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COUNCIL DESIGNATED HOSPITALS (CDHS) – VOLUNTEERING AGENCY HOSPITALS (VAHS): DOES IT MAKE A DIFFERENCE?: A COMPARATIVE ANALYSIS OF HOSPITALS' PRODUCTIVITY IN TANZANIA

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ABSTRACT

Literature records that there are a few studies assessing hospitals 'productivity in Tanzania. Council Designated Hospitals (CDHs) are private not for profit hospitals which operate as council or district referral hospitals; on the other hand Volunteering Agency Hospitals (VAHs) are private not for profit hospitals which do not have contract to operate as the council or district hospitals. This study attempts to shed light on the productivity comparison between VAHs and CDHs, with the sample size of 34 hospitals (17 CDHs and 17 VAHs), data were extracted from respective hospitals' annual reports and collected using the stratified sampling procedure, in this case zones (lake, eastern, western, southern and northern zone) were treated as stratum from which data for VAHs and CDHs were drawn. The aim of using stratified sampling was to get representation of the total population (90 faith based private hospitals) in the country; the method is also suitable for the study which focuses on specific issues. The study employed Malmquist Productivity Index (MPI) model to examine productivity over the sampled period from 2012/13 to 2015/16. The study is significant since it tells the extent to which the productivity between CDHs and VAHs differ, as well as factors behind observed productivity change between the two categories. The study also suggests what should be done to improve productivity growth of the two categories. Result revealed that, the Total Factor Productivity (TFP) mean for the VAHs and CDHs were 1.101 and 0.994 respectively, implying VAHs category was experiencing progress in overall productivity meanwhile their counterpart CDHs was experiencing the regress in Total Factor Productivity (TFP). The total factor productivity of VAHs of 1.101 implies that on average over the sampled period, there is 10.1 per cent productivity progress. Improvements in VAHs' TFP were largely due to the technological change rather than the efficiency change. On the other hand the productivity of CDHs of 0.994 implies that on average over the sampled period, there is 0.6 percent productivity regress. Deterioration in CDHs' productivity was largely caused by regress in technological change rather than efficiency change. The study concludes that both components of overall productivity attributed to the change in Total Factor Productivity (TFP) of hospitals under the study. However, technological change seemed to be much influential in deriving the regress or progress of productivity of hospitals under the scrutiny. Since productivity is the ratio of the volume of output to the volume of inputs, the result implies that CDHs had been producing outputs less by 0.6 percent over the sampled period. The study recommends that CDHs should invest in new technology, new healthcare services, new management systems as well as new methodologies in order to improve technical change (innovation). On the other hand VAHs should improve knowledge diffusions so as to move towards the frontier (catch up effect).

Keywords: *Council Designated Hospitals (CDHs), Volunteering Agency Hospitals (VAHs), Comparative analysis of Productivity, Tanzania*

INTRODUCTION AND BACKGROUND OF THE STUDY

Tanzania is situated in Eastern Africa, the country has the population of about 45 million people, about 85 percent of whom reside in rural areas (NBS, 2013).According to WHO (2015) Tanzania has the density of Nursing and midwifery personnel of 0.436 (total number per 1000 population). Generally, shortage of qualified staff spread at all levels from referral to the small health facilities in rural areas. However, the serious shortage is most evident at the lower levels and in remote with little accessibility. Reports show that doctor/patient ratio is 1:72,000, assistant medical doctor/patient is 1:27,000 and nurse/patient ratio is 1:4,000 (Health Sector Performance Profile Report 2010). There are a lot of factors contributing to the shortage, some of these factors are, low output of qualified staff, mal-distribution, poor remuneration, poor infrastructure, and lack of attractive retention scheme (PPP Guidelines, 2011).

In the year 2014 the country spent 2.6 percent of its Gross Domestic Product (GDP) on healthcare expenditure compared to the year 1995, when the country spent 1.4 percent of Gross Domestic Product (GDP) on the same (WHO, 2014).Generally, public health expenditure include recurrent as well as capital expenditure from government (central and local) budgets, external borrowings, grants (including donations from international organizations and non-governmental organizations), and social (or compulsory) health insurance funds.

Regardless of the ownership nature, health facilities in Tanzania are regulated and supervised by the Ministry of Health, Community Development, Gender, Elder and Children. Private not for profit, Private for profit as well as publicly owned hospitals define the ownership structure of health facilities in Tanzania, the three categories are in the national health map. Majority of Private not for profit health facilities in the country are owned by faith-based organizations. Depending on the nature of contract signed with the government, faith based hospitals sometimes receive direct and indirect support from the government. Private not for profit (PNFP) hospitals can be categorized into Voluntary Agency Hospitals (VAHs) and Council Designated Hospitals (CDHs). Voluntary Agencies Hospitals (VAHs) is the group under which all accredited faith-based hospitals fall. The VAHs have potentially been involved in the contracting processes since the year 2007, on the other hand Council Designated Hospitals (CDHs) are VAHs officially designated to operate as councils or districts referral health facilities (PPP Guidelines, 2011).

Hospitals Productivity and Problem Statement

This study considers productivity as one of approaches of assessing hospitals performance. Therefore improvement in the productivity implies efficiency in managing hospitals resources, in other words, it indicates the extent to which hospitals managers can produce maximum outputs given the minimum hospitals resources. Alternatively it also implies the extent to which the hospitals can use minimum inputs (resources) given the level of outputs

Measuring hospitals' Productivity implies relationship between hospitals outputs versus inputs that have been spend to produce the outputs. Hospitals productivity is said to have improved if the outputs per inputs (such as health worker or hospitals' bed) are growing and /or there is a use of advanced health technology. As many literatures contended this study also regards hospitals' productivity as the measure of the hospitals 'efficiency change between the two periods. If the hospital is technically efficient in two periods, the productivity change between these two periods will primarily be derived by 'technical change' (or shift in the best practices frontier) in the two periods. Generally, the productivity change consists of net change in output due to change in efficiency (or change in how far the hospital is from the frontier) and technical change (or shift in the frontier).

Health care costs are causing an increasing concern to many Governments in the world, the fundamental component in the health sector efforts to improve the efficiency and productivity has to do with utilizing the existing resources efficiently. The aim is to have the value for money for the health services offered. The term value for money has the implication on the quality; in this study we attempted to examine the relationship of resources used in delivery of services and the services offered (outputs) which constitute the term hospitals efficiency. The health sector reforms and other efficiency strategies adopted by the Government of Tanzania through Ministry of Health and Social Welfare in past three decades have increased the involvement of private sector in the provision of the health services.

Objective and Significance of the Study

The study generally aims at exploring the productivity change of CDHs and VAHs. Specifically the study explores:

i. The extent to which the two categories produce the maximum outputs given the available inputs, and the level at which the two categories operate at optimal scale (size)
ii. Percentage of observed total factor productivity change derived by efficiency change and technological change.

Significance of this study has been built on the ground that improvement in hospitals productivity has influence on the performance of entire health system. Mc Kee and Healy (2002) also argued that there is an increasing concern about hospitals performance. In Tanzania, even though there is an increase in percentage of GDP spent on healthcare facilities by Government, to the best of our knowledge until to date assessment of the productivity of CDHs and VAHs has not been given enough attention. Literature shows that inefficient use of the hospitals resources affects the provision of the health services to the targeted population, causing the demand and cost crisis in the health sector

(Yaiswarg 2002; Duckeit, 2003). Therefore this study attempt to answer questions on the relationships between the outputs produced and the hospitals' resources used to produce outputs in the two categories. The study will also add to the existing body of knowledge particularly hospitals productivity in Tanzania.

The remaining part of this paper is *section two* which covers the methodology, describing the data and data sources, variables selection as well as technique used in analyzing the data. *Section three* is findings and discussion, involving presentation and discussion of findings in relation to findings in previous researches. Lastly, *Section four* is conclusion and recommendation which contains summary of the findings and its implications.

METHODOLOGY

This study employs Malmquist DEA in analyzing the productivity of CDHs and VAHs over the sampled period (2002/13 -2015/16). Hospitals productivity index can be explained as the ratios of outputs quantity index to an input quantity index. Since the study employs panel data set, Malmquist –DEA was the suitable approach to determine indices of changes in total factor productivity change (TFPCH), technical change (TECH), and efficiency change (EFFCH) and scale efficiency (SECH). The model was originally developed by Sten Malmquist, later it was advanced and enforced in measuring total factor productivity (TFP) change between two data points using ratios of distance functions by Cave et al., (1982). Malmquist productivity index (MPI) may be defined as follows:

$$M_o\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \left[\frac{D_o^t\left(x^{t+1}, y^{t+1}\right)}{D_o^t\left(x^t, y^t\right)} \frac{D_o^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_o^{t+1}\left(x^t, yt\right)}\right]^{1/2}$$

From the spirit Nishimizu et al (1982) and Färe et al. (1994; 1994a) the MPI can further be decomposed into efficiency change (EFFCH) and technology change (TECH) as follows:

$$M_o\left(y^{t+1}, x^{t+1}, y^t, x^t\right) =$$

$$\left[\frac{D_0{}^{t+1}(x^{t+1}, y^{t+1})}{D_0{}^t(x^t, y^t)}\right] x \left[\frac{D_0{}^t(x^{t+1}, y^{t+1})}{D_0{}^{t+1}(x^{t+1}, y^{t+1})} * \frac{D_0{}^t(x^t, y^t)}{D_0{}^{t+1}(x^t, y^t)}\right]^{1/2}$$

EFFCH * TECH

Where D measures the distance functions, $M_o$represents output oriented Malmquist productivity index. The efficiency change **(EFFCH)** term is given by ratio of Farrell technical efficiency in period*t+1* divided by Farrell technical efficiency in period *t*. The technological change **(TECH)** means the geometric mean of the shift in technology as observed at $\left(x^{t+1}, y^{t+1}\right)$ **(**first ratio in the bracket) and a shift in technology observed at $\left(x^t, y^t\right)$ (second ratio inside bracket). The **EFFCH** component may take value greater than, equal to, or less than one depending on whether the efficiency of the evaluated hospital improves (catching up effect), stagnates, or declines. This will depend on the case. However, the **TECH** may also take a value greater than, equal to or less that unity in order to make the technological change positive, zero or negative respectively.

Malmquist productivity index (MPI) model portrays strength derived from the following assumptions (Yawe, 2006):

i. The model does not require input prices or output prices in their constructions, this makes them useful in an environment where the prices of inputs or outputs do not exist or difficult to determine, for example in health sector/measuring hospitals productivity. In Tanzania determining the prices of outputs, prices would be very difficult since each hospital (mainly private hospitals) charge its own prices.

ii. Unlike in other parametric methods, no need for specific behavior assumptions for the model to be employed in computations of productivity, this makes it suitable in situations where producers' objectives are different

or not precisely known. Though some general objectives such as cost minimization may be the same to almost all hospitals, but still is not clear to what extent each hospital would like to realize that cost minimization.

iii. The model can decompose total factor productivity index into technical efficiency change and technical/technological change. This allows the users of the research results (i.e. policy makers, hospitals administrators etc.) to establish what derived the change in totals factor productivity of hospitals.

iv. It is appropriate for panel data, such as repeated hospitals data for several records over a period of time, allows the comparison among the hospitals themselves and productivity change over time.

Malmquist DEA and Assumptions for Comparisons of CDHs against VAHs

The fundamental assumptions of the model in this study is that Malmquist DEA, uses hospitals inputs (beds and doctors) and outputs (inpatient days, total outpatients visits and surgical operations) to measure hospitals productivity, and that the model may either consider inputs contraction or outputs expansion. According to Nyhan and Peter (2000), selection of inputs and outputs is the most crucial stage of the analysis when using the model. Upon selection of the variables, Malmquist –DEA aggregated the inputs and outputs into a composite index of overall performance standard (Min et al., 2009). In this study the model has been used to compute hospitals total productivity indicators (indices) for CDHs and VAHs, then the total factor productivity index (TFPI) for each category was further decomposed into technological change and efficiency change of the same. This allowed the comparison between the total factor productivity of each category as well as the underlying components. This study assumes that both CDHs and VAHs operate under competitive market which encourages hospitals to adopt efficient strategies so as to experience growth in productivity.

Data and Data Sources

Data set (involving inputs and outputs) was extracted from respective hospital's annual reports covering 2012/13 - 2015/16. Hospitals included in the study were 17 CDHs and 17 VAHs. Hospitals from VAHs category; were Bukumbi, Iambi, Igongwe, Ilembula, Lugalawa, Lutembo, Marangu, Mbesa Mission. Others were Mbozi Mission, Mkula, Ndolage, Nkinga, Nkoaranga, ST.Bernedict, Uhai Baptis, St. Corneleous and St. Raphael Hospitals. On the other hand, CDHs included in this study were Biharamulo, Bunda, Huruma, Kilema, Rubya hospitals. Others are Sengerema, Sikonge, Sumve and Muheza hospital. Others CDHs include Ilula, Makiungu, Mbalizi Evangelism, Peramio hospitals. Others were Tosamaganga, Turiani, Mvumi, and ST. Gema hospitals.

Data reliability was tested using a special statistical measure known as Cronbach alpha. Cronbach alpha test- aimed at determining the coefficient of internal consistency, it is widely used in social sciences, business, nursing etc. it is commonly used as an estimate of the reliability, in this study the test was conducted to estimate the reliability of hospitals' efficiency scores and productivity. Based on the model used in this study, computations of hospitals productivity use the same inputs and outputs. The efficiency and productivity variables are post admissions days, total outpatient visits, total number of surgical operation, number of beds and number of staff. Generally, the higher value of alpha is more desirable, as the rule of thumb the reliability of 0.70 or higher should be obtained on sample before using the instruments, in our study we estimated the alpha using SPSS 21, and found the reliability coefficient of 0.73 which is fairly good enough. Data validity was attained through having discussions with experts who have done similar studies before and testing research instruments in a pilot study.

According to Christian Social Services Commission (CSSC), faith based hospitals in Tanzania are mapped into five zones, that is Eastern, Western, Northern, Southern and Lake Zone. VAHs and CDHs employed in the sample and respective zones in which they are situated are indicated in *Table 1* below. The five zones were considered as the strata from which we obtained study units. The target was to have at least two hospitals from each zone for VAHs and four hospitals from each zone for CDHs. However, due to the problem of flexibility and data incompleteness during data collection, we managed to have what appeared in *Table 1.*

Table 1: Faith-based Hospitals Visited According to Their Zone and Status

ZONE	Volunteering agency hospitals (VAH)	Council Designated Hospitals (CDHs)	Number of Hospitals visited in each zone
Eastern zone	2	3	05
Western one	3	2	05
Northern zone	2	5	07
Southern zone	7	2	09
Lake zone	3	5	08
Grand Total (sample size)	**17**	**17**	**34**

Source: Research Finding, 2016

In this research the study sample size of 34 hospitals were used to make inference about the population of 90 faith-based hospitals in Tanzania, since it is time-consuming and expensive to collect data about every individual hospital in the country. Therefore, a planned sample of 34 hospitals (17 CDHs and 17 VAHs) is relatively large given the population of 90 hospitals in the country. The aim was to provide a room of obtaining the data, which will guarantee reliable analysis to allow generalization even if the response rate will fall below 50% or in case there is missing value in the data set.

Model and Variable Selection

An input-oriented Malmquist index was used in productivity estimates because hospitals managers and administrators have influence over the inputs resources but not the extent and type of healthcare demanded by their clients (Yawe, 2006; Pharm, 2010). The number of outpatients' visits has been widely used as a measure of outpatient output. Similarly, the number of admissions and post admissions days (inpatients days-admissions) have also been widely employed as a measure of inpatient outputs (Rosko and Mutter, 2010; Nedelea, 2012). However, due to the heterogeneity of the hospitals outputs different researchers usually include variables such as emergencies room visits, Outpatients' surgeries and births to control outputs heterogeneity. In this study the choice of outputs was based on previous studies by Rosko and Mutter (2010) and Nedelea (2012) - the outputs may also be selected based on easy availability of data. Therefore, output in study includes the outpatient visits, post-admission days and surgical operation. Following the approaches used in previous studies and several interview with hospitals administrators, the study employs two inputs that is *labor and hospitals beds*. Given the data constraints inputs variables were assumed to be similar in hospitals productivity studies (Rosko and Mutter, 2010; Nedelea, 2012). Building on the study by Pharm (2010) all outputs used in this study are aggregate, and measuring hospitals outputs by such aggregate variables does not capture the case mix variation and quality of services provided. The absence of data in developing countries makes applicability of Diagnostic Related Group (DRG) limited (Zere et al, 2006; Pilyavisky and Staat, 2008) - Tanzania being one of the case.

Table 2: Inputs and Outputs Variables for DEA

Outputs	**Output operational definitions**
Total post admission Days (Y_1)	Total number of days that inpatients stayed on hospitals' bed receiving inpatients services during the year (2012/13-2015/16)
Total outpatients visits (Y_2)	Total outpatients visited the department (2012/13-2015/16)
Surgical operation (Y_3)	Total inpatient and ambulatory Surgical operation (2012/13-2015/16)
Inputs	**Inputs operational definitions**
Hospitals beds (X_1)	Total number of used hospital beds during (2012/13-2015/16)
Full-time Equivalents (X_2)	Total Doctors and of full-time physicians (2012/13-2015/16)

FINDINGS AND DISCUSSION

Malmquist productivity index was measured in terms of hospitals' productivity means (during the period under the study 2012/13-2015/16) and hospitals annual means for both categories of hospitals (CDHs and VAHs). The total factor productivity (TFP) was decomposed into efficiency change and technological change for each group, aimed to determine the deriving factors for the change of the total factor productivity (TFP) change in each case. Malmquist productivity index (MPI) can take the value of 1, less than 1 or greater than 1 if there is stagnation in productivity growth, deterioration in productivity or growth in productivity respectively. The summary for the hospitals' productivity index and productivity index summary for annual means are presented in *Table3* and *Table 4* respectively. Generally, the drivers of total factor productivity change are efficiency change (EFFCH) and technical change (TECH). Improvement in EFFCH is considered as the catch-up effect (in this case the hospital is trying to move towards the efficiency frontier); meanwhile the improvement in TECH is considered as the shift of the hospitals' efficiency frontier (this happens when the hospitals gain technological advancements). On the other hand, when EFFCH is deteriorating the hospitals is said to have been moving away from the efficiency frontier and vice-versa is true, while when the TECH is deteriorating it implies the hospital has failed to gain the technological advancement, that can enhance the shift of its production frontier

Table3: Malmquist Index - Hospitals' Productivity Mean (2012/13-2015/16)

	VAHs					**CDHs**				
HOSPITAL	EFF CHANGE	TEC CHANGE	PURE-EFF CHANGE	SCALE EFF	**TFP CHANGE**	EFF CHANGE	TECH CHANGE	PURE-EFF CHANGE	SCALE EFF	**TFP CHANGE**
1	0.628	1.424	0.806	0.779	**0.894**	1.039	0.985	1.016	1.024	**1.024**
2	0.515	1.172	0.702	0.734	**0.604**	1.037	0.978	1.037	1.001	**1.015**
3	0.996	1.326	1.000	0.996	**1.320**	1.055	0.984	1.056	0.999	**1.038**
4	1.034	1.426	1.017	1.017	**1.474**	0.903	1.029	0.934	0.966	**0.929**
5	0.688	1.386	0.842	0.817	**0.954**	0.882	0.995	0.899	0.981	**0.877**
6	1.061	1.285	1.000	1.061	**1.363**	0.943	1.033	0.970	0.972	**0.974**
7	0.838	1.480	0.872	0.962	**1.241**	1.117	0.969	1.113	1.003	**1.082**
8	0.786	1.366	0.892	0.881	**1.074**	1.000	0.986	1.000	1.000	**0.986**
9	0.590	1.235	0.679	0.869	**0.728**	1.014	0.956	1.000	1.014	**0.969**
10	0.576	1.438	0.765	0.753	**0.829**	0.995	1.008	1.000	0.995	**1.003**
11	0.867	1.305	0.974	0.891	**1.132**	1.000	0.977	1.000	1.000	**0.977**
12	0.828	1.367	1.012	0.819	**1.132**	1.160	0.926	1.087	1.067	**1.075**
13	1.133	1.423	1.052	1.076	**1.611**	0.957	1.018	1.057	0.906	**0.974**
14	1.000	1.347	1.000	1.000	**1.34**	1.000	0.977	1.000	1.000	**0.977**
15	1.284	1.245	1.280	1.003	**1.598**	1.117	0.959	1.113	1.004	**1.071**
16	0.700	1.435	0.806	0.869	**1.005**	0.907	0.938	0.938	0.914	**0.992**
17	0.892	1.177	1.000	0.892	**1.049**	1.000	1.122	1.000	1.122	**1.000**
MEAN	**0.822**	**1.340**	**0.912**	**0.901**	**1.101**	**1.005**	**0.990**	**1.010**	**0.995**	**0.994**
	>1=04 <1=12 =1=1	>1=17	>1=5 <1=9 =1=3	>1=4 =1=1 <1=12	**>1=12 <1=5**	>1=7 <1=6 =1=4	>1=0 <1=12 =1=5	>1=7 =1=6 <1=4	>1=6 <1=8 =1=3	**>1=7 <1=9 =1=1**

Source: Research Findings, 2016

Total Factor Productivity Change (TFP) = (Technical Efficiency Change) (Technical Change)
Total efficiency change (TECH) = (Scale Efficiency Change) (Pure Efficiency Change)
In the *Table3* above result shows that overall productivity of VAHs hospitals was 1.101 while that of the CDHs was 0.994. Generally, total factor productivity (TFP) of more than 1 implies improvement (progression) in the productivity while less than one means deterioration in the productivity. If TFP is equal to one, it means there is no change in productivity, meaning productivity is neither improving nor deteriorating. In the same line of argument, productivity of the CDHs was deteriorating by 0.006 percent (0.6%) during the period under the study, while that of the VAHs category was improving by 0.101per cent (10.1%). Out of seventeen (17) hospitals under the VAHs category 12 experienced the improvement in the productivity with index greater than one.

However, In the VAHs category hospitals were experiencing deterioration in the components of the Total Factor Productivity (TFP) for example technical efficiency change (or efficiency change EFFCH) with the mean score of 0.822 (negative improvement of 17.8 %) meanwhile improvement in the technological change with the mean index of 1.340 (positive improvement of 34%). It is evident that improvement in the total factor productivity (10.1%) in the VAHs category was mainly derived from the progress in the technical change by 34% that counterbalances the deterioration by 17.8% in the technical efficiency change. It is argued that when the scale efficiency change is greater than one (1) it means that the hospital's scale of operation contributes positively to the productivity change, while if it is less than one it means that the hospitals scale of operation (size) is contributing negatively to the hospitals productivity change (Tlotlego et al., 2010).

Result of the CDHs category shows that the hospitals under this category were experiencing deterioration of the overall productivity since the mean index was 0.994 which is less than one (this implies negative improvement of 0.6 per cent). Out of seventeen (17) hospitals under the study only seven (7) had index score greater than one, as far as the components of the TFP is concerned there was improvement of the technical efficiency change (since the mean index was 1.005). Meanwhile, there was a deterioration of the technical change by 1% (the mean index score was 0.990). The root cause of deterioration of the TFP was largely dominated by regress in technical change other than technical efficiency change which was slightly improving (with mean score of 0.5%). Furthermore, slight progress in the technical efficiency change was derived from the marginal improvement in the pure efficiency by 1 % which counterbalanced deterioration in the scale efficiency of negative 0.5% (this make the slight improvement in technical efficiency change. However, in both CDHs and VAHs scale efficiency change (SECH) was less than one, which implied that on average the hospitals scale of operations in both categories (CDHs and VAHs) contributed negatively to the productivity growth of the hospitals in those categories. In other words, whether the hospitals scale of activities was large or small it added nothing to the growth of the hospitals productivity over the study period.

Table 4: Productivity Annual Means for VAHs and CDHs Hospitals (2009/10-2012/13)

	VAHs					CDHs				
YEAR	EFF CHANGE	TECH CHANGE	PURE/EFFCH ANGE	SCALE EFF	**TFP CHANGE**	EFF CHANGE	TECH CHANGE	PEC CH	SCALE EFF	**TFP CHANGE**
2012/2013	0.953	1.014	0.966	0.986	**0.967**	1.061	0.923	1.033	1.027	**0.979**
2013/2014	1.023	1.012	0.990	1.033	**1.035**	0.951	1.099	0.988	0.963	**1.045**
2014/2015	0.987	1.021	0.993	0.994	**1.008**	0.923	1.076	0.982	0.940	**0.993**
2015/2016	0.474	3.077	0.729	0.650	**1.459**	1.094	0.880	1.037	1.055	**0.962**
MEAN	**0.822**	**1.340**	**0.912**	**0.901**	**1.101**	**1.005**	**0.990**	**1.010**	**0.995**	**0.994**

Source: Research Findings, 2016

The MPI summary for the annual means is presented in Table 4 above, over the years 2012/2013 – 2015/2016. The overall productivity (TFP) means for the VAHs, and CDHs were 1.01 and 0.994 respectively, implying that VAHs category was experiencing progress in overall productivity meanwhile their counterpart CDHs were experiencing the regress in overall productivity. The overall productivity is decomposed into the technical efficiency change and

technological change, technical efficiency change is further decomposed into pure efficiency and scale efficiency. Result also reveal that 12 out of 17 VAHs have their productivity improving while 7 out of 17 CDHs have their productivity growing over the sampled study period.

The annual movement in total factor productivity (TFP) is the result of movement in efficiency change and technical change. Therefore, evolution of VAHs' TFP over the study period was the result of decreased by 0.47 percent, increase by 0.23 percent and decrease by 0.13 and 0.526 percent in the year 2012/13, 2013/14, 2014/15 and 2015/16 respectively in efficiency change, on the other hand increase of technical change by 1.4, 1.2, 2.1 and 2.077 during the year 2012/13, 2013/14, 2014/15 and 2015/16

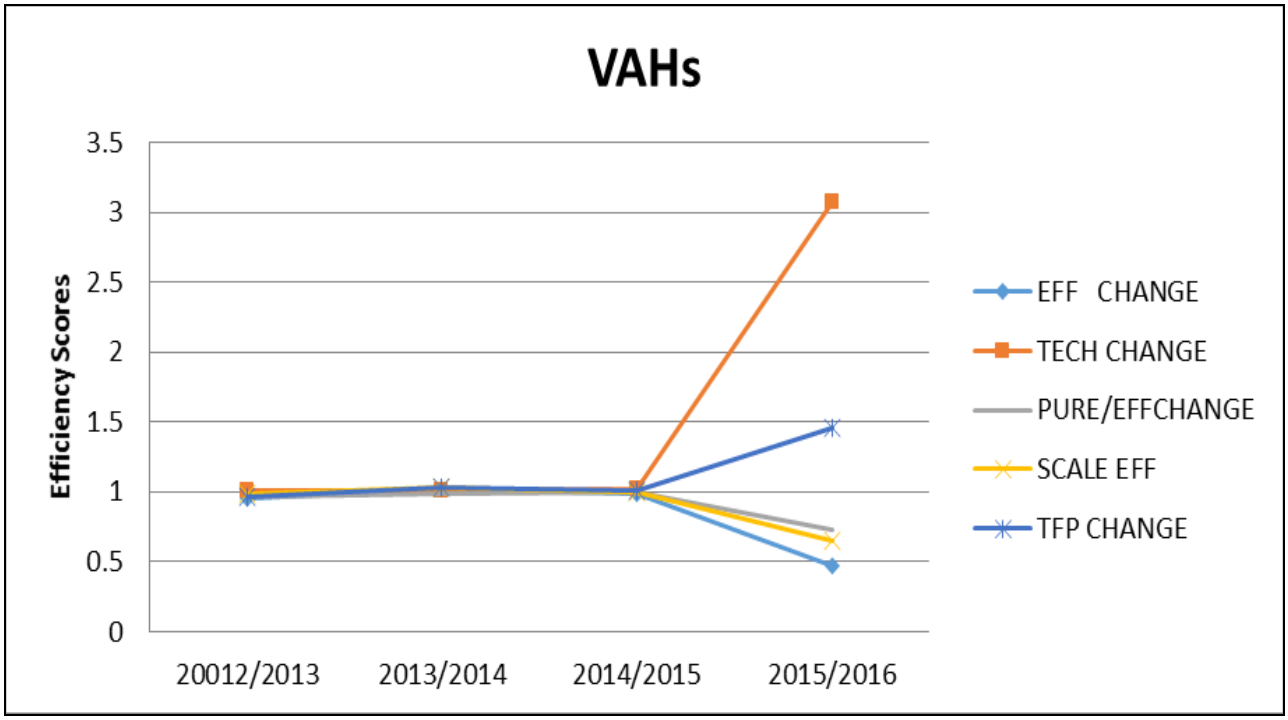

Figure1: Productivity Index Change for VAHs Annual Means
Source: Research Findings, 2016

The CDHs had TFP index of 0.994 which implied the regress/deterioration of the productivity over the sample period, the deterioration in TFP was mainly derived by regress in technical efficiency that cannot be counterbalanced with the small improvement in pure efficiency of hospitals (Ref. Table 3). The trend for CDHs productivity change *(Figure: 1)*show that there was a progress of 6.1% in technical efficiency change experienced in the first year (2012/13) followed by regress of negative 4.9% and 7.3% in the subsequent two years before reversing the move and experience progress of 9.4% in the last year (20015/16). As far as the technical change is concerned there was regress negative 7.7 % in the first year 2012/13 followed by progress in subsequent three years 9.9%, 7.6% before downturn to regress of negative 12%in the year 2015/16.

The trend of total factor productivity (TFP) for CDHs is mixed, it started with slight regress in 2012/13 then a small increase by 4.5% followed by continuous regress in the remaining years *(Figure 2).* TFP reflect the movement of technical change while the efficiency change follows the pattern of scale efficiency and pure efficiency. Generally, the annual productivity trend is considered as mixed in both categories of hospitals (VAHs and CDHs) as in some cases (components of TFP) the productivity changed by progressing while in some cases by regressing, so there was no consistency as far as annual movements of productivity is concerned.

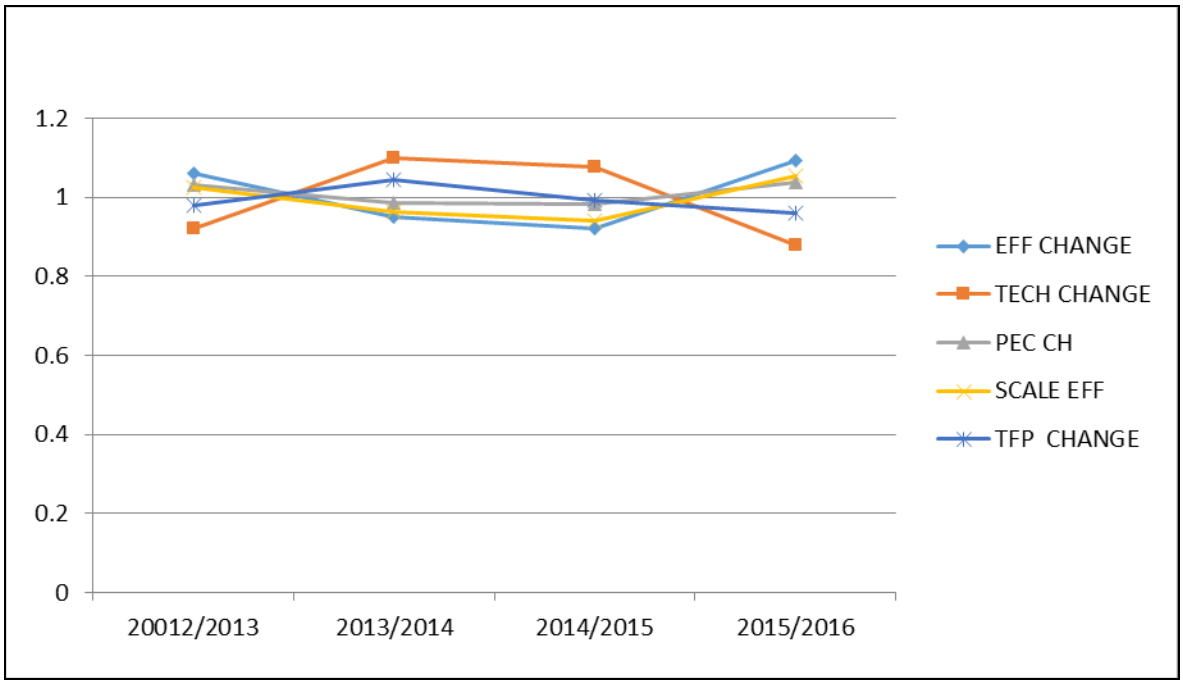

Figure 2: Productivity Index Change for CDHs Annual Means
Source: Research Findings, 2016

However, by looking at the efficiency change (EFFCH) in both VAHs and CDHs, the result in the two categories show similar move in the first three years where the groups experienced progression in the productivity. Moreover, the determinants of TFP change were also mixed, like in some previous studies the change in overall productivity was largely derived by technical change (innovation); meanwhile efficiency change was found to be primarily deriving the overall productivity change in other studies.

Similarly, there is a few numbers of hospitals studies conducted in Africa, for example, Zere et al. (2001) conducted a study in South Africa, and result shows that Total Factor Productivity (TFP) of hospitals under the study declined by 12.1 percent over the sampled period it further revealed that the deterioration of TFP was largely derived by decline in technical efficiency. The decline by 12.1% in the study by Zere et al. (2001) was high compared to the decline by 0.6% of Total Factor Productivity (TFP) in CDHs productivity in Tanzania; however decline in productivity in both cases was largely caused by technological regress. In another study conducted by Yawe (2006) on productivity of the district referral hospitals in Uganda (from 2000-2003), it was found that there was decline in technical efficiency which derived the low level of growth in TFP of district hospitals in Uganda in all models except in model 3 where there was productivity improvement of 5.5%, when compared to this study, productivity gain of 5.5% of district referral hospitals in Uganda is less than productivity gain of 10.1% of VAHs hospitals in Tanzania. Therefore VAHs seem to outperform CDHs in Tanzania as well as district referral hospitals in Uganda

Kirigia et al. (2008) conducted a study using 28 Municipal hospitals in Angola employing the use of DEA-based Malmquist productivity index, covering the period from 2000 to 2002. The result indicates improvement in Total Factor Productivity (TFP) by 4.5 % (TFP=1.045), improvement was primarily derived from efficiency improvement of 12.7% (EFFCH=1.127) and technological regress of 7.3% (TECH=0.927), the 12.7% progress in efficiency change (EFFCH) was due to a 5 % increase in pure efficiency change (PECH) (PECH=1.050) and a 7.3% increase in Scale efficiency (SECH= 1.073). When compared to the result of this study, VAHs in Tanzania experienced high productivity improvement (10.1%) than Municipal hospitals in Angola (4.5%). While improvement of TFP of Municipal hospitals in Angola was largely influenced by the Efficiency change, in Tanzania overall productivity in VAHs was primarily derived by progress in technical change (innovation).

On the other hand there are a number of such studies conducted outside Africa; Gannon (2008) used DEA based-Malmquist to measure hospitals productivity on samples of 6 regional, 8 general, and 22 country hospitals in Ireland covering the period of 1995 to 1998. The result shows that regional hospitals had a total factor productivity (TFP) of 1.028; efficiency change (EFFCH) of 0.994 and technical change (TECH) of 1.034. On the other hand, the general hospitals had efficiency change (EFFCH) equal to 0.999; technical change (TECH) of 1.013, and Total Factor Productivity (TFP) of 1.012. The country hospitals had TFP of 0.997; technical change (TECH) of 0.992, and efficiency change (EFFCH) of 1.005. In short the productivity of both regional and general hospitals improved, while those of country hospital deteriorated during the sampled period. The improvement in productivity of the regional (2.8%) and general (1.2%) hospitals in Ireland was less than the improvement in the productivity of VAHs (10.1%) in Tanzania. Improvement in TFP of the regional and general hospitals was largely caused by the improvement in technical change rather than efficiency change; this conforms to the findings in this study where it has been revealed that the improvement of the VAHs' productivity was primarily determined by technological change (innovation) of 34%.

Oullete and Vierstraete (2004) evaluated productivity changes of emergency units of 15 hospitals in Canada, for 1997/1998 and 1998/1999 using Malmquist DEA, the result shows the overall mean of TFP is 0.92, efficiency change (EFFCH) is 0.94 and technical change (TECH) is 1.05. The 8 percent deterioration in Total Factor Productivity (TFP) was mainly caused by 0.6% decrease in efficiency change. When compared to result in this study deterioration by 0.6 percent of TFP of CDHs in Tanzania was less compared to productivity deterioration of 8% in emergency units in Canada. In both study the influencing factor for the deterioration of TFP was regress in efficiency change. Barros et al. (2007) examined the productivity change in 51 hospitals in Portugal hospitals using the Luenberger indicators and the Malmquist index covering the period of 1997 to 2004, the results from the Malmquist productivity index showed that TFP was 1.042, EFFCH score was 1.036 and TECH score was 0.995 which means therefore that, on average the overall productivity (TFP) of hospitals under the study was improving due to improvement in efficiency change (EFFCH), the improvement in overall productivity of hospitals in Portugal hospitals 4.2% was less than growth in overall productivity of VAHs in Tanzania 10.1%. However, the deriving factor for the improvement of Total Factor Productivity (TFP) in Tanzania was technical progress contrary to the Portugal where the improvement was primarily caused by efficiency progress. However, in some study both technical change (TECH) and efficiency change were found to have influenced on overall hospitals' productivity change. For example, in the study by Dash (2009) DEA based Malmquist productivity index was employed to examine productivity of 29 hospitals in India covering the period from 2002 to 2007. The results revealed that hospitals under the study had Total Factor Productivity (TFP) of 1.2358, efficiency change (EFFCH) of 1.15 and technical change (TECH) of 1.07. It was further observed that the improvement of 23.6 percent in TFP was derived from 15 percent improvement in efficiency together with a 7 percent increase in innovation. Therefore, in this case, both components of TFP attributed to the improvement in TFP of hospitals under the study. This means the hospital is trying to balance between the innovation (technical advancement) and efficiency improvement. Since the efficiency change can be decomposed into scale efficiency and pure efficiency, it means that either both are deriving the efficiency change or one of the two (scale or pure efficiency) outweigh the other in deriving the efficiency change.

In the study by Roh et al., (2012) it was found that average scale efficiency was almost less than one for all period under the study, except in the year 1999/2003, which means that during the period under the study scale of operation of non-profit hospitals in US contributed negatively to the productivity growth of the hospitals. It is contended that when the scale efficiency change is greater than one implied that hospitals' size has contributed positively to the productivity growth while less than one the hospitals' size has contributed negatively to the productivity.

CONCLUSION AND RECOMMENDATION

The study aimed at comparing productivity of CDHs and VAHs as well as identifying factors that derive the observed percentage change of total factor productivity in Tanzania. The study also aimed at determining level at which the firm operate at optimal scale.

Conclusively, the study marked that VAHs in Tanzania were experiencing growth in productivity, while CDHs were experiencing deterioration of overall productivity over the sampled period. Improvement of productivity for VAHs was mainly derived from improvement in technical efficiency rather than efficiency change. Meanwhile deterioration

of productivity for CDHs was largely influenced by the deterioration of the technical change. Therefore, it implies that technological improvement (innovation) plays a big role in determining total factor productivity change (TFP) in private hospitals in Tanzania, since in both CDHs and VAHs improvement or deterioration of total factor productivity was primarily caused by a progress or regress in the technical change (innovation). The study also stresses that relationship between the outputs and inputs in CDHs is largely determined by administration and not technology. However, in both categories (CDHs and VAHs) scale efficiency contributed negatively to the productivity growth, implying that size or scale of hospitals' operation did not contribute anything towards hospitals' productivity growth.

The study recommends that CDHs should try to invest in new technology, new healthcare services, new management systems as well as new methodologies in order to improve technical change (innovation). On the other hand VAHs should improve knowledge diffusions so as to move towards the frontier (*catch up effect*). Since the technical change seems to be the main deriving factor of hospitals productivity in Tanzania, managers, owners and hospitals administrators whose hospitals are experiencing a regress move are urged to invest in innovation so as to counterbalance the decline in total factor productivity in their hospitals.

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