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Measurement and Evaluation of the Efficiency of Tanzania Pension Funds

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Abstract

This study measured and evaluated the efficiency of public pension funds in Tanzania, focusing on the Public Service Social Security Fund (PSSSF), which serves public sector employees. Tanzanian pension funds face significant challenges, including delays in pension payments and declining investment returns due to underperforming portfolios. Using non-parametric Data Envelopment Analysis (DEA) with an input-based Banker, Charnes, and Cooper (BCC) model, the study assessed the efficiency of the public pension funds in Tanzania across 25 regional pension fund offices in Mainland Tanzania, treated as Decision-Making Units (DMUs). Three input variables: number of staff, administrative costs, as well as advertisement and promotion costs; and two output variables: membership growth rate and pension payout ratio were analyzed. Efficiency scores were calculated to evaluate resource utilization. Results revealed that none of the DMUs achieved maximum efficiency, suggesting that resources could be reduced without affecting outputs. Furthermore, efficiency was significantly and negatively influenced by the number of staff and administrative costs, while advertisement and promotion costs had no significant impact. The study concludes that the number of staff, administrative costs, as well as advertisement and promotion costs collectively affect the efficiency of pension fund. The study recommends that the Government, through PSSSF, should evaluate regional office operations and reallocate resources optimally to enhance efficiency and maximize outputs.

Keywords: *Pension Funds, Efficiency, Data Envelopment Analysis, Pension Payout Ratio, Membership Growth Rate.*

1. Introduction

Pension funds are increasingly playing a dominant role in economic development, particularly in socio-economic advancement across many countries (Bijlsma et al., 2018). Tanzania is among the nations with pension fund schemes that have operated for over 80 years, providing services to both public and private sectors during various periods of growth. So far, Tanzania has witnessed the operation of five distinct pension funds, with some undergoing transformations to serve specific employee categories. These include the Local Authorities Pension Fund (LAPF), which catered for government employees in local authorities; the Parastatal Pension Fund (PPF), serving employees in parastatals and the private sector; the Public Service Pension Fund (PSPF), for public sector employees; the Government Employees Provident Fund (GEPF), covering formal and informal sectors; and the National Provident Fund, later transformed into the National Social Security Fund (NSSF), serving the private sector, non-governmental and religious organizations, as well as foreign employees working in international organizations.

In 2018, the Tanzanian government merged four pension funds (LAPF, PPF, GEPF, and PSPF) into a single entity, the Public Service Social Security Fund (PSSSF), in order to reduce pension benefit and operational costs (Tarimo, 2022). However, despite this harmonization, the fragmented structure of the remaining schemes continues to impact efficiency due to their relatively small size thus limiting economies of scale and hindering

investment performance (WB, 2019). The close link between technical efficiency and investment returns has resulted in declining performance because inefficiencies have negatively affected the overall efficiency in Tanzania's public service pension fund (Nourani et al., 2022). Consequently, the Return On Investment (ROI) from pension funds has steadily declined from 1.2 in 2017 to 0.4 in 2021 (CAG, 2022).

Studies indicate a direct relationship between the technical efficiency of pension schemes and their financial performance, particularly investment returns (Michiel et al., 2018). The Tanzanian pension schemes have provided relatively low benefits due to operational and technical inefficiencies (Mwakisisile, 2018). This study aimed to conduct an in-depth analysis of factors affecting efficient resource allocation in pension funds. Inefficiencies, such as arrears collection delays, have been identified as major contributors to delays in processing benefits (Matimbwa, 2021). According to the National Bureau of Statistics, more than 90% of pension fund members are managed by the PSSSF, with less than 5% managed by the NSSF, which serves private, parastatal, and religious organizations. Therefore, the PSSSF's poor performance significantly impacts the Tanzania's economy, particularly the pension subsector in the financial sector.

The section that follows engages the discussion with scholars in the area of public pension funds across the globe in order to contextualize the current study and establish the knowledge gap to be filled.

2. Literature Review and Hypothesis Development

A pension is a guaranteed monthly payment based on a predefined formula, typically paid after a person retires from work, which serves as the primary source of contributions. Efficiency refers to the ratio of observed input to the maximum potential output attainable from that input, or the ratio of minimum potential input to the observed input required to produce a given level of output (Lovell, 1993). Technical efficiency is the ability of an organization to achieve the maximum level of output from a given input or to minimize input usage for a given level of output (Anna et al., 2021). Many researchers have explored the relationship between technical efficiency and organizational performance.

Williamson (1979, 1986) established that organizational efficiency is related to transaction costs. According to Williamson, an entity reaches optimal efficiency by minimizing transaction costs, which include monitoring, controlling, and managing expenses. Similarly, Ludwig von Bertalanffy emphasized that efficiency arises from the interaction of subsystems within an organization. Bertalanffy's theory highlights the systematic transformation of inputs into outputs through key managerial functions like planning, organizing, staffing, leading, and controlling (Cornell & Jude, 2015). Thus, human resource organization in delivering pension services influences the overall efficiency and it requires careful management to achieve desired outputs.

Empirical studies confirm the relationship between input and output variables and efficiency. For example, Yean Hoang and Delpachitra (2016) used Data Envelopment Analysis (DEA) to evaluate the efficiency of Australian superannuation funds (2005–2012). Their findings showed that higher expenses were associated with lower efficiency scores. Yang (2009) also analyzed the impact of administrative costs on efficiency in public sector organizations using the Cobb-Douglas production function. The study found that reducing administrative costs positively affected organizational efficiency.

Lotto (2019) examined the link between operating efficiency and profitability in 36 commercial banks in Tanzania, and he came with the conclusion that a direct relationship exists between the two. This finding aligns with Arbelo et al. (2021), who noted that profitability is a measure of overall efficiency, reinforcing the positive relationship between operating efficiency and organizational performance. Similarly, Aziz (2005) evaluated

technical efficiency among Chilean pension fund managers (1982–1999) using DEA. The study found that higher advertisement costs negatively affected efficiency, while a higher ratio of contributors positively influenced efficiency. Kyle (2005) further observed that greater advertising expenditures often lead to increased monopoly and reduced efficiency.

In light of these studies, this research develops and tests the following null hypotheses to assess the factors influencing pension fund efficiency in Tanzania:

Hypothesis 1*: There is no significant effect of changes in the number of staff on the efficiency of pension funds in Tanzania.*

Hypothesis 2*: There is no significant effect of changes in administrative costs on the efficiency of pension funds in Tanzania.*

Hypothesis 3*: There is no significant effect of changes in advertisement costs on the efficiency of pension funds in Tanzania.*

3. Research Methodology

3.1. Scope, Target Population and Sample Size

The study aimed to measure and evaluate the efficiency of pension funds in Tanzania by analyzing the interaction between input resources: number of staff, administrative costs, and advertisement costs; and outputs: membership growth rate and pension payout ratio. These input and output resources were analyzed based on delivery of pension services to beneficiaries. The target population for this study comprised all Public Service Social Security Fund (PSSSF) regional offices in Mainland Tanzania engaged in the social insurance business by collecting contributions from employees with the promise of paying pensions upon their retirement.

In determining the sample size, two considerations were applied. First, the rule of thumb for sample size selection under the DEA model, which requires the sample size to be greater than or equal to three times the sum of the input variables (3) and output variables (2). Second, the feasibility of studying the entire population was assessed, given that a small and accessible population allows for full population analysis using the study's methodologies (Ajay & Micah, 2019). The study identified a total population of 27 Decision-Making Units (DMUs). Since the population size was relatively small, studying the entire population was deemed feasible. However, due to the unavailability of data from 2 DMUs, the study ultimately analyzed information from 25 DMUs.

3.1.1. Criteria for Sample Selection

In determining the sample size for this study, two main considerations were applied. The first consideration was the rule of thumb for sample size determination in the Data Envelopment Analysis (DEA) model. According to this rule, the number of Decision-Making Units (DMUs) must be at least three times the sum of input and output variables to obtain valid efficiency scores and accurate benchmarking of DMUs (Aradhana & Ravi, 2013). Based on the conceptual model, which includes three input variables and two output variables, the sample size was calculated as follows:

$$n \geq 3(3 + 2)$$
$$n \geq 15$$

Thus, the sample size under the DEA methodology was required to be greater than or equal to 15. The second consideration was the feasibility of studying the entire population because small and accessible populations are conducive to full population analysis using the study's methodologies (Ajay & Micah, 2019). The total population for this study comprised 27

DMUs, and given its relatively small size, analyzing the entire population was deemed feasible. However, due to the unavailability of data from 2 DMUs, the final analysis was conducted on 25 DMUs.

3.2. Data Source

The primary source of data for this study was secondary data obtained from PSSSF. Specifically, data were collected for the sampled 25 DMUs, including annual details on the number of staff, administrative costs, advertisement costs, membership growth rate, and pension payout ratio. The study utilized annual performance reports of the 25 DMUs from 2017 to 2022, as well as consolidated annual reports of PSSSF over the same six-year period.

3.3. Variables and Measurements

The study was guided by both independent and dependent variables, which formed the basis for measuring efficiency and drawing conclusions about the overall efficiency of the pension fund, as summarized in Table 1.

Table 1: Study Variable Measurements

SN	Variable Name	Measure	Type	Unit	Code
1	Number of Staff	A count of number of staff	Independent – Input	Sum	NOS
2	Administrative Costs	Sum of costs incurred administrative expenses incurred per annum	Independent – Input	Sum	ADC
3	Advertisement Costs	Sum of costs incurred on advertisement and promotions activities per annum	Independent – Input	Sum	AVC
4	Pension Payout Ratio	The ratio between actual pensions paid out and the total outstanding pensions	Independent – Output	Ratio	PPR
5	Membership Growth Rate	The ratio between change in number of members between two consecutive years and number of members in the previous year	Independent – Output	Ratio	MGR
6	Age of the DMU	The number of years that DMU has been on operations from establishment year	Control Variable	Sum	AoD
7	Efficiency Scores	Ratio of Output to Inputs determined by DEA Model	Dependent	Ratio	EFF

Source: Researcher (2023)

3.4. Data Analysis and Model Specifications

The study employed various quantitative analyses to generate results and findings that would enable the researcher to draw conclusions. The primary tool for analysis was STATA, which was used for descriptive analysis, diagnostic tests, regression analysis, and formatting data from the original spreadsheet files. A total of 125 observations, derived from 25 DMUs and containing data on seven model variables, were exported into STATA 14 for analysis. Additionally, R Console and Studio Version 4.3.0 were used to compute efficiency scores from the DEA model. Both STATA and R were used collaboratively because the input data for R required formatting as a STATA-compatible DTA file.

The primary model applied in this study was a two-stage DEA model, which facilitated the analysis. The first stage involved measuring efficiency scores for the DMUs over a six-year period (2017–2022). In this stage, the input-oriented variable returns to scale (BCC model) was utilized. The BCC model maximizes the efficiency of a unit when the

efficiencies of all units in the set are bounded by an upper limit of 1. The weights in the model are treated as unknown positive values and they are determined to maximize the efficiency of each unit. A unit is considered efficient if its efficiency score equals 1; otherwise, it is deemed inefficient if the score is less than 1. Efficiency scores for all other units are calculated in reference to the most efficient unit. The input-oriented BCC model aims to identify an optimal point where inputs are minimized for a given level of output. The mathematical expressions for the input-oriented BCC model are as presented in Equations 1, 2 and 3.

$$\textbf{Min} \quad \sum_{j=1}^{n} v_j \cdot x_{jo} - w \tag{1}$$

Subject to:

$$\sum_{i=1}^{m} u_i \cdot y_{i0} = 1 \tag{2}$$

$$\sum_{i=1}^{m} u_i y_{ik} - \sum_{j=1}^{n} v_j x_{jk} + w \leq 0 \quad for\ k = 1, 2 \ldots\ldots, h \tag{3}$$

Where,

h denotes units or DMUs (Regional Offices of PSSSF i.e PSSSF Tanga, PSSSF Tabora, etc).

m denotes outputs (Membership Growth Rate (MGR) and Pension-Payout-Ratio (PPR)).

n denotes inputs (Number of Staff (NoS), Administrative Costs (ADC) and Advertisement and Promotional Costs (AVC)).

w denotes the scale factor.

u_i = weight given to output i

v_j = weight given to input j

y_{ik} = amount of output i from kth DMU

x_{jk} = amount of input j from kth DMU

The second stage of the DEA model involved regressing the value of aggregate efficiency scores and the three input variables using the multiple linear regression model in Equation 4.

$$Yit = \beta 1 + \beta 2\, x1it + \beta 3 x2it + \beta 4 x3it + ei \tag{4}$$

Whereas,

Yit symbolizes average efficiency scores for ith DMUs in year t.

$x1it$ average number of staff for ith DMU in year t.

$x2it$ average administrative expense for ith DMU in year t.

$x3it$ average advertisement costs for ith DMU in year t.

$\beta 1$ is the constant term.

$\beta 2, \beta 3, \beta 4$ are coefficients for average number of staff, administrative costs and advertisement costs respectively.

ei is the error term.

The third model that was used is the panel data model. Panel data is a model that organizes data in a multi-dimensional manner that is being reported repeatedly over time (Alam, 2020). In this type of data, the same objects or individuals are being observed at multiple points in times with multiple variables. This study therefore utilized a balanced panel data model. The panel data model is expressed in Equation 5.

$$Yit = \alpha + \pi 1\, x1it + \pi 2\, x2it + \pi 3\, x3it + \pi 4\, x4it + ei \quad (5)$$

Whereas,

Y_{it} denotes the efficiency score for i^{th} DMU in year t.

$x1it$ denotes the number of staff for ith DMUs in year t.

$x2it$ denotes the administrative costs for ith DMU in year t.

$x3it$ denotes the advertisement and promotion costs for ith DMUs in year t.

$x4it$ denotes the age of ith DMU in year t.

$\pi 1$, $\pi 2, \pi 3, \pi 4$ are the coefficients for number of staff, administrative costs and advertisement, promotion costs, and age of DMUs respectively.

ei is the error term.

4. Findings and Discussion of Results

The discussion of findings is divided into three parts. The first part presents the descriptive analysis of the variables, the second part evaluates the efficiency of DMUs using the DEA model, and the third part explores the regression analysis and the relationship between input variables and efficiency scores.

4.1. Descriptive Analysis

The descriptive analysis aimed to highlight the extent to which the variables used in the study differentiated one DMU from another and the degree of similarity or variation among DMUs. The data revealed that the mean number of staff was 61.03, with a standard deviation of 33.05, indicating substantial variation in staff numbers across DMUs. Some DMUs had a higher number of staff, reflecting larger membership bases, while others had fewer staff due to a lower number of potential members. The minimum number of staff was 26, observed at Songwe DMU, while the maximum number was 130, recorded at Kinondoni DMU.

For administrative expenses, the mean value was 744 million, with a standard deviation of 635 million, indicating moderate variation. The lower variation was attributed to the standardized nature of administrative expenses, which included costs such as office supplies, rent, utilities, insurance, depreciation, and other minor expenses. The minimum administrative cost was 254 million, recorded at Iringa Region, while the maximum administrative cost was 2.66 billion, observed at Temeke Region.

Advertisement costs had a mean of 98.2 million and a standard deviation of 78.9 million, with a minimum of 33.9 million in Kigoma Region and a maximum of 320 million in Tanga Region. The relatively low variation was due to the similar cost structures of advertisement programs across DMUs, which included banners, posters, radio and TV programs, as well as marketing outreach activities.

The pension payout ratio had a mean of 0.443 and a standard deviation of 0.076, indicating significant variation among DMUs. The minimum payout ratio was 0.27, while the maximum payout ratio was 0.61.

The membership growth rate had a mean of 0.46 and a standard deviation of 0.12, reflecting minor variations among DMUs. These minor differences were due to the standardized methods of acquiring new members. The minimum growth rate was -0.017, observed in Mtwara Region, while the maximum growth rate was 0.3, recorded in Dodoma Region.

4.2. Measurement and Evaluation of DMU's Efficiency Scores

The study assessed the efficiency scores of 25 regional offices over a six-year period (2017–2022) to evaluate the overall efficiency of the DMUs. Figure 1 presents the descriptive summary of the average efficiency scores, aggregated over the six-year period.

	Percentiles	Smallest		
1%	.4252	.4252		
5%	.4651	.4651		
10%	.4909	.4909	Obs	25
25%	.7969	.4937	Sum of Wgt.	25
50%	.8678		Mean	.81816
		Largest	Std. Dev.	.1789796
75%	.942	.963		
90%	.9643	.9643	Variance	.0320337
95%	.9861	.9861	Skewness	-1.157588
99%	1	1	Kurtosis	2.912813

Figure 1: Summary Statistics of the Mean Efficiency Scores (Source: Research data, 2023)

On aggregate, the mean efficiency score across all 25 DMUs over the six-year period was 0.81816. This indicates that the DMUs, on average, were approximately 82% efficient in utilizing the resources available to them, while 18% being inefficient. This inefficiency implies that the DMUs could have used 18% fewer resources and still achieved the same output.

The standard deviation of the efficiency scores was 0.18, slightly distant from the mean (0.82), suggesting significant variation in efficiency scores among the DMUs. However, this variation had no explanatory implications. This is because efficiency scores are not explanatory against any variable within the analysis. Furthermore, the Variance Inflation Factor (VIF) for the dataset was within acceptable limits, confirming that the variance did not affect the explanatory power of the analysis.

The minimum efficiency score was 0.4252, while the maximum efficiency score was 1.000. The median efficiency score (50th percentile) was 0.8678, and the third quartile (75th percentile) was 0.9420. This indicates that more than 50% of the regions achieved an efficiency level exceeding 86.7% under the BCC model.

Table 2 presents the year-wise distribution of average efficiency scores, with the minimum average score of 0.724784 recorded in 2020 and the maximum average score of 0.873792 observed in 2022.

Table 2: Summary Statistics of the BCC Efficiency Scores (Absolute Score Values)

Variable	Obs	Mean	Std. Dev.	Min	Max
Eff_Sco~2017	25	.8188564	.2410261	.34089	1
Eff_Sco~2018	25	.853648	.2170722	.3235	1
Eff_Sco~2019	25	.83796	.2341507	.2325	1
Eff_Sco~2020	25	.724784	.2204749	.2638	1
Eff_Sco~2021	25	.79988	.264348	.2116	1
Eff_Sco~2022	25	.873792	.1500611	.4967	1

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Source: Research data (2023)

The results of the DEA analysis indicate that the minimum efficiency score across the 25 regions was 0.2116, observed in Kinondoni Region in 2021. Conversely, the maximum

efficiency score was 1.000, achieved by 21 different regions at various points during the six-year period. While Ilala Region recorded the lowest efficiency scores in overall, the maximum score, representing the most efficient regions, was achieved by a total of 12 different regions.

The study also conducted an individual assessment of the efficiency scores for each DMU to classify them as efficient, moderately efficient, or least efficient among the 25 DMUs evaluated. Table 3 presents the individual efficiency scores of the DMUs over the six-year period from 2017 to 2022.

Table 3: Efficiency Scores of DMUs using BCC Model

DMU	Efficiency Scores 2017	Efficiency Scores 2018	Efficiency Scores 2019	Efficiency Scores 2020	Efficiency Scores 2021	Efficiency Scores 2022
Katavi	0.86376	0.865	0.8684	0.6667	1	0.9319
Tanga	0.92703	0.9908	0.7756	0.8333	0.7895	0.8596
Arusha	1	1	0.7361	0.4765	0.6493	1
Dodoma	0.36217	0.3235	1	0.6008	0.2696	1
Mwanza	0.96871	1	1	1	1	0.6184
Kigoma	0.97898	1	1	0.7072	1	1
Tabora	0.94952	0.8458	1	1	1	0.8448
Simiyu	1	1	1	0.8678	0.9181	1
Shinyanga	1	0.9545	1	0.779	1	0.754
Temeke	0.42823	0.5768	0.2373	0.2638	0.2845	1
Kinondoni	0.34089	0.3617	0.2325	0.4044	0.2116	1
Singida	1	0.9603	0.9059	0.5556	0.7851	1
Mara	1	0.9163	1	1	1	1
Ruvuma	1	1	0.7959	0.6522	0.6522	0.6809
Morogoro	0.92823	1	0.8459	1	1	0.8781
Iringa	0.65766	0.8011	1	0.6236	0.7753	1
Manyara	1	0.9914	0.9532	0.8333	1	1
Lindi	0.73913	1	0.9724	0.7658	1	0.6953
Mtwara	0.87081	1	1	0.7969	1	0.7768
Ilala	0.4235	0.5187	0.4122	0.332	0.4547	0.8041
Songwe	1	1	1	1	1	1
Geita	1	1	1	0.7895	1	0.8233
Kilimanjaro	0.36474	0.4921	0.5853	0.4828	0.5404	0.4967
Mbeya	0.73291	0.8115	0.8283	0.6884	0.6667	0.6809
Pwani	0.93514	0.9317	0.8	1	1	1
AVERAGE	**0.8188564**	**0.853648**	**0.83796**	**0.724784**	**0.79988**	**0.873792**

Source: Research data (2023)

Table 3 illustrates the varying levels of efficiency scores from the 25 DMUs over the six years assessed. A total of 21 DMUs achieved at least one instance of the optimal efficiency score of 1.000. However, four regions never attained this maximum efficiency level. The aggregated average efficiency scores, assessed year-by-year, indicate an upward trend in efficiency beginning in 2020. Efficiency scores increased from 2017 to 2018, reaching 0.85 (equivalent to 85% efficiency level) in 2018. The analysis of financial statements and performance reports suggests that this improvement resulted from efficiency gains following

the merging of the four pension funds (LAPF, PPF, GEPF, and PSPF) into PSSSF. The increased efficiency may have stemmed from enhanced management, technical, and operational efficiency, or improved staff productivity due to shared resources, including the number of staff, administrative expenses, and advertisement costs, as well as improvements in pension payout ratios and membership growth rates.

Despite these initial improvements, efficiency levels began to decline after 2018, dropping from 0.85 (85%) in 2018 to 0.83 (83%) in 2019, and further to the lowest efficiency level of 0.72 (72%) in 2020. This decline was attributed to challenges associated with the post-merger reorganization of resources, as well as an increase in inputs, including, staff numbers, administrative expenses, and advertisement costs without a corresponding increase in outputs, such as pension payout ratios and membership growth rates. Additionally, the period leading up to 2020 was an election year, during which the government significantly reduced hiring thus limiting the registration of new members, who are the primary source of growth for pension funds.

The study also summarized the frequency distribution of efficiency scores to analyze the score distribution among the 25 regions assessed. The results are presented in Figure 2.

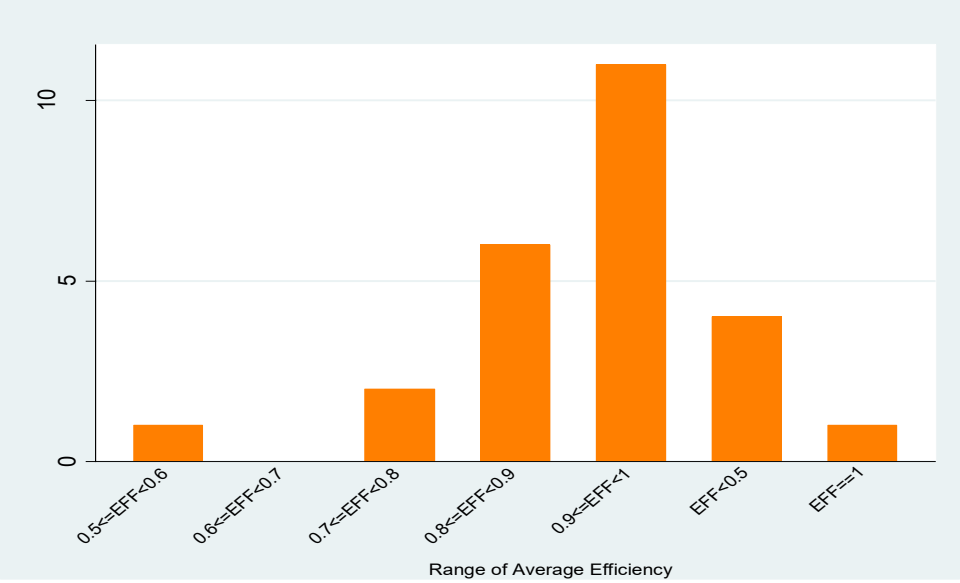

Figure 2: Frequency Distribution of the Average Efficiency (Source: Research data, 2023)

The analysis of the frequency distribution indicates that the majority of efficiency scores fall between 0.8 and 0.9, suggesting that most regions were relatively efficient. The results show that 11 DMUs had scores between 0.9 and 1.0 (excluding 1.0) as their average efficiency score, indicating that these regions were more efficient than all others. Additionally, 6 DMUs had average efficiency scores between 0.8 and 0.9 (excluding 0.9). The minimum efficiency score of 0.5 was observed in only one region.

The analysis further reveals that Songwe DMU was the most efficient among all 25 DMUs, achieving the maximum efficiency score of 1.0 for all six years (2017–2022). Despite variations in efficiency levels, most DMUs achieved relatively high scores. A total of 16 DMUs scored above the overall average efficiency score of 0.8182, while 9 DMUs were below the average level.

The top five DMUs: Songwe, Mara, Manyara, Simiyu, and Kigoma, had an average efficiency score of 0.9630, making them the most efficient among all selected DMUs. In contrast, the bottom five DMUs: Temeke, Kinondoni, Kilimanjaro, Ilala, and Dodoma, had the lowest efficiency scores. These regions were associated with the highest number of staff

among all DMUs, requiring corresponding increases in outputs, such as membership growth rates and pension payout ratios. The low efficiency scores in these DMUs suggest that the increase in inputs, including newly engaged staff, did not lead to a proportional increase in outputs.

Figure 3 illustrates the trend in the aggregate mean efficiency score over a six-year period, starting in 2017. The trend shows that the maximum efficiency score of 0.8738 was attained in 2022, while the lowest efficiency score of 0.7248 was recorded in 2020. There was a gradual decline in efficiency scores from 2018 to 2020, with the lowest point occurring in 2020.

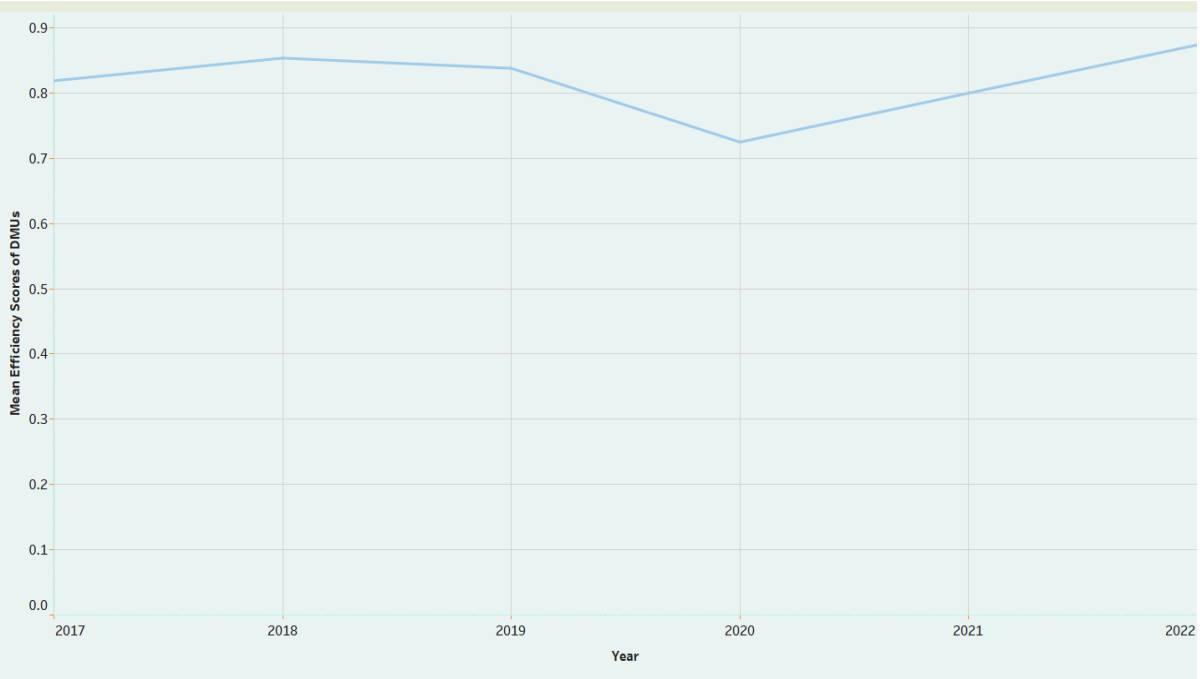

Figure 3: The trend of mean efficiency scores from 2017 to 2022 (Source: Research data, 2023)

The decline in efficiency after 2018 is attributed to the merging of the four pension funds. The increased levels of inputs: staff, administrative expenses, and advertisement costs, were not matched by corresponding increases in outputs after the merging of the pension funds. During this period, only four DMUs: Tabora, Mwanza, Mara, and Songwe, maintained efficiency scores of 1.000, consecutively from 2019 to 2021.

In 2020, the majority of DMUs experienced lower efficiency scores, which were associated with a decline in pension payouts. The analysis of financial statements revealed that pension payments declined during this period compared to previous years. Additionally, contributions receivable dropped from 1.39 trillion TZS in 2019 to 1.36 trillion TZS in 2020 (PSSSF, 2020). This decrease in contributions corresponded to a reduction in benefit disbursements, which fell from 1.9 trillion TZS in 2019 to 1.7 trillion TZS in 2020 (PSSSF, 2021).

4.3. Regression Analysis

As part of the two-stage DEA model, the study assessed the relationship between independent input variables and efficiency scores to address the research objectives and uncover the relationship between these variables. This was achieved using regression analysis. The regression analysis involved regressing the mean efficiency scores (dependent variable) on

the average number of staff, average administrative costs, and average advertisement costs (independent variables). The results of the regression analysis are presented in Table 4.

Table 4: Regression Analysis

Source	SS	df	MS	Number of obs	=	25
				F(4, 20)	=	25.26
Model	.641767354	4	.160441839	Prob > F	=	0.0000
Residual	.127041646	20	.006352082	R-squared	=	0.8348
				Adj R-squared	=	0.8017
Total	.768809	24	.032033708	Root MSE	=	.0797

av_eff_score	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
av_nos	-.0021786	.0007301	-2.98	0.007	-.0037016	-.0006556
av_adc	-1.18e-10	3.02e-11	-3.91	0.001	-1.81e-10	-5.51e-11
av_avc	-2.98e-10	2.15e-10	-1.38	0.183	-7.47e-10	1.52e-10
age_of_DMU	-.0131728	.0051474	-2.56	0.019	-.0239101	-.0024356
_cons	1.193389	.060605	19.69	0.000	1.066969	1.319809

Source: Research data (2023)

The results of the regression analysis indicate the presence of significant explanatory power of the independent input variables on the dependent variable, which is the efficiency scores of the DMUs. The analysis shows that the R^2 value is 0.8348, meaning that 83% of the variation in efficiency scores is explained by the independent variables. However, as noted by Bhandari (2020), R^2 is not the most accurate measure of variation because it is not sensitive to additional independent variables in the model. Instead, the Adjusted R^2, which accounts for additional variables, is considered a more reliable measure. The Adjusted R^2 in this model is 0.8017, indicating that 80% of the variation in efficiency scores is explained by changes in the independent variables. The study tested three hypotheses, and the following results were obtained:

Hypothesis 1 was rejected; there was a statistically significant negative relationship ($p = 0.007$) between efficiency scores and the number of staff, with a coefficient of -0.0021786 at a 95% confidence interval (C.I.). These results align with a study by Ifeoma et al. (2019), which showed that downsizing had a positive impact on employee performance in selected manufacturing firms.

Hypothesis 2 was also rejected; a statistically significant negative relationship ($p = 0.001$) was found between administrative expenses and efficiency scores, with a coefficient of -1.18e-10 at 95% C.I. These findings are consistent with Matei and Savelescu (2009), who reported that reducing administrative costs improved organizational efficiency.

Hypothesis 3 was accepted; there was no statistically significant relationship ($p = 0.183$) between advertisement costs and efficiency scores at 95% C.I., with a coefficient of -2.98e-10. However, this contradicts the study by Spanier (2019), which observed that efficiency levels decreased as advertisement costs increased, and vice versa.

Finally, the study found a statistically significant positive relationship ($p = 0.019$) between efficiency scores and the control variable, "Age of DMU," at 95% C.I.

5. Conclusion and Recommendations

The research established that technical efficiency significantly influences the overall efficiency scores of the DMUs. The assessment of input and output variables highlighted the potential for optimizing the combination of inputs and outputs to improve the efficiency of

pension funds. Inputs such as administrative costs, advertisement costs, and staff size, as well as outputs like the pension payout ratio and membership growth rate, were evaluated. The independent input variables showed a positive correlation with the output variables, consistent with the principle that an increase in input should lead to a corresponding increase in output. The study concluded that staff size is negatively related to the efficiency of pension funds. An increase in the number of staff was associated with a decrease in efficiency scores, as confirmed by the regression coefficients. Administrative costs were also negatively related to efficiency scores. A decrease in administrative costs was associated with an increase in efficiency, while higher administrative costs reduced the efficiency of pension offices. The study found no statistically significant relationship between advertisement costs and the efficiency of regional pension offices. Although the regression coefficients indicated a negative relationship, this was not statistically significant.

Based on the study results, PSSSF should assess the operations of its regional offices to identify and address inefficiencies based on this study's findings. Establishing peer benchmarking among regional offices could provide a basis for determining reasonable sizes and scales of operation. The government should help to avoid oversight of the social security sector to improve operational efficiencies, which would, in turn, enhance financial performance and protect members' contributions. Active members should engage with fund managers to explore ways to improve the efficiency of regional offices. This can safeguard member contributions from erosion or misuse and ensure timely settlement of pensions when due.

The findings of this study can be applied to evaluate efficiency in other fields by analyzing the interactions between input and output variables. The study contributes to academic knowledge by examining how staff size, administrative costs, and advertisement costs affect the overall efficiency of pension funds. It provides insights into optimizing resource allocation to improve efficiency in production units, such as pension funds.

Future studies should explore the relationship between investment expenditures and returns on investments and their impact on the overall efficiency of pension funds. Given the significance of investment activities in the operations of pension funds, this area of study is crucial for understanding efficiency dynamics in financial management.

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