

## Efficiency Analysis of Public Universities in South-Western Nigeria

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### Abstract

*This study examines the efficiency of public universities in south-western Nigeria in comparison with the other universities employing the Data Envelopment Analysis (DEA) technique. Although the focus is South-Western Nigeria, the study examined 121 universities spread among four categories of owners (40 Federal, 30 States, 29 privates and 23 faith-based). Data for the study were based on the year 2017 and were sourced from the Nigerian University System Statistical Digest and The State of Nigeria Universities both of the National Universities Commission. Results reveal that on the average, universities in the South-West are not technically efficient. However, the most efficient Nigeria public South-West universities are found to be Federal universities. The plausible outcome of this research is that federal universities are the efficient ones. Federal universities from the North Central zone of the country were also found to be better than those from the South-West. None of the state universities which are usually plagued with perennial financial crisis is efficient. The study calls for mechanisms to re-strategize and to get these public universities to be more financially buoyant and strong in order to deliver on their various missions and mandate.*

**Keywords:** *Efficiency, South-West, Education, Data Envelopment Analysis*

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## 1.0 Introduction

It is widely known that Nigeria has been plagued with frequent economic and political instability over the past decades. The instability has generated negative effects on the education system due mainly to poor funding of the sector. The financial crisis has often led to regular occurrence of unpaid staff salaries, degeneration of educational facilities and infrastructure at all levels and frequent disruption of academic activities across all higher education systems in Nigeria. Generally, poor financial investment has been the bane of Nigerian education system, to the end the budgeting allocation has been very low compared to other sectors (CBN, 2017). This is particularly important in view of huge increase in number of intakes at all levels of education – primary, secondary and tertiary. In recent time, the total number of students' enrolment tripled while budget allocated to the education sector continued to decline from 11.5 percent in 2002 to 8.7 percent of the total government expenditure in 2013 (Ahmed, 2013).

As far back as during the oil crisis in 1980s, the administration and funding of higher institutions in Nigeria has called for constant policy changes. The changes included the (i) termination of the student – teachers' bursary awards and subsidized feeding for students in higher education institutions, (ii) establishment of state-owned universities that were financed in part from tuition fees, and (iii) restructuring of education funding arrangements. (Imahe, 2001, Hinchliffe, 2002 and Fashina, 2005). A major alternative source of funding education explored by government is the Education Tax Fund (ETF) established in 1995. ETF ensured that companies with more than 100 employees contribute 2% of their pre-tax earnings to the fund. Primary education receives 40% of this fund. Secondary education receives 10% and higher education 50%, Primary education has in the past also receives from Petroleum Trust Fund (PTF) for capital expenditure and provision of instructional materials. In higher institutions, gifts, endowment funds, consultancy services, farms, satellite campuses, pre-degrees etc remain other alternative funding sources (Moja, 2000, Udoh, 2008).

Despite all the alternatives, the infrastructure and facilities remained inadequate for coping with a system that is growing at a very rapid pace. The annual population growth rate for Nigeria is 2.61%, more than twice the growth rate of world population (1.14). The morale of teachers is low due to poor basic conditions of service, delay or modulated payment of monthly salary and allowances and low remunerations. Furthermore, physical facilities and resources such as libraries, laboratories, modern communication and Information Technology equipment are inadequate to meet the demand of students. The quest for meeting these basic education needs has been the cause of unending crisis between government, and trade unions such as Nigeria Union of Teachers (NUT), Academic Staff Union of University (ASUU), and Non Academic Staff Union (NASU) (Nwagwu, 1997).

Given the financial limitations and its attendant problems, there is a need for a clear-cut knowledge of the efficiency of the university system.

The Nigerian higher institutions comprise at present, 43 federal, 47 states and 75 private universities. Like other universities in the world, the priority of the public universities in Southwestern Nigeria is to become world class. However, they are far away from the dream because of several challenges such as poor funding, inadequate infrastructure, brain drain, strike actions, and mounting pressure on scarce resources by ever growing population of student intakes. Given the seriousness of the resource scarcity situations, efficiency becomes an important issue. The state, society, media and other stakeholders expect universities to manage their resources more effectively and ensure increased transparency in state funding of the higher education sector. This is particularly important in Southwestern Nigerian

universities where increasing number of alternative financing schemes that rely on larger contributions from students is the norm among the state universities. One of the ways to create stimuli for the rational management of public funds by the universities and promote a quality improvement of their services is the comparative efficiency assessment of their activities. An advantage of this type of analysis is that it defines reference points (benchmarks) for studied activities. The results will contribute to a more efficient allocation of public funds, enhance efficiency of conducted processes, and promote higher quality of offered services and improvements in management of public institutions.

The rest of this paper is structured as follows: Section 2 shows the review of literatures, section 3 deals with the methodology employed in the research, section 4 deals with the results and presentation while section 5 gives the conclusion and policy recommendations to the study.

## **2.0 Review of Literature**

### **2.1 Policies and Development of Nigeria Educational System**

Education has evolved in Nigeria even prior to amalgamation of the Northern and Southern Protectorate in 1914. The most active period of the development, however began from 1950 when the constituent part of the country (Northern, Eastern and Western regions) became self-governing (Sambo, 2005). Following division of Nigeria into Northern, Eastern and Western regions when Richard's constitution came to effect in 1947, Nigerians became the sole policy makers for the educational system. The three geo-political regions had the ministry of education under the leadership of ministers of education who were mainly responsible for educational policies in each region. Director of education in each region handled the implementation of the policies. At the national level, the director general of education was coordinated by the regional educational systems. In 1955, the Joint Consultative Committee on education (JCC) was established as a major organization directly involved in educational activities in the country. It is obvious from Nigerian industry of education that the period (1950 – 1975) brought western education to limelight, increased access of Nigerian to formal education through efforts of the regional governments and voluntary agencies. The Nigerian educational statistics had it that in 1947, the number of pupils in primary school was 626, 000 while in 1960, it rose to 2,912,619. In the same vein, the number of post-primary schools in 1955 was 161 but 912 in 1960 with the population rising from 9,908 in 1947 to 140, 401 in 1960 (Imahe, 2001). The two main reasons adduced to the increases were the government's continued grant-in-aids to voluntary agencies and direct establishment of government and local government schools, community post-primary schools and private post-primary schools.

At the above formative years, one major problem of education was that it was colonial in nature, in that, it was not tailored towards the developmental needs of the country. Even in the University College at Ibadan, there were not faculties of law, engineering and economics as at 1963. This instance led to the Ashby Commissions of the post school certificate and higher education which recommended that technical streams should be created in many Nigeria post primary institutions from where students could acquire technical skills up to the level of city and guilds certificate of London. On the other hand, commercial education, which was higher than those available at the commercial school, should be left to the University institutions. The Ashby report emphasized the significance of University programmes diversification in the University College of Ibadan and in any other University to be founded later in the country. Between 1960 and 1970, University of Nigeria Nsukka, University of Ile-Ife, Ahmadu Bello University Zaria and University of Benin, Benin City were established. These solve the problem of lack of sufficient opportunities for higher education for qualified Nigerians. By the end of 1972/73 academic year, the student

population had more than doubled the Ashby Commissions projection for 1980. The growth of Polytechnics and Colleges of Education was more phenomenal. Now each state has at least one NCE or University. This increase, as good as it is, has caused several adjustment in the structure of education and government allocation to Education.

Until 1984, the structure of Nigeria education system was 6 years of primary schools, 5 – 7 years of post primary schools (Secondary, Teacher Training College and sixth form) and 4 – 6 yrs of tertiary education (Colleges of education, polytechnics, Colleges of Technology and University Education). From 1985, the structure that emanated can be classified thus, pre-primary or kindergarten education (2 – 3 yrs), for the children of ages 3 – 5 years the primary school which is of 6 years period for children of ages 6 – 11 yrs, the post primary education which is of 6 years duration but divided unto two halves (3 years of Junior Secondary School and 3 years of Senior Secondary School) and the 4 – 6 of tertiary education level.

One of the major studies in Nigerian education policy thrust was the public takeover of grant-in-aids schools in states and launching of Universal Primary Education (UPE) in 1976. The programme was not sustained due to frequent change in socio-economic and political conditions in the nation. However, the recent civilian government is trying to revive the policy of universal education of 1976, under the Universal Basic Education (UBE) scheme. Like other national policies on education, UBE has resulted to increased enrolment, but the commitment of government could not sustain the policy drive because of the reintroduction of school fees.

## 2.2 Conceptual Issues

Watchekon and Weltman (2008) in their framework paper on political institution and service delivery, provide a thorough survey of the growing literature on the relationship between political and social institution and public service delivery. The survey includes the evidence of Easterly and Levine (1997), Alesina *et.al* (1999), Miguel and Gugerty (2005), Kimenyi (2006) and Cho (2007) on how ethnic division affects public service delivery. The consensus of the authors is that public service delivery differs along ethnic divides. The contribution of ethnicity to public service delivery by the authors has been shown to be either positive or negative. Easterly and Levine demonstrate that ethnically homogenous countries have lower levels of educational attainment and lower ranking in measurement of development, while Cho (2007) introduces the possibility that certain electoral institutions mitigate the decline in trust often seen in ethnically diverse communities. Watchekon and Vermeersch (2005) and Fafchamps (2004) similarly found a positive ethnic network and investment in public goods.

Other areas covered by the review of Watchekon and Weltman (2008) are decentralization of governance, access to information and the role of mass media and electoral system. In their review of Azfar (2006), they found out that decentralization may improve government response to local preferences in terms of allocative efficiency. They argued that decentralization may also increase the capability of governments to collect user fees. Nevertheless, decentralization has been found to create its own problems. It can lower the quality of public services when citizens lack the mechanism to monitor the progress of newly decentralized services. Bardhan (2002) describes how decentralized services can be over-provided to the non-poor, thus widening local inequality. Watchekon and Weltman (2008) conclude with the fact that both cross country and micro-level research is necessary to determine the relationship between decentralization and under-provision of services to the non-poor.

In Nigeria, the limitation imposed by poor funding on improvement of the quality of education to meet the challenges of constantly changing environment has been given attention by several researchers (Ajani (1999); Banjo (1999); Nwaka (2000); Moja (2000); Akinkugbe (2001); Alumannah (2001) and Akintayo (2008)). However, there is the need for further research to explore what strategies work to ensure pro-poor education service delivery particularly in what seems to be a relatively difficult learning environment. This is the focus of this proposed research designed to consider the effectiveness of various educational institutions under different policy regimes and ethnic diversity. Very little published research appears to analyse the subtle relationships between political environment and education service delivery, beyond a general analysis that good governance and participation provide an enabling environment. No analysis of 'what works' and why within a given environment.

### 2.3 Theoretical and Methodological Issues

Nwangi *et al* (2006) discuss several empirical tools and techniques for evaluating service delivery performance. Taking a leave from the paper, public service delivery can be viewed as any other production activity. In respect of education for instance, the system requires teachers administrative and support staff and physical resources, classroom facilities, textbooks and school supplies. These are inputs of the educational production process. The outputs on the other hand are different kinds of cognitive skill acquired by the candidates. This implies that a school can be treated as a firm producing desired outputs with a given level of inputs.

Nevertheless, a public service delivery agency differs from a commercial firm in about three ways: (1) the outputs are provided at zero or minimal cost. (2) there are no market prices available to evaluate the output bundle and (3) there is no obvious criterion such as profitability or return on equity to assess the performance of a public service provider. Given the shortcomings, several alternatives are reviewed by Nwagi *et al* (2006) to measure performance even when market prices are not available. By far, the most commonly used measurement of performance is productivity. A producer with a higher output per unit of input used is more productive and is deemed to perform in a superior fashion. There are two principal approaches to production function and efficiency measurement that are widely used in literature. These are Stochastic Frontier Approach (SFA) and Data Envelopment Analysis (DEA).

Afonso and Aubyn (2005) applied DEA to analyze public education efficiencies for OECD countries. They used two quantitative inputs, total intended instruction time in public institution in hours per year for 12-14 years old in 2000 and number of teachers per student in public institutions for secondary education in 2000. The output was measured by the performance of the 15 year olds on the PISA reading mathematics and science literacy. Gupta and Verhoeven (2001) use FDA to analyze the overall efficiencies of government expenditure on public education and health in 37 African countries and 48 Asian or Western countries from 1984-1995. The input variable for education was per capita education spending by the government and three output variables for education were primary school enrollment, secondary school enrollment and reduction of adult illiteracy. The result showed that on the average, countries in Africa are less efficient than countries in Asia and the Western Hemisphere. Similarly, Bradley *et al* (2001) reviewed 14 studies of DEA of primary and secondary schools in Europe and in the US. They pointed out that in these studies; output of the education system typically includes some measures of examination success.

Afonso and Santo (2008) employ DEA to estimate efficiency scores for Portuguese public universities. The inputs are number of teachers and university spending while the output



measures are based on the undergraduate success rate and number of doctorate dissertations. Using frontier analysis, they separate universities that might qualify as performing well from those where some improvement might be possible. The DMUs are both primary faculties and institutes while universities are considered as an aggregate institution. In all they collected data from 52 universities. The inputs and outputs are measured in physical terms.

Wadhwa *et.al* (2005) used DEA for efficient evaluation of technical education system. In the case study, there are 3 outputs and 8 inputs. They employed a variable return to scale option because an increase in inputs does not yield the same increase in outputs. They found out that there is growing need to improve the multidimensional effectiveness of technical education. Abbott and Doucoaliagos (1999) used DEA to derive estimates of the technical and scale efficiencies of New Zealand's polytechnics. They used full-time equivalent enrolments as the output measure and 3 inputs – teaching staff, non-teaching staff and value of fixed assets. The study covered 23 polytechnics in 1995 and 21 in 1996. The results indicate that, in terms of technical efficiency, there is a fairly wide dispersal and therefore, there are opportunities for improving the technical efficiency. There are also potentials for increasing scale efficiency within the system as a whole.

Wolszczak-Derlacz and Parteka (2011) focus on the European public higher education institutions (HEI) using the two-stage approach. They analyzed 259 public HEIs from 7 European countries across the time period of 2001– 2005 combining parametric and non-parametric approaches. Authors used different specifications for DEA: 3 inputs and 2 outputs; 2 inputs and 2 outputs. After the efficiency scores were obtained, they were connected with the HEI characteristics. The paper highlights that the size of the educational institution, the number and composition of faculties, sources of funding and gender staff composition are the most significant parameters for the efficiency evaluation.

Taking into account a negligible level of the efficiency estimation in Nigeria and widespread usage of the DEA methodology in the world, current analysis becomes especially crucial for the Nigerian government and researchers to identify the country position.

### 3.0 Analytical Techniques

#### 3.1 Data envelopment analysis

In broad terms, DEA technique defines an efficiency measure of a production unit by its position relative to the frontier of the best performance established mathematically by the ratio of weighted sum of outputs to weighted sum of inputs. Norman and Stoker (1991) and Coelli (1996) provide a detail description of DEA technique. The estimated frontier of the best performance is also referred to as efficient frontier or envelopment surface. The frontier of the best performance characterizes the efficiency of production units and identifies inefficiencies based on known levels of attainment. For instance, a production unit attains 100% efficiency only when it is not found to be inefficient in using the inputs to generate the output when compared with other relevant production units. The original formulation of the DEA model was introduced by Charnes, Cooper and Rhodes (CCR) (1978), and it assumes constant return to scale (CRS) and the production frontier is a piecewise linear envelopment surface. In order to fix the idea, given that

$S = \{1... s\}$  is the set of outputs considered in the analysis

$M = \{1... m\}$  is the set of inputs considered in the analysis

$y_{rj}$  = known positive output level of production unit  $j$ ,  $r \in S$

$x_{ij}$  = known positive input level of production unit  $j$ ,  $i \in M$

$n$  = total number of production units evaluated

An interpretation of the CCR model that estimates the proportional increase  $\theta$ , in all outputs required to achieve efficiency in DMU 'k' is given by

Min  $\mu_k$

Subject to

$$\sum_{j=1}^n \lambda_j y_{rj} \geq y_{rk} / \mu_k, r = 1, 2, \dots, s$$

$$\sum_{j=1}^n \lambda_j x_{ij} \leq x_{ik}, i = 1, 2, \dots, m$$

$$\lambda_j \geq 0, j = 1, 2, \dots, n \quad (1)$$

The variables in the CCR model are  $\mu_k$ , and  $\lambda_j$ . The sufficient condition for efficiency of DMU 'k' is that the optimum value of  $\mu_k$  is 1. Otherwise, it is regarded as inefficient when compared to other DMUs in the sample. The constraints in the model ensure that relative technical efficiency of DMU 'k', given by  $\mu_k$  never exceeds 1. Usually, in the CRS model, the technical efficiency estimated with input and output orientation is the same and the optimal value of  $\mu$  will be the Farrell (technical) efficiency. A DEA run involves solving the above model  $n$  times, once for each DMU analyzed. The measure of efficiency obtained from the solution to model (1) consists of two components: 'pure' technical efficiency and scale efficiency. Banker, Charnes and Cooper (BCC) (1984) proposed the variable-returns-to-scale (VRS) version of the model (1). The BCC model is (1) together with the additional constraint

$$\sum_{j=1}^n \lambda_j = 1 \quad (2)$$

which captures returns to scale characteristics. Hence, the efficiency estimates obtained in the BCC model is net of the contribution of scale economies and therefore is referred to as 'pure' technical efficiency and also as the managerial efficiency. The model given in (1) is output-oriented since it provides information as to how much equi-proportional increase in output is necessary (while maintaining levels of input) for an inefficient unit to become DEA-efficient. Under CRS specification, input and output orientation provides identical DEA estimates. Moreover, the efficiency frontier estimated with input and output orientation DEA models is the same. Generally, the purpose of an input-oriented example is to study the amount by which input quantities can be proportionally reduced without changing the output quantities produced. Alternatively, and by computing output-oriented measures, one could also try to assess how much output quantities can be proportionally increased without changing the input quantities used. The two measures provide the same results under constant returns to scale but give different values under variable returns to scale. Nevertheless, since the computation uses linear programming, which is not subject to statistical problems such as simultaneous equation bias and specification errors, both output and input-oriented models will identify the same set of efficient/inefficient producers or DMUs. The VRS technology usually envelops data more closely than CRS technology, and consequently, VRS technical efficiency scores are greater than or equal to CRS technical efficiency scores. The advantages of the VRS model outweigh the increase in computational power necessary to solve the model, which allowed the VRS to gain popularity over the CRS method (Fried *et al.* (2002), Coelli *et al.* (1998)).

### 3.2 Empirical Specification

In this study, DEA method was used to analyze the efficiency of public universities in Southwestern Nigeria. Based on the DEA methodology, to analyze the efficiency of the universities in Southwestern Nigeria, it is assumed that each university (DMU – Decision Making Unit) may be characterized by its initial assets (system input), effects (results, system output) and production processes, which transform assets into effects controlling for environmental factors (variables out of university's control).

### 3.3 Data and Measurement Issues.

Data for this study were primarily sources from the National Universities Commission the body officially saddled with the responsibility and coordination of university education in Nigeria. Specifically, the data were extracted from two official publications of the National Universities Commission viz *Nigerian University System Statistical Digest (2017)* and *The State of Nigeria Universities (2017)*

Although the focus of this study is the public universities in the southwestern Nigeria, which include those owned by the federal government and those owned by the state governments, this study examined all universities in Nigeria and succinctly studied how the southwestern public universities performed among them. The universities dropped from the analysis are those with insufficient information for the year of study. A total of One hundred and twenty – one universities were considered for the study. Of this number, thirty-nine (39) are owned by the federal government, thirty (30) are owned by the state governments, twenty-nine (29) are owned by individuals and private organizations while the remaining twenty-three (23) are owned by missions (that is their ownership are religious organization-based)

While some studies have analyzed different types of efficiency such as teaching and research efficiency, it is important to state that the variables selection plays one of the crucial role for DEA analysis. According to Chernoknyzhna (2018), the literature suggests a wide range of the potential indicators, but the choice is still has quite subjective intuition due to the lack of one best practice for this process. He opined that number of number of graduates is one of the most controversial indicators, because it could reflect the success of the teaching performance from the one side. However, the quantity of graduates could not be considered as the quality of the education. Nonetheless Aracil and Palomares (2008), Abott and Doucoullagos (2003) used this indicator in their research.



**Table 1. Input-output Variables in Previous DEA Studies on the Universities**

Author	Input variables	Output variables
Babacan & Kartal (2007)	Number of Prof.	University Revenues
	Number of Assoc.	Number of Publications in Indexes
	Number of Assist. Prof.	Number of Graduate Student Graduates
	Number of Assist. Instructor	Number of Graduate Students
	General Budget Expenditures	Number of Undergraduate Graduates
Kutlar & Babacan (2008)	Number of Administrative Personnel	Number of Undergraduate Students
	Expenditures out of Budget	
	General Budget Expenditures	Number of Publications in Indexes
	Expenditures Out of Budget	University Revenues
	Number of Prof.	Number of Undergraduate Students
Özden (2008)	Number of Assoc.	Number of Undergraduate Graduates
	Number of Assist. Prof.	Number of Graduate Students
	Number of Assist. Instructor	Number of Graduate Student Graduates
	Number of Administrative Personnel	
		Number of Publications
Bal (2013)	Number of the Faculty Members	Number of Graduate Students
	Number of Other Academic Staff	Number of Undergraduate and Graduate Students
	Total Expenses	Other Revenues
		Education-Teaching Income
Selim & Bursalıoğlu (2015)	Number of Faculty Members	Ratio of Students to Faculty
	Number of Other Academic Staff	Sum of the Articles and Citations in Journals Indexed by SCI, SSCI, AHCI
	Central Government Budget Allowances	Number of Graduates per Academician
	University Revenues	Number of Graduate Students Graduate per Academician
	Project Share (TUBITAK)	Number of Ph.D. Students per Academician
Erkoç (2016)	Project Share (BAB)	Number of Publications
	Number of Total Academician	Number of Employees
	Number of Academic Staff	Number of Undergraduate Students
	Labor Expenditures	Number of Graduate Students
	Capital Expenditures	Number of Publications in Indexes Per Academician
Arık & Seyhan (2016)	Goods and Service Expenses	Total Research Award Amount
	Total Expenditures	
	Number of Academic Staff	Number of Publications
Source: Türkan and Özel, (2017)	Number of Units in the University	Number of Undergraduate Students
		Number of Graduate Students

**Table 2: Model Variables**

Type of Variable	Description	measurement
Input	Government/ Owner Subvention	Naira
Input	Internally generated revenue	Naira
input	University running cost	Naira
Input	Internet wifi supply	Ratio
Input	Number of academic programmes	Number
Input	academic teachers	Number
Input	Student/staff ratio	Number
Output	Undergraduate students enrollment	Number
Output	Postgraduate students enrollment	Number

Meanwhile, the unavailability of information or database on research publications of Nigeria university lecturers makes it difficult to assess the research efficiency; therefore the main focus of this study is on the teaching efficiency.

The combinations of the inputs with the fixed mix of the outputs which was used to estimate the efficiency of Nigeria universities in this study and which was considered as the best mix is described in the table below. The model was analyzed using the input-oriented approach of the Data Envelopment Analysis component of the R – Studio statistical package.

## 4.0 Results and Discussion

### 4.1 Efficiency Distributions of Nigeria Universities According To Geopolitical Zones

Table 3 below shows the efficiency of selected Nigerian Universities. As stated in the methodology, the efficiency was measured using the CCR model of the DEA. Analysing the efficiency of Nigeria universities along the line of the geopolitical zones, the result show that universities in the North – Central part of Nigeria are the best performing universities. Available data show that the universities in this region are the best in terms of funding. They also have one the highest staff to student ratio when compared with other geopolitical zones. Universities in the South-West zone have one of the low average efficiency values. Universities in the North-West and South- South zones of Nigeria have better efficiency output when compared with those from the South-West

**Table 3: Efficiency Distributions According To Geopolitical Zones**

	zone	mean	sd	min	max	n
1	FCT	0.291063	0.381413	0.01037	1	7
2	NC	0.43664	0.42085	0.0061	1	15
3	NE	0.263482	0.286008	0.06473	1	9
4	NW	0.379563	0.369047	0.03342	1	15
5	SE	0.239776	0.313483	0.00413	1	24
6	SS	0.365724	0.338924	0.04918	1	11
7	SW	0.269788	0.356409	0.00136	1	40

Source: Authors' calculation, 2019

#### 4.2 Efficiency Distributions of South- West Universities According To Ownership

Analysis of efficiency of universities in south- western Nigeria is shown in table 4. The result revealed that universities in south-western Nigeria which are owned by the Federal government are the best performing universities in the region with an average efficiency value of 0.622. This is closely followed by state universities. The private universities which are not owned by faith organizations are third on the line in terms of performance. The Federal universities in Nigeria are generally well funded hence once will not be surprised at the level of their efficiency. State universities in Nigeria are many times plagued financial crisis and this has significantly affected the efficiency performance of many of them.

**Table 4: Efficiency Distributions of Universities in the South-West**

	Class	mean	min	max	n
1	Federal	0.622339	0.15463	1	7
2	State	0.236497	0.0599	0.97876	14
3	Private(Mission-based)	0.153984	0.00533	1	8
4	Private	0.235184	0.0026	1	16

*Source: Authors' calculation: 2019*

#### 4.2 Efficiency Distributions of Each South- West Universities

As shown in Table 5, only five universities are technically efficient in Southwestern Nigeria. The five universities are Federal university of Technology Akure, The Bells University, University of Ibadan, Lead City University and Babcock University. That is two federal universities, two private universities and one mission-based private university. The results with respect to the south-west universities also show that the Federal universities in the country have the highest mean efficiency. They have a mean efficiency of 0.622 while the state universities in the South-West have mean efficiency value of about 0.237. Mission - based private in the South –West as it is in other geopolitical zones have the least efficiency performance.

**Table 5 : Efficiency Distribution of South – West Universities**

1	Federal University of Agric. Abeokuta	SW	F	0.7799
2	Federal University of Oye, Oye Ekiti	SW	F	0.86072
3	Federal univrsty of Tech. Akure	SW	F	1
4	Obafemi Awolowo University, Ile-ife	SW	F	0.066
5	Tai Solarin College of Education, Ijebu Ode	SW	F	0.49512
6	university of Lagos	SW	F	0.15463
7	university of ibadan	SW	F	1
8	Ajayi Crowther university, oyo	SW	FP	0.25501
9	Anchor university, Ayobo	SW	FP	0.00533
10	Babckok University, Ilishan Remo	SW	FP	1
11	Bowen University, Iwo	SW	FP	0.06842
12	Covenant Unicersity, Ota	SW	FP	0.16304
13	Crawford univrsty	SW	FP	0.02285
14	Cresent University, Abeokuta	SW	FP	0.32429
15	Dominican University, Ibadan	SW	FP	0.00314
16	Fountain University, Osogbo	SW	FP	0.07273
17	Joseph Ayo Babalola Univ., Ikeji Arakeji	SW	FP	0.09603
18	Kings University, Ode Omu	SW	FP	0.00597
19	Macpherson University, Ajebo	SW	FP	0.0435
20	Mountain Top University, Lagos	SW	FP	0.00518
21	Redeemers university, Mowe	SW	FP	0.22878
22	Wesley University, Ondo	SW	FP	0.0074
23	Achivers University Owo	SW	P	0.01789
24	Adeleke University Ede	SW	P	0.07104
25	Afe babalola University	SW	P	0.14425
26	Augustine University, Ilara Epe	SW	P	0.0026
27	Bells University of Tech, Ota	SW	P	1
28	Chrisland University, Owode Abeokuta	SW	P	0.00779
29	Christopher University, Mowe	SW	P	0.00136
30	Elizade University, Ilaramokin	SW	P	0.21784
31	Hallmark University, Ijebu itele	SW	P	0.00203
32	Lead City University	SW	P	1
33	Oduduwa University, Ipetu	SW	P	0.16461
34	Pan - Atlantic university, Lagos	SW	P	0.1928
35	Ekiti Stat Univrsty, Ado Ekiti	SW	S	0.12101
36	Ladoke Akintol University of Tech	SW	S	0.11065
37	Lagos State University, Ojo	SW	S	0.97876
38	Ondo State University of Scienc and Tech, Okitipupa	SW	S	0.13837
39	Ondo State Univrsty of Medicals, Ondo	SW	S	0.0599
40	Technical University, Ibadan	SW	S	0.01029

**Source: Authors' calculation: 2019**

### 4.3 Input Slacks for South-West Universities

The slack in inputs are the unnecessary inputs that can be done away with in DEA efficiency analysis without sacrificing efficiency. The slacks for the various inputs and outputs combinations employed in this study are shown in tables 6a to 6d. The inputs slacks for each of the selected universities represents the amount by which specific inputs for a particular university must be reduced while the output slacks represents the increase in the level of

output for a particular university to attain efficiency. From Tables 6a to 6d, one can observe that the five efficient South-West Universities (Federal university of Technology Akure, The Bells University, University of Ibadan, Lead City University and Babcock University) have zero slacks inputs and outputs and where slacks exists for them, they were very negligible. For the other inefficient universities, they have various slacks values for their inputs and outputs.

**Table 6: Input Slacks Distribution among South- West Universities**

DMU	zone	class	slack_._ssr	slack_._wifi
Federal University of Agric. Abeokuta	SW	F	0.07877529	11.34402731
Federal University of Oye, Oye Ekiti	SW	F	0.10169863	24.243746
Federal univrsity of Tech. Akure	SW	F	0	0
Obafemi Awolowo University, Ile-ife	SW	F	0.00868782	0
Tai Solarin College of Education, Ijebu Ode	SW	F	0	0.782399872
university of Lagos	SW	F	0.01477812	0
university of ibadan	SW	F	0	0
Covenant Unicersity, Ota	SW	FP	0.09417686	2.489704002
Crawford univrsity	SW	FP	0.02141006	0.500254672
Crescent University, Abeokuta	SW	FP	0	0
Dominican University, Ibadan	SW	FP	0.00128416	0.071514349
Fountain University, Osogbo	SW	FP	0.00825669	1.502385735
Joseph Ayo Babalola Univ., Ikeji Arakeji	SW	FP	0.01409449	1.234684336
Kings University, Ode Omu	SW	FP	0.00282693	0.112253262
Macpherson University, Ajebo	SW	FP	0.01772618	0
Mountain Top University, Lagos	SW	FP	0.00124087	0
Redeemers university, Mowe	SW	FP	0.04068446	0
Wesley University, Ondo	SW	FP	0.00358213	0
Ajayi Crowther university, oyo	SW	FP	0.03549315	4.500760954
Anchor university, Ayobo	SW	FP	0.00253658	0.104519206
Babcock University, Ilishan Remo	SW	FP	0	0
Bowen University, Iwo	SW	FP	0.00966754	0
Achivers University Owo	SW	P	0.01296869	0.089285182
Adeleke University Ede	SW	P	0.00728577	1.260456103
Afe babalola University	SW	P	0.0076683	1.534541439
Augustine University, Ilara Epe	SW	P	0.0015894	0.030801507
Bells University of Tech, Ota	SW	P	0	0
Chrisland University, Owode Abeokuta	SW	P	0.00412204	0.177963479
Christopher University, Mowe	SW	P	0.00259697	0.024025968
Elizade University, Ilaramokin	SW	P	0.04151229	5.5671443
Hallmark University, Ijebu itele	SW	P	0.00376038	0.020932181
Lead City University	SW	P	0	0
Oduduwa University, Ipetu	SW	P	0.04645645	3.405138875
Pan - Atlantic university, Lagos	SW	P	0.13598613	3.846151047
Ekiti Stat Univrsity, Ado Ekiti	SW	S	0.01043948	0
Ladoke Akintol University of Tech	SW	S	0.01021242	1.127765131
Lagos State University, Ojo	SW	S	0.01116886	0
Ondo State University of Scienc and Tech, Okitipupa	SW	S	0.02655802	0.350269829
Ondo State Univrsity of Medicals, Ondo	SW	S	0.0170323	0.279195958
Technical University, Ibadan	SW	S	0.00369383	0.065150175

*Source: Authors' calculation: 2019*



**Table 7: Input Slacks Distribution among South- West Universities**

DMU	zone	class	slack_subv	slack_igr
Federal University of Agric. Abeokuta	SW	F	4273204.67	0
Federal University of Oye, Oye Ekiti	SW	F	0	0
Federal univrsity of Tech. Akure	SW	F	0.00058512	0
Obafemi Awolowo University, Ile-ife	SW	F	531423146	0
Tai Solarin College of Education, Ijebu Ode	SW	F	13369525.8	1492980465
university of Lagos	SW	F	578148488	87629623.41
university of ibadan	SW	F	0	0
Covenant Unicersity, Ota	SW	FP	178472928	0
Crawford univrsity	SW	FP	0	0
Cresent University, Abeokuta	SW	FP	0	0
Dominican University, Ibadan	SW	FP	10255.321	0
Fountain University, Osogbo	SW	FP	0	0
Joseph Ayo Babalola Univ., Ikeji Arakeji	SW	FP	0	0
Kings University, Ode Omu	SW	FP	333704.723	6901576.704
Macpherson University, Ajebo	SW	FP	188466075	220463985
Mountain Top University, Lagos	SW	FP	3640944.63	18995647.09
Redeemers university, Mowe	SW	FP	550780131	30155335.43
Wesley University, Ondo	SW	FP	0	24627059.37
Ajayi Crowther university, oyo	SW	FP	898884079	0
Anchor university, Ayobo	SW	FP	0	0
Babckok University, Ilishan Remo	SW	FP	0	0
Bowen University, Iwo	SW	FP	0	0
Achivers University Owo	SW	P	0	0
Adeleke University Ede	SW	P	0	0
Afe babalola University	SW	P	1.07E+10	0
Augustine University, Ilara Epe	SW	P	264527.903	10317991.08
Bells University of Tech, Ota	SW	P	0	0
Chrisland University, Owode Abeokuta	SW	P	0	0
Christopher University, Mowe	SW	P	124892.085	1270117.033
Elizade University, Ilaramokin	SW	P	0	363238988.8
Hallmark University, Ijebu itele	SW	P	159931032	0
Lead City University	SW	P	0	0
Oduduwa University, Ipetu	SW	P	0	0
Pan - Atlantic university, Lagos	SW	P	0	853114408.1
Ekiti Stat Univrsity, Ado Ekiti	SW	S	160159318	307362247.7
Ladoke Akintol University of Tech	SW	S	0	280730845.8
Lagos State University, Ojo	SW	S	25941297.1	3670030864
Ondo State University of Scienc and Tech, Okitipupa	SW	S	0	0
Ondo State Univrsity of Medicals, Ondo	SW	S	1642982.24	0
Technical University, Ibadan	SW	S	27243811.6	0

**Source: Authors' calculation: 2019**

**Table 8: Input Slacks Distribution among South- West Universities**

DMU	zone	class	slack_prog	slack_runcost
Federal University of Agric. Abeokuta	SW	F	0	0
Federal University of Oye, Oye Ekiti	SW	F	17.2458828	0
Federal univrsty of Tech. Akure	SW	F	0	0
Obafemi Awolowo University, Ile-ife	SW	F	0	442822677
Tai Solarin College of Education, Ijebu Ode	SW	F	5.53118204	0
university of Lagos	SW	F	0	742879106.3
university of ibadan	SW	F	0	0
Covenant Unicersity, Ota	SW	FP	0	0
Crawford univrsty	SW	FP	0.06774968	0
Cresent University, Abeokuta	SW	FP	0	0
Dominican University, Ibadan	SW	FP	0.00778324	0
Fountain University, Osogbo	SW	FP	0	10125510.67
Joseph Ayo Babalola Univ., Ikeji Arakeji	SW	FP	1.04668958	0
Kings University, Ode Omu	SW	FP	0	0
Macpherson University, Ajebo	SW	FP	0.50660227	0
Mountain Top University, Lagos	SW	FP	0	2466491.036
Redeemers university, Mowe	SW	FP	0.07352393	0
Wesley University, Ondo	SW	FP	0.00248725	0
Ajayi Crowther university, oyo	SW	FP	0	2058349351
Anchor university, Ayobo	SW	FP	0.00461035	0
Babckok University, Ilishan Remo	SW	FP	0	0
Bowen University, Iwo	SW	FP	0.05133088	0
Achivers University Owo	SW	P	0.16611541	0
Adeleke University Ede	SW	P	0.16717707	0
Afe babalola University	SW	P	0	13398413569
Augustine University, Ilara Epe	SW	P	0	0
Bells University of Tech, Ota	SW	P	0	0
Chrisland University, Owode Abeokuta	SW	P	0.13033148	0
Christopher University, Mowe	SW	P	0	0
Elizade University, Ilaramokin	SW	P	1.44376781	0
Hallmark University, Ijebu itele	SW	P	0	28083974.37
Lead City University	SW	P	0	0
Oduduwa University, Ipetu	SW	P	0	0
Pan - Atlantic university, Lagos	SW	P	0	108915634.2
Ekiti Stat Univrsity, Ado Ekiti	SW	S	0	0
Ladoke Akintol University of Tech	SW	S	0	460408310.7
Lagos State University, Ojo	SW	S	0	0
Ondo State University of Scienc and Tech, Okitipupa	SW	S	0	46754827.36
Ondo State Univrsity of Medicals, Ondo	SW	S	0	0
Technical University, Ibadan	SW	S	0	0

**Source: Authors' calculation: 2019**

**Table 9: Input Slacks Distribution among South- West Universities**

DMU	zone	class	slack_ .uenroll	slack_ .penroll
Federal University of Agric. Abeokuta	SW	F	0	0
Federal University of Oye, Oye Ekiti	SW	F	0	418.8003985
Federal univrsity of Tech. Akure	SW	F	0	0
Obafemi Awolowo University, Ile-ife	SW	F	0	2345.06657
Tai Solarin College of Education, Ijebu Ode	SW	F	0	3718.611
university of Lagos	SW	F	6608.14911	0
university of ibadan	SW	F	0	0
Covenant Unicersity, Ota	SW	FP	3035.18586	0
Crawford univrsity	SW	FP	0	0.26042708
Cresent University, Abeokuta	SW	FP	0	0
Dominican University, Ibadan	SW	FP	0	8.843060795
Fountain University, Osogbo	SW	FP	0	192.6017138
Joseph Ayo Babalola Univ., Ikeji Arakeji	SW	FP	0	0
Kings University, Ode Omu	SW	FP	0	35.36449891
Macpherson University, Ajebo	SW	FP	0	4.465154265
Mountain Top University, Lagos	SW	FP	0	120.9875686
Redeemers university, Mowe	SW	FP	288.158852	0
Wesley University, Ondo	SW	FP	0	117.1001404
Ajayi Crowther university, oyo	SW	FP	9194.62937	0
Anchor university, Ayobo	SW	FP	0	43.2267925
Babckok University, Ilishan Remo	SW	FP	0	0
Bowen University, Iwo	SW	FP	0	603.8646057
Achivers University Owo	SW	P	0	60.51871689
Adeleke University Ede	SW	P	0	388.4492833
Afe babalola University	SW	P	0	681.1239006
Augustine University, Ilara Epe	SW	P	0	27.73076032
Bells University of Tech, Ota	SW	P	0	0
Chrisland University, Owode Abeokuta	SW	P	0	22.16551444
Christopher University, Mowe	SW	P	0	13.13166928
Elizade University, Ilaramokin	SW	P	0	45.35815297
Hallmark University, Ijebu itele	SW	P	0	9.044090579
Lead City University	SW	P	0	0
Oduduwa University, Ipetu	SW	P	0	45.57485007
Pan - Atlantic university, Lagos	SW	P	9562.30852	0
Ekiti Stat Univrsity, Ado Ekiti	SW	S	0	3796.735411
Ladoke Akintol University of Tech	SW	S	0	570.1475702
Lagos State University, Ojo	SW	S	0	0
Ondo State University of Scienc and Tech, Okitipupa	SW	S	0	309.9111223
Ondo State Univrsity of Medicals, Ondo	SW	S	0	170.9164547
Technical University, Ibadan	SW	S	0	25.16661804

**Source: Authors' calculation: 2019**

## 5.0 Concluding Remarks

The results of this study show that Nigerian universities are still largely inefficient. Of the 121 universities examined, only 19 of them are operating at the efficiency level which implies that they have successfully and strategically managed and utilized all the resources available to them. No input was left idle or underutilized.

The situation in the South-West is as critical as other parts of the country where the study reveals that only 5 of the universities in the South-West are technically efficient which represents 26 percent of Nigerian universities. Of these 5 universities, 2 of them are federal universities, 2 are private universities while the other 1 is mission-based private university.

However, one is not unaware of the limitations of our research study. The selection of inputs and outputs to control performance at the universities is very difficult (McCormick and Meiners, 1988). At the same time, we used have used in this study the available data when compared with other notable works that have been carried out in this regard. In the future, it will be our greatest desire to exploit other inputs combination to see if better results could be obtained for the South-West universities and Nigeria as a whole.

## 6.0 Policy Recommendations

A number of relevant policy implications flow generally from this study, the following are of utmost importance:

1. There is the need for better funding of university education in Nigeria. It is obvious that university education in Nigeria is well underfunded. Without it, basic infrastructures needed for excellence in academic output and research will be largely missing.
2. It is very important that stakeholders in Nigeria university education be aware of the possible sources of inefficiency in order to increase the university productivity and to make more accurate resource allocation decisions; indeed, as pointed out by Avkiran (2001), failing to make efficiency analysis a standard practice would certainly lead to less than efficient allocation of educational resources. Regulators operating in this sector might take advantage of these studies and make, through appropriate policy decisions (i.e. focusing on the distribution of available additional resources either among the more efficient units, as reward, or the more inefficient units, helping them to improve their efficiency), the tertiary education system more effective.

## References

- Abbott, M and Doucoaliagos (1999). Technical and scale efficiency of vocational education and training institutions. The case of new Zealand polytechnics. Center for the Economics of Education and Training Working Paper 22.
- Afonso, Antonio and M. St. Aubyn (2005): Non –parametric Approaches to Education and Health efficiency in OECD countries. Journal of Applied Economics. Vol VIII, No 2, 227- 246
- Afonso, A and Santos, M (2008). A DEA approach to the relative efficiency of Portuguese public universities. Portuguese Journal of Management Studies 13(1): 67-87

- Ajani, C. (1999) Higher Education and the Challenges of 21<sup>st</sup> Century. *International Journal of Continuing Education*, vol. 2(2), 21 – 33
- Akinkugbe, O. (2001). The Piper, the tune and University Autonomy. *Newsletter of the Social Science Academy of Nigeria (SSAN)*, vol. 4(1), March, 11 – 15.
- Akintayo, D. I. (2008): University Educational Service Delivery Strategy In A Changing World: Implications For Ethical Values And Leadership Integrity In Nigeria. *Journal of College Teaching & Learning* – January 2008 Volume 5, Number
- Alesina, Alberto and Eliana, La Ferrara. (1999) Ethnic Diversity and Economic Performance. *Journal of Economic Literature* 93 (2005): 762-800.
- Alumanah, J. N. (2001). Higher Education in Nigeria: Obstacles and Options for Sustainability. In Layi Erinsho, R. A. Akindele, I. N. Obasi and G. J. Odepe (eds.) (2001); Paths to the Sustainability of Higher Education in Nigeria, Proceedings of the 12<sup>th</sup> General Assembly of SSAN, 37 – 45
- Azfar, Omar, Sa Kaehkoenen, Anthony Lanyi, Patrick Meagher, and Diana Rutherford. (2006) “Decentralization, Governance and Public Services: The Impact of Institutional Arrangements.” *Devolution and Development: Governance Prospect in Decentralizing states*. Ed Mwangi Kimenyi and Patrick Meagher. Burlington: Ashgate Publishing Company, 2004. 19- 63
- Avkiran, N.K. (2001). Investigating technical and scale efficiencies of Australian Universities through data envelopment analysis. *Socio-Economic Planning Sciences*, 35, 57–80.
- Banjo, A. O. (1999). The Future of Scholarship in Nigeria. *Newsletter of the Social Science Academic of Nigeria (SSAN)*, Vol. 2(1) March, 2 – 11.
- Banker, R. (1984). Estimating most productive scale size using Data Envelopment Analysis. *European Journal of Operational research*, 17:35-44
- Bardhan, Pranab. “Decentralization of Governance and Development. *The Journal Economic Perspectives* 16.4: 185-205
- Bradley , Steve, G Johnnes and J. Millington (2001): The Effect of Competition on the Efficiency of Secondary schools in English. *European Journal of Operational Research*. Vol135, 545-568
- Charnes, A.; Cooper, W. and Rhodes, E. (1978). “Measuring the efficiency of decision making units,” *European Journal of Operational Research*, 2 (6), 429–444.
- CBN (2017): Central Bank of Nigeria, Annual Report and Statement of Account, Abuja.
- Cho, Wonbin. (2007): Ethnic Fractionalization, Electoral Institutions, and Africans’ Political Attitudes.” Working paper for the African Barometer.
- Coelli, T.; Rao, P. and Battese, G. (1998). *An Introduction to Efficiency and Productivity Analysis*, Kluwer, Boston.



- Coelli, T.J and D.S Rao (2003): "Total Factor Productivity Growth in Agriculture: A Malmquist Index Analysis of 93 Countries, 1980-2000" CEPA Working Papers, No. 2/2003, School of Economics, University of New England, Armidale, pp.31
- Diewert, W. E. and C. J. Morrison (1986). Adjusting output and productivity indexes for changes in terms of trade. *Economic journal* 96: 659 – 679.
- Easterly, William and Ross Levine (1997): "Africa's Growth Tragedy: Policies and Ethnic Divisions." Quarterly Journal of Economics 112.4: 1203- 1250
- Fare, R; Grosskopf, S; and, C.K Lovell (1994): *Production Frontier*. Cambridge University Press, Cambridge
- Farrell M. J (1957): The measurement of Productive Efficiency, *Journal of the Royal Statistical Society*, 120,252-290.
- Fashina, D. (2005): Reforms in Nigeria University System: What Direction? *National Freedom* 1 (6): 9-12
- Fried, H. O; Lovell, C. A. K; Schmidt, S and Yaisawarng, S. (2002). Accounting for environmental effects and statistical noise in DEA. *Journal of productivity analysis* 17:157-174.
- Gupta, Sanjeev and M. Verhoeven (2001): "The Efficiency of Government Expenditure: Experiences from Africa. Journal of Policy Modeling. Vol 23 433-467
- Hinchliffe, K. (2002): Public Expenditure on Education in Nigeria: Issues Estimates and Some Implications. Abuja, World Bank.
- Hjalmarsson, L and Veiderpass 1992. Productivity in Swedish electricity retail distribution. *Scand. J of Economics* 94 supplement 193-205
- Imahe, O. J. (2001): Human Capital Formation in Nigeria: A case Study of Tertiary Education 1975- 1995. Ph.D Thesis, Ambrose Alli University, Ekpoma.
- Inua, O. I. and Maduabum, C. (2012). Performance Efficiency Measurement In The Nigerian Public Sector: The Federal Universities Dilemma. *Mediterranean Journal of Social Sciences*, 5 (20): 838-847
- Kimenyi, Mwangi (2006): Ethnicity, Governance and the Provision of Public Goods." Journal of African Economies 15.1 : 62-99.
- Miguel, Edward and Mary Kay Gugerty. Ethnic Diversity, Social Sanctions and Public Goods in Kenya. *Journal of Public Economics* 89. 11-12: 2325- 2368 (2005)
- McCormick, R. E. and R. E. Meiners (1988). University Governance: A property rights perspective. *Journal of Law and Economics*, 31
- Moja (2000): Nigeria Education Sector Analysis: An analytical Synthesis of Performance and main Issues. Abuja, World Bank

- Nwangi, S. K. (2006): "Tools and Techniques for Evaluating Service Delivery." African Economic Research Consortium Framework Papers for the Collaborative Project on Institutions and Service Delivery.
- Nwagwu, C. C. (1997): The Environment of Crisis in the Nigerian Education System. *Comparative Education* 33 (1): 87- 95
- Nwaka, G. I. (2000). Higher Education, Social Sciences and National Development in Nigeria. *Newsletter of the Social Science Academy of Nigeria (SSAN)*, vol. 3(1) March, 25 – 33.
- Sambo, A. A. (2002): The Nigerian Education System: Brief History. *National Freedom*. 1 (6): 8-9
- Shephard, R. W. (1970): *Theory of Cost and Production Functions*. Princeton: Princeton University Press.
- Udoh, A. O. (2008). Alternatives Sources of Funding University Education in Nigeria. *African Research Review* 2(3): 187-194
- Wadhwa, S; A. Kumar and A. Saxene (2005). Modelling and analysis of technical education system: AKM and DEA approach. *Studies in Informatic control* 14(4):235-250.
- Watchenkon, Leonard and Christel Vermeersch (2005): Information, Social Networks and the Demand for Public Goods: Experimental Evidence from Benin.
- Watchenkon, L and S. Weltman (2008): Political Institutions and Public Service Delivery: A Survey of the Literature and Directions for Future Research. AERC Framework Paper on Public Institution Service Delivery.