ASSESSMENT OF THE EFFICIENCY OF SELECTED PUBLIC SECTOR ENTITIES IN NIGERIA

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Abstract

The study examined the efficiency of Decision Making Units (DMUs) in the health sector in the personnel cost releases and utilization to the various (DMUs) by the Federal Government of Nigeria. Secondary data over a period of 2008-2016 were sourced from the Annual General Warrants from the office of the Accountant- General of the Federation, office of the Auditor-General of the federation and Audited financial statements of the Public Sector entities. Sample size of the study comprised twenty-five (25) DMUs out of the major Federal Ministries from four (4) geo-political Zones and Abuja. Data were analyzed using Data Envelopment Analysis Model (DEA). The results of the average efficiency scores from Charnes, Cooper and Rhodes Model (CCR) on the DMUs showed that the sector was marginally inefficient. The summary of the overall results therefore revealed that the DMUs under health sector performed averagely well in the utilization of personnel cost allocations with the application of both CCR and BCC models. The study recommended that a central monitoring team be created jointly by the Federal Ministry of Finance and Accountant-General's office to ensure full utilization of personnel cost releases to the DMUs. Also, continuous assessment and periodic appraisal of the personnel cost utilization by the ministry can guarantee full efficiency in the utilization of personnel cost releases.

Keywords: Efficiency, Decision Making Units (DMUs), Health, DEA, Nigeria
JEL Classification: H2, HI1, H83, CI, H5

Introduction

The public sector entities have been under intense pressure to increase efficiency and improve the qualities of its various activities. This is in line with the minimum acceptable standards obtainable in the private sector (Zafiropoulos & Vrana, 2008). The growing expectation gap between the stakeholders of the public sector outputs and the quality of result output produced to the teeming populace has been a major concern. The desire of the various Decision Making Units (DMUs) for the Public Sector Entities (PSEs) has been an improved capacity of the sector to stimulate growth by efficiently managing public financial releases by the central authority, most especially the personnel cost releases, for the appropriate payment of staff salaries. The efficiency of PSEs in personnel costs utilization is sometimes affected by the weak dispositions and pervading corruptive tendencies that characterize the environment where the PSEs operate coupled with the instability of governments through incessant and frequent political changes (Bonaccors & Daraio, 2009; Nazarko, 2009). Public sector entities (PSEs) are the public organizations that engage in public programmes and providing general services among the citizenry through the public pool of wealth available in the domestic economy (Kara,2012). Generally, these entities are grouped into three categories according to their reliance on central authority's allocations. The first category is the fully funded PSEs. The activities of this class of public entities are fully financed from the federation account. The entities are not expected to keep any part of the Internally Generated Revenue owned by the entities but to remit all the inflows accruable to them to the federation account. Next to this is the partly funded public sector entities. Operations of these entities are not fully funded from the federation account. The entities are allowed to generate own revenue internally to cushion the effect of shortfalls from the central government's releases. However, major activities of these entities are funded by the federation account in form of monthly financial releases to the entities. Such releases are personnel cost releases for the payment of staff salaries, capital

grant releases for capital development and investment and overhead cost releases for financing recurrent expenditure. All the PSEs under the health sector fall into this category. The staff personal emoluments are paid by the central authority through the monthly personnel cost allocation released to the entities from the approved annual appropriations. Third category is the non-funded PSEs. None of the activities of these entities is funded by the federation account. They are financially independent of federal government's funding. The entities generate enough revenue that finance all their operating activities. Most of the literature on public sector efficiency are focused on either productive efficiency or dynamic efficiency. However, the aspect of public sector service efficiency and allocative efficiency whereby the efficiency of the utilizations of various financial releases to the DMUs by the central authority are assessed is often untouched. This neglected aspect of allocative efficiency is the mainstay of this study.

The purpose of the paper is therefore to evaluate the efficiency of utilization of personnel cost releases allocated to Decision Making Units under health sector in line with other previous works on public sector entities' efficiency (Warning, 2005; Kempkes & Pohl, 2018). Corporate standard and model used to access the efficiency frontiers of the public sector entities is the Data Envelopment Analysis (DEA). The model has been proven to be a more reliable tool for efficiency measurements over the traditional ratio analysis which fails to provide quality information when firms' estimations of overall efficiencies are measured. The usefulness of ratio analysis is therefore restricted to measuring firms' performance when its activity is limited to managing a single input to generate a single output on a linear frontier. The adoption of the Data Envelopment Analysis (DEA) therefore over ratio analysis in evaluating the entities' efficiency is in its ability to measure sectors' relative efficiency by using multi-inputs and multi-outputs variables of the two sectors. Therefore, following the introductory part, section 2 reviewed the relevant literature while section 3 focused on methodology. Section 4 discussed the results while section 5 concluded the paper with salient policy recommendations.

Literature Review

Farrell (1957) introduced the Data Envelopment Analysis (DEA) model in his famous seminar paper on measurement of productive efficiency. His idea of DEA's model was centered on a radial model which is limited to the DMU's efficiency score measurement alone. It focuses on contracting inputs and/or expanding output variables where either of the two occurs proportionately during production processes. Charnes, Cooper and Rhodes (1978) however exemplified the DEA models by presenting the model of two orientations of input and output in line with Farrell proposition. The CCR model which was coined after the names of the proponents was originally built on the assumption of Constant Returns to Scale (CRS). This was later modified by Banker, Charnes and Cooper (BCC) (1984) by introducing dimension of Variable Returns to Scale (VRS) assumption to fit into real life situation. Subsequent adoption of DEA's models has been tremendous with numerous authors as a meaningful tool for evaluating entities' efficiency on a frontier approach. Frontier techniques commonly used in appraising corporate's efficiency are generally parametric and non-parametric. DEA approach is a non-parametric technique which assumes no prior functional form for the frontiers except the assumption of linear connection between variables (Novickyte & Drozolz, 2018; Tahir & Yusuf,2011).

Alikhan, Kunt and Parupati (2011) examined the financial statements during production process of thirty-three firms using Window Data Envelopment Analysis as a technique to analyze the variables. They concluded that DEA was a reliable efficiency measurement tool in evaluating corporate financial health of a going concern. Karimi, Pirasteh and Zaledikerapea (2008) employed Interval Data Envelopment Analysis and Window Data Envelopment Analysis in assessing the efficiency cultivation processes among Khozestan, Hamedan and Eastern Azerbaijan provinces. The results showed that DEA was effective in the determination of entity's efficiency. The adoption of DEA is popular among the efficiency authors in measuring the corporate efficiency of entities both in the private and public organizations (Fethi & Pasiouras, 2010; Titko, Lace & Stanleviciene, 2014; Paradi & Zhui, 2013; Asmild & Zhu, 2016; Tuskan & Stojanovic, 2016; Cvetkoska & Savic, 2017).

As a financial measurement tool, DEA is often employed in assessing the efficiency of higher education management and the change in productivity in public sector entities (Leitner, Prikoszovits, Schaffhauser-Linzatti, Stowasser & Wagner, 2007; Aoki, 2010; Agasisti & Pohl, 2011; Abramo & D'Angelo, 2011; Chen & Chen, 2011; Inua & Maduabum, 2014). DEA's application model is equally useful in efficiency assessment of public sector – schools and hospitals – because of the difficulty of measuring their inputs and outputs in unified units (Wei, Chen, Li, Tsai & Huang, 2012). Erkut and Hatice (2007) employed the super slack based model of Data Envelopment Analysis to evaluate the performance of five hundred industrial enterprises in Turkey using 2 inputs and 3 outputs. The result of research revealed that only 9 firms were efficient out of the total of 500 firms. The use of DEA as a tool for measuring efficiency transverses public sector entities' efficiency alone. Literature has also revealed how the application of DEA is preferred against the traditional ratio analysis because of its use of multiple inputs and outputs in public sector (Cheng,Cai,Tai, Lin & Zuo,2016; Hermandez & San,2014).

Aghimen (2016) examined the level of efficiency of forty-three (43) Gulf Cooperation Council (GCC) banks on both technical efficiency and pure technical efficiency using DEA. The results of their findings showed that many GCC banks operated within an optimal level of efficiency during the research period. Abedin (2017) investigated the effect of efficiency and profitability on Bangladesh economy using CCR model. The findings revealed a positive relationship between efficiency and profitability on the country's economy.

Hussainey, Ismail and Ahmed (2017) carried o of out an extensive study on the impact of efficiency on the performance of Islamic banks. The results revealed that there is a direct relationship between the Islamic bank's efficiency and banks performance. Also, Shokr and AlGasaymeh (2018) investigated the banking efficiency situation in Egypt using DEA. The result suggested that banks with low inflation and GDP have tendency to perform more efficiently. In their study,

Abreu, Kimura and Subreiero (2019) analyzed the banking efficiency by assessing various articles on DEA from major finance journals. More than 87 papers were examined and classified to different categories of efficiencies. Also, Chen, Cheng, Lee and Chi (2019) estimated the efficiency of inputs factors for 39 operating banks in Taiwan between 1999 and 2011 using DEA. The results revealed that most of the banks were inefficient. The use of DEA has been frequently employed in the determination of efficiency assessment of many hospitals and healthcare centres (Buchner, Hinz & Schreyogg, 2016; Fragkiadakis, Doumpos, Zopounidis & Germain,2016).In Nigeria, various authors have employed DEA in the assessment of technical efficiency of educational institutions(Igbinosa,2008; Agasisti & Johnes, 2009; Abdulkareem & Oyeniran, 2011). From the extensive literature on efficiency in both private and public sector entities, it can be easily observed that some caveats are clearly created in the various works and studies. Most of the literatures focused on productive efficiency or technical efficiency, dynamic efficiency and distributive efficiency. The aspect of allocative efficiency has been left out of various analysis and literature.

This latter measure of efficiency is the main focus of this study. The paper focuses on the efficiency of utilization of personnel cost allocations to the Decision Making Units in Federal Health Sector in Nigeria.

Theoretical Framework

Many theories have been propounded by various authors on the efficiency of public sector entities. The earlier authors on efficiency based their works on productive efficiency (Farrel, 1957) which subsequent authors exemplified and built on. Besley (2011) classified public sector's efficiency theories into two major categories. The first category deals with the government's activities in the interest of the populace. This group of theories examine and spell out the various line of government's activities that improve the lives of its citizens in all phases of life. The other category of efficiency according to Besley places emphasis on accounts of governments as a private interest within the domestic economy. Prominent among the theories of efficiency is Pareto efficiency theory which emphasizes that public resources available in a country are

allocated in the most economically efficient manner within an entity. This, however does not translate to equality of resources in the organization. An entity in a domestic economy therefore operates in a Pareto optimum state where no economic forces and changes have ability to transform an individual within the economy better off without making at least one individual operating within the entity in the economy worse off. Also, the public choice theory and bureaucracy was pioneered by Tullock (1965) on efficiency of public sector. The theory was built on Webber's model (1947) of sociological theories that were at variance with the economic behaviours of bureaucrats. Public choice theory is centered on the growth of bureaucracy and output of bureau from a dynamic perspective (Erkoc, 2013; Onrubia-Fernandez & Sanchez, 2017). In their study, Rhys Andrews and Tom Entwistle (2013) identified the four faces of public service efficiency. The first face is the theory of productive efficiency which relates to the maximization of outputs over inputs engaged in the process of production in an entity. The second face of efficiency is the theory of allocative efficiency which centers on the match between the demand for services and their supply for service delivery. The third efficiency face is the theory of distributive efficiency which relates to the extent to which government can deliver an equitable distribution of services. The fourth face of efficiency is the theory of public service efficiency which concerns the assessment of the relationship between inputs invested and outputs produced with these resources. The improvement of the measure of this efficiency is a way of controlling public expenditure. This study therefore anchors on the theories of public service efficiency and allocative efficiency to drive the rest of the paper.

Methodology

The study employed panel data of (25) twenty-five public sector entities in federal health sector in Nigeria. Taro Yamane technique was used to calculate the sample size out of the entire population of DMUs who derived their personnel cost allocation from the central authority. Secondary data for a period of 2008-2016 were sourced from the Annual General Warrants from the office of the Accountant- General of the Federation, office of the Auditor-General of the federation and Audited financial statements of the Public Sector entities. Sample size of the study comprised twenty-five (25) DMUs out of the major Federal Ministries from four (4) geo-political Zones and Abuja. Both Charmes, Cooper and Rhodes (1984) models and Banker, Charmes and Cooper (1984) models were applied on the personnel cost data obtainable for the comparative analysis of the efficiencies of the sector in the utilization of personnel cost allocations.

The study adopted two Data Envelopment Analysis techniques for constant and variable inputs and outputs. Out-put oriented model measures the capacity of Decision Making Unit to achieve the level of output within the limits of available inputs in the entity. Whereas, the input-oriented model measures the capacity of a DMU to maintain the maximum level of production with the available inputs within the organization. In output-oriented version, the efficiency score ranges from 1 to infinity but in the input -oriented version, efficiency score is between 0 and 1. The efficiency score is estimated as the ratio of weighted outputs to weighted input (Charnes *et al.*, 1978). Weights are selected from each variable of every analyzed unit in order to maximize its efficiency score. The efficiency rate for each unit of the reference set of $j = 1, \ldots, n$. DMU is evaluated in relation to other set members (Charnes *et al*., 1978). The maximal efficiency score is 1, and the lower values indicate the relative inefficiency of the analyzed objects. The Data Envelopment Analysis model with m inputs variables, s outputs variables, and u DMU's, the envelopment form of the input-oriented model is given by (Charnes *et al*., 1978) and Cooper *et al*. (2007) in their proposition as follows:

$$max h_0(u, v) = \frac{\sum_r u_r y_{r0}}{\sum_i v_i x_{i0}}$$

Subject to:

$$\frac{\sum_r u_r y_{r0}}{\sum_i v_i x_{i0}} \leq 1 \; for \; j = 1, \ldots, n, \qquad (1)$$

$$u_r, v_i \geq 0 \; for \; all \; i \; and \; r$$

The proposition developed by (Charnes & Cooper, 1962) was employed for linear fractional programming. This proposition then selects a combination of solution of (u, v) for which $\sum_{i-1}^{n} v_i x_{i0} = 1$) and results into the equivalent linear problem in which the variance of variables from (u, v) to (μ, v) is a direct result of the application of DEA model as propounded by "Charnes-Copper" transformation which can be re-written as:

$$maxz = \sum_{r-1}^{s} \mu_r y_{r0}$$

Subject to:

$$\sum_{r-1}^{s} \mu_r y_{rj} - \sum_{i-1}^{m} v_i x_{ij} \leq 0 \qquad (2)$$
$$\sum_{i-1}^{m} v_i x_{i0} = 1$$
$$u_r, v_i \geq 0$$

For which the linear programming dual problem is

$$\Theta^* = min\Theta$$

Subject to:

$$\sum_{j-1}^{n} x_{ij}\lambda_j \leq \Theta x_{i0} \; i = 1, 2, \ldots, m;$$
$$\sum_{j-1}^{n} y_{rj}\lambda_j \geq y_{r0} \; r = 1, 2, \ldots, s; \qquad (3)$$
$$\lambda_j \geq 0 \; j = 1, 2, \ldots, n.$$

This expressional transformation is the original DEA model and commonly referred to as the "Farell model" by a wide range of finance and economic scholars. It is otherwise referred to as the output-oriented model that aims at maximizing outputs of a given DMU with the given input level at a particular time. The second is the input-oriented model, which also aims at minimizing inputs at a given output level (Cooper *et al*., 2007; Zhu, 2009):

$$min\Theta - \varepsilon \left(\sum_{i=1}^{m} {S_i}^{-} + \sum_{r=1}^{n} {S_r}^{+} \right)$$

Subject to:

$$\sum_{j=1}^{n} \lambda_j x_{ij} + {S_i}^{-} \leq \Theta x_{i0} \; i = 1, 2, \ldots, m;$$
$$\sum_{j=1}^{n} \lambda_j y_{r0} + {S_i}^{+} = y_{i0} \; r = 1, 2, \ldots, s; \qquad (4)$$

Using a single input and single output baseline model, we have

$$\sum_{j=1}^{n} \lambda_j BR_{ij} + {S_i}^{-} \leq \Theta x_{i0} \; i = 1, 2, \ldots, m;$$
$$\sum_{j=1}^{n} \lambda_j AR_{r0} + {S_i}^{+} = y_{i0} \; r = 1, 2, \ldots, s; \qquad (5)$$
$$\lambda_j \geq 0 \; j = 1, 2, \ldots, n$$
$$\sum_{j=1}^{n} \lambda_j = 1$$

Where, *xij* indicates the *ith* input of the *jth* DMU; BR_{ij} represents the input in the baseline model; y_{rj} indicates the *rth* output of the *jth* DMU, AR_{r0} represents the output in the baseline model and λj *and* u_r, indicate the weight of the *jth* DMU while v_r is the efficiency score of DMU_j. If the constraint $\sum_{j=1}^{n} \lambda_j = 1$ is adjoined, they are then referred to as the Banker, Cooper and Charmes model (BCC model) (Banker *et al*., 1984). The BCC model is also otherwise referred to as the Variables Return to Scale (VRS). The VRS assumption is different from the CCR assumption which is referred to as the Constant Returns to Scale (CRS model). The VRS assumption or BCC model considers the variation of efficiency with respect to the level or scale of operation and measures pure technical efficiency arising from the variables. The BCC model or the VRS assumption is used to measure the scale efficiency which is determined as follows:

$$Scale \; Efficiency = \frac{Technical \; efficiency \; from \; CRS}{technical \; officiency \; from \; VRS} \qquad (6)$$

The determination of adequate model variables (inputs and outputs) was the second important consideration used in measuring efficiency of the public entities. Also, Cooper *et al*. (2011) and Paradi, David and Fai (2018) indicate that the number of DMUs should be at least three times the total number of inputs plus outputs used in the models. Cook, Kaoru and Joe (2014) suggested a similar rule in order to set

a minimum number of DMUs in relation to the number of variable inputs to have a meaningful result with a clear set of efficient and inefficient units which are expressed as follows:

$$n \geq \max\{m \times s, 3\,(m+s)\}, \quad (7)$$

Where $m, s,$ and n are the numbers of inputs, outputs and DMU's respectively. The study made use of single input variable and single output variable to measure the relative efficiency of selected twenty-five (25) federal health institutions. The input variable is the size of payroll /number of employees in each institution made up as follows: No of staff on IPPIS payment platform, No of staff on GIFMIS payment platform and No of locum appointees on sub- receipt platform. The output variable is the value of gross total personnel cost expended on total employees made up as follows: total personnel cost expended on staff on the IPPIS payment platform, Total personnel cost expended on staff on the GIFMIS payment platform and Total personnel cost expended on staff on the Locum payment platform.

Results and Discussion

Table1 shows efficiency scores in personnel costs utilization for the 25 sampled DMUs in public health sector using CCR. The mean efficiency level as calculated by the average efficiency scores which determines the efficiency of the sampled DMUs in the utilization of the personnel cost allocations are 0.866, 0.966, 0.969, 0.895, 0.909, 0.595, 0.317, 0.947 and 0.419 respectively. The CCR model was employed to calculate the overall efficiency (TE) of the entity which measures the success of a decision making unit in producing outputs from a given set of inputs (Farrell, 1959). The overall mean for the twenty-five DMUs was stated at 0.719. Within the research period, the DMUs operated above the overall mean score in years 2008, 2009, 2010, 2011 and 2015 while in years 2012, 2013, 2014 and 2016 the operation of the DMUs was below the overall efficiency mean scores. The implication is that there was a sliding trend in the efficiency of the DMUs in the utilization of personnel cost allocations. The technical efficiency of DMU is always appraised based on its efficiency scores. A DMU is fully efficient when its efficiency scores is100% or 1 and inefficient when the efficiency score is less than 1. From 2008 – 2016 however, only (8) eight DMUs achieved 100% efficiency out of twenty-five (25) sampled DMUs in the health sector while the rest seventeen (17) DMUs were inefficient at different levels of inefficiency. These fully efficient DMUs represent only 4% of the total number of DMUs. The inference is that only the 4% achieved 100% optimal level of efficiency without any need for external improvement on their efficiency frontiers in utilizing their personnel cost allocation. However, (Baidya & Mitra, 2017) identified different levels of inefficiency according to the values attached to their efficiency scores. According to them, a DMU can be marginally inefficient, averagely inefficient or distinctively inefficient. Many of the DMUs were grouped into the different levels of inefficiency as revealed by their average efficiency scores during the period.

Table 1: Efficiency Scores In Personnel Costs In Health Sector Using CCR Model

S/N	DMU	2008	2009	2010	2011	2012	2013	2014	2015	2016	
		CCR	CCR	CCR	CCR	CCR	CCR	CCR	CCR	CCR	AVERAGE
1	NTPA	0.854	0.854	0.028	0.947	0.602	0.307	0.648	0.91	0.367	0.613
2	FMCK	0.872	0.872	0.968	0.948	0.634	0.317	0.712	0.996	0.387	0.745
3	FMCL	0.876	0.876	0.973	0.98	0.596	0.317	0.665	0.934	0.512	0.75
4	FMCE	0.876	0.876	0.976	0.956	0.609	0.313	0.655	0.92	0.39	0.73
5	UCH	0.881	0.881	0.994	0.936	0.609	0.258	0.727	0.968	0.501	0.75
6	LUTH	0.882	0.882	0.998	0.98	0.597	0.229	0.759	0.976	0.436	0.75
7	UNIBENTH	0.88	0.88	1	1	0.593	0.237	0.668	0.974	0.444	0.74
8	OAUTH	0.895	0.895	0.924	0.967	0.601	0.248	0.671	0.907	0.395	0.72
9	UNILORINTH	0.883	0.883	0.991	0.968	0.599	0.252	0.62	0.957	0.387	0.73
10	NTTI	0.875	0.875	0.886	0.91	0.623	0.304	0.59	0.998	0.342	0.71
11	FSHI	0.876	0.876	0.98	0.968	0.624	0.262	0.688	0.972	0.553	0.76

12	MLSCY	0.877	1	0.843	0.866	0.618	1	0.636	0.991	0.346	0.80
13	FNHY	0.871	0.871	0.945	0.961	0.596	0.267	1	0.944	0.386	0.76
14	FNHA	0.869	0.869	0.955	0.923	0.614	0.222	0.056	0.873	0.403	0.64
15	FPHB	0.872	0.872	0.943	0.921	0.618	0.312	0.653	1	0.365	0.73
16	NOHL	0.872	0.872	0.964	0.931	0.605	0.266	0.675	0.932	0.406	0.72
17	FMCO	0.874	0.874	0.991	0.964	0.598	0.316	0.65	0.965	0.389	0.74
18	FMCA	0.869	0.869	0.996	0.95	0.598	0.312	0.678	0.991	0.385	0.74
19	NIMR	0.863	0.863	0.957	0.929	0.654	0.309	0.497	0.89	0.368	0.70
20	PCN	0.907	0.907	0.959	0.957	0.692	0.165	0.675	0.904	0.345	0.72
21	MRTB	0.802	0.801	0.954	0.575	0.846	0.303	0.773	0.906	0.405	0.71
22	EHOT	0.88	0.88	0.437	0.505	1	0.277	0.613	0.902	0.356	0.65
23	MDCN	0.853	0.853	0.873	0.891	0.622	0.546	0.633	0.898	0.348	0.72
24	CHPR	0.801	0.801	0.848	0.828	0.096	0.277	0.731	0.978	1	0.71
25	ODOBH	0.798	0.798	0.994	0.974	0.022	0.305	0.584	0.978	0.262	0.64
	MEAN	0.866	0.871	0.895	0.909	0.595	0.317	0.650	0.947	0.419	0.719

Source: Authors' Computation, (2019)

Table 2 shows the average efficiency rankings of the sampled DMUs in descending order. MLSCY has the highest average efficiency ranking of 80.1% in personnel cost utilization while NTPA recorded the lowest with 61.3%.

Table 2: Average Efficiency Scores Ranking Using CCR for the DMUs in Health Sector

DMU	Efficiency Scores	Efficiency Ranking
MLSCY	0.801	1st
FNHY	0.762	2nd
FSHI	0.761	3rd
LUTH	0.760	4th
UCH	0.754	5th
FMCE	0.753	6th
FMCI	0.752	7th
UNIBENTH	0.746	8th
FMCK	0.745	9th
FMCO	0.744	10th
NOHL	0.743	11th
UNILORINTH	0.738	12th
FPHB	0.734	13th
FNHA	0.733	14th
OAUTH	0.727	15th
NIMR	0.725	16th
NTTI	0.719	17th
PCN	0.717	18th
EHOT	0.716	19th
CHPR	0.715	20th
FMCA	0.713	21st
MRTB	0.653	22nd
ODOBN	0.642	23rd
MDCN	0.641	23rd
NTPA	0.613	25th

Source: Authors' Computation (2019)

Table 2 shows the ranking of the efficiency scores on personnel cost utilization for the sampled DMUs in the health sector. The summary of the ranking suggests appreciable efficiency scores performance for the DMUs in the health sector. From the efficiency scores' ranking on the personnel cost utilization for the DMUs, MLSCY is on top of the list with the highest efficiency score ranking of 0.8011 or 80.11% while NTPA is the last on the list with the lowest efficiency ranking of 0.613 or 61.3%. The efficiency scores performance of the rest DMUs were between the two extremes. The summary of the ranking of the DEA results on personnel cost utilization among the DMUs in the sector using CCR model reveals an appreciable efficiency scores performance. The implication is that the DMUs under the health sector utilized the personnel cost allocations released to them during the research periods.

Table 3 shows the summary of the result of the analysis for the efficiency scores in personnel costs for the twenty-five (25) sampled DMUs using BCC model. The calculated average mean efficiency scores which determines the efficiency in the utilization of personnel cost allocations were stated at 0.899, 0.901, 0.904, 0.920, 0.822, 0.682, 0.650, 0.955 and 0.672 for years 2008 to 2016 respectively. From the table, only (2) two DMUs achieved full efficiency of 100%. That is, the DMUs attained maximum level of efficiency in the utilization of personnel cost allocation to them during the year without any slack funds. Also, only (7) seven DMUs (which is 28% of the sampled size) had their BCC efficiency scores above the average mean of 0.899. The DMUs were LUTH, UNIBENTH, OAUTHC, PCN, and EHOT. These DMUs, though were not fully efficient in utilizing fully personnel cost allocation in year 2008, but they were marginally efficient with their individual BCC efficiency scores greater than the average BCC efficiency scores. This therefore implies that the DMUs had sticky fund balances in their personnel cost accounts during the year which were not utilized for the payment of salaries and wages. The remaining (16) sixteen DMUs (which represents64%) had their BCC efficiency scores below the average efficiency score of 0.899 in year 2008. These DMUs fell into either averagely inefficient or distinctively inefficient based on the values attached to individual efficiency scores in comparison with the average BCC efficiency scores. The direct implication was that the DMUs had idle personnel cost balances which were in excess of the actual capacity level needed for the payment of staff salaries within the DMUs. The summary of the analysis of the BCC efficiency scores for the DMUs in year 2008 therefore showed that out of (25) twenty- five DMUs, only 8% were fully efficient, while 28% were marginally inefficient and 64% were either averagely inefficient or distinctively inefficient.

In 2009, the BCC efficiency scores for the DMUs showed a slight improvement with (3) three DMUs attaining full efficiency level of 100%. This slight improvement of 50% over the 2008 efficiency performance showed that the utilization of personnel cost allocation in 2009 among the DMUs in the health sector was relatively better. This trend continued in 2009. In 2010, four DMUs attained full efficiency representing 16% of the sampled DMUs in the sector. The marginally inefficient entities stood at (17) seventeen representing 68% of the total DMUs. This pattern characterized the DMUs in the health sector in the pre- Integrated Payroll and Personnel Information System (IPPIS) until 2013 when the full implementation of IPPIS took a firm grip.

As from 2013 when the commencement of IPPIS in DMUs took off, personnel cost allocations were not directly released to the DMUs' personnel accounts domiciled with the CBN by the office of the Accountant General of the federation but channeled through the IPPIS' office. This arrangement enables the unutilized appropriated personnel cost allocations to the various DMUs be mopped up at the end of the budget year automatically without recourse to the DMUs. The post IPPIS implementation therefore, has positive impact on the utilization of personnel cost allocation in the sector.

Table 3: Efficiency Scores In Personnel Costs Releases In Health Sector Using BCC Model.

		2008	2009	2010	2011	2012	2013	2014	2015	2016	
S/N	DMU	BCC	BCC	BCC	BCC	BCC	BCC	BCC	BCC	BCC	AVERAGE
1	NTPA	0.915	0.907	0.929	0.976	0.701	0.307	0.648	0.911	0.373	0.741
2	FMCK	0.873	0.872	0.968	0.95	0.876	0.903	0.712	1	0.691	0.872
3	FMCL	0.877	0.876	0.973	0.98	0.918	0.954	0.665	0.948	0.939	0.90
4	FMCE	0.877	0.876	0.977	0.957	0.885	0.903	0.655	0.923	0.698	0.86
5	UCH	1	1	1	0.959	0.99	0.798	0.727	1	1	0.94
6	LUTH	0.974	0.974	0.998	0.98	0.959	0.702	0.759	1	0.84	0.91
7	UNIBENTH	0.968	0.968	1	1	0.957	0.728	0.668	0.998	0.859	0.91
8	OAUTH	0.978	0.978	0.925	0.967	0.962	0.761	0.671	0.934	0.776	0.88
9	UNILORINTH	0.957	0.957	0.991	0.968	0.962	0.776	0.62	0.98	0.745	0.88
10	NTTI	1	1	1	1	0.624	0.304	0.59	1	0.342	0.76
11	FSHI	0.876	0.876	0.98	0.968	0.971	0.79	0.688	0.982	1	0.90
12	MLSCY	0.877	1	0.85	0.876	0.785	1	0.636	0.991	0.519	0.84
13	FNHY	0.871	0.871	0.945	0.961	0.906	0.774	1	0.949	0.692	0.89
14	FNHA	0.87	0.869	0.955	0.924	0.861	0.631	0.056	0.875	0.711	0.75
15	FPHB	0.873	0.872	0.943	0.922	0.844	0.866	0.653	1	0.634	0.85
16	NOHL	0.872	0.872	0.965	0.932	0.912	0.777	0.675	0.938	0.729	0.85
17	FMCO	0.875	0.874	0.991	0.965	0.897	0.939	0.65	0.976	0.703	0.87
18	FMCA	0.869	0.869	0.997	0.95	0.907	0.93	0.678	1	0.694	0.88
19	NIMR	0.866	0.863	0.959	0.932	0.843	0.723	0.497	0.89	0.615	0.80
20	PCN	0.911	0.907	0.962	0.962	0.884	0.366	0.675	0.904	0.563	0.79
21	MRTB	0.832	0.821	0.986	0.583	1	0.332	0.773	0.906	0.491	0.75
22	EHOT	0.96	0.954	0.453	0.535	1	0.277	0.613	0.904	0.356	0.67
23	MDCN	0.865	0.853	0.882	0.904	0.765	0.749	0.633	0.898	0.456	0.78
24	CHPR	0.828	0.817	0.873	0.86	0.107	0.304	0.731	0.978	1	0.72
25	ODOBH	0.807	0.798	1	0.985	0.027	0.453	0.584	0.978	0.372	0.67
	MEAN	0.899	0.901	0.903	0.920	0.822	0.682	0.650	0.955	0.672	0.827

Source: Authors' Computation (2019)

Table 3 shows the results of the efficiency scores of the DMUs in health sector using BCC Model on the sampled size. The highest efficiency value was recorded against NTPA with an average efficiency score of 0.741 while ODOBH recorded the lowest efficiency score with an average efficiency score of 0.67.Table 4 showed the average efficiency scores ranking in descending order on personnel cost usage among the DMUs in health sector. From the table, UCH had the highest average efficiency score of 94% while NTPA came up in the last position with the lowest average efficiency performance of 64%. The breakdowns of the average efficiency scores' ranking showing the performance of the DMUs in the sector were disclosed in the table 4.

Table 4: Average efficiency scores ranking using BBC for the DMUs in Health Sector

DMU	Efficiency Scores	Efficiency Ranking
UCH	0.94	1st
LUTH	0.91	2nd
UNIBENTH	0.91	2nd
FMCI	0.9	4th
FSHI	0.9	4th
FNHY	0.89	6th
OAUTH	0.88	7th
UNILORINTH	0.88	7th
FMCA	0.88	7th
FMCK	0.87	10th
FMCO	0.87	10th
FMCE	0.86	12th
FPHB	0.85	13th
NOHL	0.85	13th
MLSCY	0.84	15th
NIMR	0.8	16th
PCN	0.79	17th
MDCN	0.78	18th
NTTI	0.76	19th
FNHA	0.75	20th
MRTB	0.75	20th
CHPR	0.72	22nd
EHOT	0.67	23rd
ODOBN	0.67	23rd
NTPA	0.64	25th

Source: Authors' Computation (2019)

Table 4 is the summary of the efficiency ranking for the sampled DMUs in health sector. The highest efficiency ranking among the DMUs under health sector was 94% while the lowest was 64%.

Conclusion and Policy Recommendations

The study evaluated the efficiency of the DMUs under the federal ministry of health in the utilization of personnel cost releases using DEA techniques. Both CCR and BCC were adopted for the comparative analysis. The results from both techniques showed that none of the DMUs under health sector achieved full efficiency on the average in the utilization of personnel cost releases during the research period. However, results of the findings on the utilization of personnel cost allocations were averagely appreciable among the DMUs in the health sector with application of both CCR and BBC techniques. The spread of average efficiency scores among the DMUs in the health sector are less marginally efficient and more skewed to full efficiency frontiers signifying an improved utilization of personnel cost allocations in the sector. The implication is that the personnel cost allocations released to the DMUs in health sector were not fully utilized for the payment of staff salaries during the research period. Some of the DMUs kept idle and sticky personnel cost balances that were neither expended nor returned to the treasury at the end of each financial year. This implies that the DMUs received allocations that were in excess of the actual needs of the entities. Therefore, in order to enhance the DMUs' efficiency performance in the sector, the following recommendations are essential for consideration:

The budget office should set up the monitoring team to regulate the activities of inefficient DMUs in terms of the personnel cost utilization vis-à-vis the size of the institutions' payroll. Personnel cost allocations should be based on the degree of need of the DMUs as against political scheming. Mopping up exercise should be on monthly basis whereby unspent personnel costs balances are mopped up and redirected to the areas of need. There is a great need for close monitoring and supervision of the DMUs by the central authority in order to enhance an efficient utilization of personnel cost allocation and boast efficiency frontiers of the overall personnel cost efficiency in resource utilization.

The supervising authorities must enforce that all DMUs should either reduce their personnel cost inputs or increase the size of the payroll to achieve full efficiency in line with personnel cost releases. They should regulate the appointment processes in all DMUs in proportion to their personnel cost budget. The central authority should discourage the DMUs holding idle personnel cost balances as unspent in their personnel cost budget. These sticky balances in the various accounts of the DMUs should be investigated and culprits be brought to books. The DMUs under the sector were not fully efficient in the utilization of personnel cost allocation. That means the possibility of sticky fund balances is a reality among the DMUs in the health sector. Appropriate appraisal techniques should be adopted in order to carry out the need assessment of the DMUs in the health sector to enhance their efficiency. The number of staff that will retire during the year should be a composite requirement to be factored in before approval for personnel cost budget is granted for the DMUs. The DMUs should seek for approval for every recruitment exercise and such approval should be based on the provision in the personnel cost budget for the current year as a condition precedent to any recruitment. The paper therefore concluded that only central authority's control, supervising ministries' effective monitoring of the personnel cost releases to the DMUs and the periodic appraisal of the personnel cost utilization by the Budget office of the federation can guarantee an improved efficiency performance and enhance optimum utilization of personnel cost allocations among the DMUs in the sector.

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