consists of variable 9 and 10. The firth PC includes variable 7 and 8. The variables within components are highly related while the group of variables in a particular component are not related with another group of variables loaded to a another component. After removing the principal components which are less important, the modified liner regression model is now:

 $Y = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \varepsilon$ (18) Where predictors $Z_1, Z_2, Z_3, \dots, Z_5$ are principal components

	Unstandardized Coefficients		Standardized Coefficients	Т	Sig.	Collinea Statisti	irity ics
Variables	В	Std.	Beta			Tolerance	VIF
		Error					
(Constant)	.970	.179		5.414	.000		
Z ₁	.470	.041	.428	11.494	.000	.816	1.225
Z ₂	.426	.048	.307	8.789	.000	.925	1.081
Z ₃	143	.033	154	-4.348	.000	.896	1.116
Z ₄	.156	.030	.198	5.157	.000	.770	1.299
Z ₅	144	.031	173	-4.587	.000	.796	1.256
F-value=56	.972	p-valu	ie=0.000				

Table 4: Significance of the predictors (after removal of multicollinearity)

Instead of using Ordinary Least Square (OLS) method of estimating parameters in linear regression model, principal components regression was used. Table 4 indicates results of regressing dependent variables on five explanatory variables (PCs). In comparison this method brought some changes on standard error. In the original regression model where OLS method was employed, standard errors of estimate coefficients were large that weakened the statistical power due to presence of severe multicolinearity. This is contrary to the output of regression model after utilizing principal component, where the standard errors were smaller compared to the OLS methods. In assessing whether the collinearity exist between variables, VIF was computed on each of the variables treating as dependent variable and regress on the rest of the variables. The result indicates that multicollinearity problem was eliminated since VIF values for each of the variables were less than ten (10).

6. Discussion

The key objective was to demonstrate how principal components method can be used to eliminate multicollinearity problem that may exist when running linear regression model. The real application of the techniques was presented in the problem of predicting factors influencing student satisfaction where overall student satisfaction was predicted on several fourteen variables. The results of linear regression model revealed a large standard error of coefficients, the situation which resulted into biasness of the mean estimates of the coefficients. The major reason is the violation of ordinarily least square assumption that requires the predictors to be independent. The Variance Inflation Factor was used as indicator to detect collinearity among predictors. It was observed that VIF values of twelve predictors exceed 10 which indicate presence of multicollinearity problem. Thus ignoring this statistical problem can lead to wrong conclusion.

After confirming the presence of high relationship between independent variables, the principal components was utilized to find the possible linear combination of variables that can produce large variance without much loss of information. The first component contained the variables which were highly related namely variables number 5,6,13 and 14.Similarly, the second component contained variable number 1, 2, 3 and 4.Third component contained variable number 11 and 12 while fourth component contained variable number 9 and 10.The last principal component combined variable number 7 and 8.These original fourteen (14) set of variables were transformed into five (5) variables (Principal components) as a linear combination of related variables, but the new variables are independent to each other.

The last step was to assess the efficiency of Principal component methods in solving multicollienarity. In order to examine the presence of relationship between predictors, dependent variables were regressed on these five principal components. The results show that VIF values for each predictor range from 1 to 3 which indicate that multicollinearity problem was eliminated. Principal components method helps not only in identifying which variables are highly related, but also providing solution for improving results of the estimated coefficients. The method transforms a set of linearly related variables into artificial variable that are not related with each other. If these new variables can be named meaningfully they may be treated as variables for further analysis and considered as a remedial solution to multicollinearity, its application is limited to a large sample size specifically a minimum of 300 observations (Comrey and Lee, 1992).

7. Conclusion

The principal objective of this study was solution to multicollinearity when fitting linear regression model. Multicollinearity was detected using Variance Inflation Factor (VIF) and then principal component analysis as solution to the problem was presented. The study indicated that principal component analysis is one of the appropriate methods of solving this matter. Therefore applying principal components produce better estimation and prediction than ordinary least squares when predictors are related.

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Bio-note

Abubakari Gwelo is Assistant Lecturer in the Department of Mathematics and Statistics, Faculty of Science and Technology, Mzumbe University in Tanzania. He holds Master degree in Statistics and Bachelor degree in Statistics of the University of Dar es Salaam. His main research interests are Multivariate statistical methods, time series analysis, sampling design, experimental design, Social science researches. He has published widely in various reputable international journals. The published papers are based on theoretical statistics, and its application in different fields such as economics, social science, business, education, and health science.

Scientific events at the Doctoral School of Economics, University of Oradea

On 21st of November 2018, the Doctoral School of Economics organized the 9th edition of the International Conference of Doctoral Students and Young Researchers "Emerging Markets Economics and Business". This scientific event was conducted in partnership with the Faculty of Economics, University of Miskolc, Hungary, and the International Business School from Botevgrad, Bulgaria. During the conference, over 70 papers were presented by doctoral and post-doctoral students and other young researchers from Romanian and foreign universities. The papers were grouped in four sections, addressing topics related to Microeconomics and Business Economics, Entrepreneurship and SMSs, Tourism and related services, Macroeconomics, and other topics included in the broad field of Economics. All submitted contributions were double-blind reviewed and 63 of them were accepted for publication in the Proceedings of the 9th International Conference of Doctoral Students and Young Researchers, which is also available online at http://steconomiceuoradea.ro/wp/wp-content/uploads/2014/01/Volum-doctoranzi-2018.pdf. Moreover, as in all previous editions, selected authors were invited to submit extended versions of their contributions for publishing in Oradea Journal of Business and Economics. Some of them are published in the current issue, namely issue (4 (1) / 2019, but several papers will be published in the following issues.

Congratulations to all the participants in the Conference, especially to those whose contributions were published, and we are happy to welcome you again at the 10th edition of the Conference, on 20th of November, 2019!

On 12th of December 2018, at the Doctoral School of Economics of the University of Oradea took place the defense of the Ph.D. thesis in Economics of Mr. Csintalan Csaba - teacher of economic modules at "Gheorghe Dragoş" Economic College from Satu Mare. He defended his Ph.D. thesis titled "Education and its role in economic growth and development", under the supervision of Prof.Dr.Habil. Alina Badulescu. As mentioned by the referees, Dr. Csintalan's thesis was elaborated and structured with remarkable coherence and with an adequate logic, and organized into five chapters and also a summary of the conclusions and contributions of the thesis.

His thesis represents a notable contribution to enriching the knowledge in a field of great impact and importance; his research work carefully and harmoniously combines theoretical aspects with quantitative and qualitative analyses. Among such contributions, we mention the following: the generalization of the Montanini model and its use for predicting the equalization of education expenditures, under the following conditions: 1.demographic developments; 2.increase of the enrollment rate; 3.the hypothesis of closing or diminishing the gaps in several European countries; identifying the main challenges and shortcomings faced by the Romanian education reform, i.e. insufficient financial allocations; school drop-out high levels; reshaping the importance of lifelong learning; labour market inconsistencies, and correlations between them and the assessment of the impact of these trends over the coming decades; the analysis of teachers' perceptions regarding the way and necessity of upbringing and developing the economic education; the awareness of the necessity of change, as well as the availability and directions of action in this regard. The board of referees also acknowledged that Dr Csintalan published 12 scientific papers during the PhD program. Congratulations to Dr. Csaba Csintalan, the most recent doctor in Economics of the University of Oradea!

Professor Alina Badulescu

Dean of the Faculty of Economic Sciences – University of Oradea President of International Conference of Doctoral Students and Young Researchers







