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# Financial Efficiency of Licensed SACCOS in Arusha and Dar es Salaam Regions, Tanzania. An Evaluation of Financial Efficiency Levels, Trends, and License Category Variations

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**Abstracts:** *Licensed SACCOS in Tanzania face persistent challenges in attaining their full financial performance potential. This study evaluated the financial efficiency of licensed SACCOS in the Arusha and Dar es Salaam regions, Tanzania. A panel research design was used and Data Envelopment Analysis (DEA) was used to calculate financial efficiency. A bootstrap confidence interval for the mean efficiency was used to test whether the average efficiency differed significantly from 1. Random-effects Generalized Least Squares (GLS) was used to determine the trend in financial efficiency over the study period. The Mann–Whitney U test examined differences in financial efficiency between category A and category B SACCOS. Findings indicate that the average financial efficiency of licensed SACCOS (FeCRS = 0.38, FeVRS = 0.47, SE = 0.85) diverges significantly from 1. The findings also indicate no significant improvement in the financial efficiency of licensed SACCOS over the study period. Further results indicate significant variations in FeCRS, FeVRS, and FeSE between licensed SACCOS. This study contributes to the growing body of knowledge on licensed SACCOS and offers useful insights for managers, regulators, and policymakers seeking to enhance their financial efficiency. The study recommends strengthening cost-control mechanisms, improving the allocation of mobilized financial resources, promoting income diversification, and implementing category-specific managerial improvement strategies to enhance the financial efficiency of licensed SACCOS.*

**Keywords:** Licensed SACCOS, Financial efficiency, Data Envelopment Analysis, category A SACCOS, category B SACCOS.

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## INTRODUCTION

Savings and Credit Co-operative Societies (SACCOS) are member-owned financial institutions that operate on Co-operative principles to provide affordable financial services to members (Antony et al., 2024). Beyond promoting a savings culture, they provide affordable loans that enable members to participate in economic activities, increase their income, and contribute to broader community development (Shaw & Sharma, 2021). According to the World Council of Credit Unions (WOCCU, 2024), SACCOS have accumulated approximately USD 3.15 trillion in savings and Shares, and USD 2.71 trillion in loans globally. In Africa, they have mobilized savings and shares totaling USD 12.53 billion and provided loans totaling USD 13.13 billion. In Tanzania, licensed SACCOS have mobilized savings and shares approximately USD 387.61 million and disbursed loans totaling USD 434.62 million. SACCOS contribute to the attainment of Sustainable Development Goal (SDG) One, which aims to eliminate all forms of income poverty by 2030 (World Bank, 2022).

SACCOS in Tanzania are classified into category A and category B based on the scope of microfinance services they are licensed to provide and the applicable regulatory capital requirements (URT, 2018; 2019). According to WOCCU (2020; 2024), SACCOS in Tanzania experienced a 121.6% increase in savings and share capital, while the loan portfolio increased by 188.9% from 2020 to 2024. Despite a substantial increase in the amount of savings, share capital, and loan portfolios. Licensed SACCOS continue to face persistent challenges in attaining their full financial performance potential. Evidence indicates that the average Return on Assets (ROA) of licensed SACCOS in 2024 was 0.97%, significantly below the recommended standard of 5%. The operating cost ratio reached 86.85%, exceeding the standard of not more than 85% (TCDC, 2024). Likewise, Non-Performing Loan (NPL) remained steadily above the 5% threshold, reaching 8.91% (2022), 8.79% (2023), and 8.26% (2024) (TCDC, 2022, 2023, 2024). This raises alarms about the financial efficiency of licensed SACCOS in Tanzania.

Financial efficiency is defined as the efficient mobilization and allocation of financial resources to generate sufficient revenue to cover operating costs, meet financial obligations, and sustain the provision of financial services (Hu et al., 2019). Financial efficiency is important for licensed SACCOS to attain their financial and social objectives (Collin et al., 2021). Evaluation of financial efficiency indicates the extent to which licensed SACCOS efficiently transform mobilized financial resources into productive loans and income-generating investments (Fu et al., 2015). It also discloses the sources of inefficiency and provides a basis for improving the allocation of financial resources (Bhatia & Mahendru, 2019). Enhanced financial efficiency enables licensed SACCOS to provide affordable, sustainable, and reliable financial services, thereby strengthening members' confidence in these services (Cordero et al., 2015).
Statistics indicate that approximately 69.65% of loans and 69.15% of savings held by licensed SACCOS in Tanzania are owned by licensed SACCOS in the Arusha and Dar es Salaam regions (TCDC, 2024). Evaluating the financial efficiency of licensed SACCOS operating in these regions

is important to understand how effectively they perform the intermediation function. Consequently, evidence generated from these regions can provide useful insights into the overall financial efficiency of licensed SACCOS in Arusha and Dar es Salaam, Tanzania.

Previous studies on financial efficiency in the context of SACCOS include Sun et al. (2018) in America, Purmiyati et al. (2022) in Asia, and Pereira et al. (2023) and Barros et al. (2020) in Latin America. From Sub-Saharan Africa, Duguma and Han (2021), Oteng-Abayie et al. (2016), and Ochola (2016). These studies indicate that the average efficiency level of SACCOS is significantly below the optimal efficiency score of 1. Limited studies have comprehensively evaluated the financial efficiency level of licensed SACCOS operating under the existing Tanzanian regulatory framework (The Microfinance Act of 2018 and The SACCOS Regulation of 2019). Further, limited evidence exists on trends and variations in financial efficiency among licensed SACCOS in Tanzania. Consequently, policymakers, regulators, and SACCOS managers lack sufficient empirical evidence to guide interventions to improve the efficient mobilization and utilization of financial resources.

This study addresses this gap by evaluating the financial efficiency of licensed SACCOS in Tanzania's Arusha and Dar es Salaam regions using panel data. Accordingly, this study has three specific objectives. First, to determine the financial efficiency levels of licensed SACCOS; second, to examine the financial efficiency trend of licensed SACCOS; and third, to examine the financial efficiency variations between category A and category B SACCOS. This study contributes to the growing body of knowledge on the financial efficiency of licensed SACCOS and offers useful insights for managers, regulators, and policymakers. The remaining sections are structured as follows. Section 2: Literature Review; Section 3: Research Methodology; Section4: Findings and Discussion; and Section 5: Conclusions and Recommendations.

## LITERATURE REVIEW

### Overview of Savings, Credit and Co-operative Societies (SACCOS) in Tanzania

SACCOS are also known as financial co-operatives, financial services co-operatives, or credit unions (Khafagy, 2021). The Government of Tanzania has implemented several initiatives to support the operations of licensed SACCOS, including the development of the Co-operative Policy of 2002, the enactment of the Co-operative Societies Act of 2013, the introduction of the National Microfinance Act of 2018, and its Regulations of 2019 (URT, 2002; 2013; 2018; 2019). Section 16 of the Microfinance Act of 2018 classified licensed SACCOS into category A and category B based on their licensing conditions, particularly the range of microfinance services they are authorized to provide and the minimum core capital requirements prescribed by the regulator (URT, 2018). The SACCOS Regulations of 2019 stipulate that any SACCOS intending to conduct microfinance business must apply for either a category A or category B License (URT, 2019). The permitted activities differ between the two licensing categories. Under Regulation 13(1), a SACCOS with a category A license may solicit members, offer voluntary shares, mobilize member savings, issue loans, undertake investments, and engage in any other activities permitted by the

regulation. In addition to all activities authorized under category A, SACCOS holding a category B license are allowed to accept deposits from members, engage in loan syndications, participate in micro-leasing activities, provide micro-insurance agency services, deliver agent banking services subject to prior regulatory authorization, make equity investments, issue debit cards, and undertake any additional activities approved by the regulator. Minimum core capital for SACCOS with a category A license is ten million shillings, while SACCOS with a category B license is two hundred million shillings (URT, 2018). In this study, licensed SACCOS refers to registered SACCOS authorized by the Microfinance Act of 2018 to conduct microfinance business under tier 3 (TCDC, 2021).

**Efficiency concepts**

Efficiency in Microfinance institutions can be categorized into financial efficiency and social efficiency (Herath et al., 2023). Financial efficiency is defined as the efficient mobilization and allocation of financial resources to generate sufficient revenue to cover operating costs, meet financial obligations, and sustain provision of financial services (Hu et al., 2019). Social efficiency is the ability of licensed SACCOS to effectively utilize their resources to improve members' social and economic welfare (Wijesiri et al., 2017). This study focused on financial efficiency, as it is a prerequisite for social efficiency. Financial efficiency is important for ensuring the long-term sustainability of licensed SACCOS in providing financial services to members (Chauhan, 2021). Attaining financial efficiency enables SACCOS to achieve their dual objective (improving members' socio-economic status and financial sustainability).

**Theoretical underpinnings**

**Economic Theory of Credit Union**

Smith et al. (1981) developed the economic theory of credit unions**.** According to this theory, SACCOS members are both owners and users of financial services, savers and borrowers, consumers of its output, and suppliers of its inputs; the membership provides both the demand and supply of loanable funds. This dual role aligns member interests with those of the SACCOS. The theory further posits that dual roles enhance financial efficiency through interrelated mechanisms, as owners and members contribute savings and share capital, providing low-cost sources of funds that support SACCOS lending and investment activities. At the same time, their close social and economic relationship, through a common bond, reduces information asymmetry by enabling a more accurate assessment of borrowers' creditworthiness. This familiarity also reduces transaction costs associated with screening loan applicants, monitoring borrowers, and enforcing contracts. Because members are also the beneficiaries of financial services, they have strong incentives to repay loans on time, as poor loan repayment directly weakens the institution they collectively own. These characteristics facilitate the efficient mobilization and allocation of financial resources, ensuring that savings, share capital, and operating expenditures are converted into productive loans, investments, interest income, and non-interest income. The theory provides a conceptual explanation of how unique characteristics of SACCOS facilitate efficient mobilization and allocation of financial resources. However, it does not offer an empirical methodology for

evaluating SACCOS' financial efficiency. The Economic Theory of Credit Unions cannot identify which SACCOS are efficient and which are inefficient, or estimate the magnitude and sources of inefficiency. Therefore, the Production Theory, which is linked to analytical approaches such as Data Envelopment Analysis (DEA), complemented the Economic Theory of Credit Unions to empirically measure how efficiently SACCOS transform financial inputs into financial outputs.

**Production Theory**

Samuelson developed production theory in 1947. This theory assumes that every decision-making unit (DMU) transforms a set of inputs into outputs through a production process. An efficient DMU is one that generates the maximum possible outputs from a given quantity of inputs or minimizes inputs to produce a given level of outputs. In the context of licensed SACCOS, production theory views each licensed SACCOS as a production unit that transforms financial resources into financial services and income. According to production theory, members' savings, share capital, and total costs constitute the financial inputs, while loans disbursed, productive investments, interest revenue, and non-interest revenue represent the financial outputs. Production theory provides the theoretical foundation for applying Data Envelopment Analysis (DEA) to measure financial efficiency. DEA applies production theory to determine how efficiently individual licensed SACCOS convert financial resources into desired financial outputs relative to the best-performing licensed SACCOS. Consequently, DEA quantifies efficiency and identifies the efficient frontier, providing performance benchmarks for inefficient licensed SACCOS. Therefore, production theory provides the conceptual basis for understanding the resource transformation process, while DEA provides the empirical methodology for determining and comparing the financial efficiency of licensed SACCOS without specifying a particular production function.

**Empirical Literature Review and Hypothesis Development**

**Financial Efficiency Levels**

Empirical studies evaluating SACCOS efficiency have predominantly used non-parametric techniques, particularly Data Envelopment Analysis (DEA). These studies provide valuable insights into efficiency across different institutional and geographical contexts; however, their findings may not be directly generalizable to licensed SACCOS operating within Tanzania's distinct regulatory and operational environment. Pereira et al. (2023) and Barros et al. (2020) used DEA to estimate credit union efficiency. Pereira et al. (2023) reported a median efficiency score of 0.52, indicating substantial inefficiency, while Barros et al. (2020) found relatively high efficiency in financial intermediation but low efficiency in banking service provision. The latter study used a two-stage panel regression framework, adding analytical depth by linking efficiency scores to explanatory variables.

Nouran et al. (2021) examined the efficiency of 90 MFIs from 2013 to 2018 using the Network Data Envelopment Analysis (NDEA) technique. Findings indicate that the MFIs' financial efficiency did not meet the required standard. Oteng-Abayie et al. (2016) used a Cobb-Douglas

stochastic frontier model with both production and intermediation approaches. The study reported average technical efficiencies of 53.40% and 57.96%, respectively, implying that credit unions could increase output by 42-47% through improved input utilization.

A study by Marwa and Aziakpono (2015) applied DEA to 103 audited SACCOS in Tanzania and reported average technical, pure technical, and scale efficiencies of 42%, 52%, and 76%, respectively. These findings indicate considerable inefficiencies in converting inputs to outputs but relatively stronger scale efficiency. Nevertheless, both studies primarily follow production or intermediation approaches and do not sufficiently articulate the theoretical rationale for selecting inputs and outputs. Accordingly, the following hypothesis was developed: $H_1$. *The financial efficiency levels of licensed SACCOS differ significantly from the optimal efficiency score of 1.*

**Financial Efficiency Trend over Time**

Zheng and Shan (2025) evaluated financial sector efficiency in China using an enhanced neoclassical production function between 1997 and 2018. Results show a fluctuating trend: an initial improvement, a subsequent decline, and a later recovery, with the highest efficiency attained in 2008. A study by Mishra (2023) examined the financial efficiency of microfinance institutions (MFIs) in India from 2005 to 2018; findings indicate that Indian MFIs improved steadily throughout the study period. Duguma and Han (2021) analyzed efficiency trends among Rural SACCOS in Ethiopia during 2014–2017. The first-stage analysis indicated a steady improvement in the average efficiency of Rural SACCOS over time, accompanied by a decline in average inefficiency. Barros et al. (2020) assessed the efficiency of financial intermediation and banking service provision by Brazilian credit unions, using primarily accounting-based variables. The study also examined how efficiency varies over time. The results revealed that credit unions sustained a relatively high level of financial intermediation efficiency, with only minor fluctuations throughout the study period. The following hypothesis was developed: *$H_2$: Licensed SACCOS have a significant fluctuation trend in financial efficiency.*

**Financial Efficiency Variations**

A study by Mishra (2023) examined the financial efficiency of microfinance institutions (MFIs) in India from 2005–2018, and the findings indicate that their overall financial efficiency exceeded their social efficiency. Duguma and Han (2021) examined the effect of deposit mobilization on technical efficiency among Rural SACCOS in Ethiopia from 2014 to 2017. The results revealed that technical efficiency varies across Ethiopia's regional states. Tesfamariam et al. (2013) analyzed 329 rural SACCOS in Tigray and reported extremely low average technical efficiency (21.3%), with only 5.5% of SACCOS identified as fully efficient. Larger SACCOS tended to be more efficient, reinforcing the scale-efficiency argument. Both studies reveal significant variation in efficiency across geographical zones and institutional size, yet again rely heavily on conventional DEA frameworks without explicit theoretical anchoring. Based on the empirical literature review, the following hypothesis was developed: *$H_3$: There are statistically significant variations in financial efficiency between category A SACCOS and category B SACCOS.*

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**Conceptual Framework**

The conceptual framework is based on the economic theory of credit unions and Production Theory. The economic theory of credit unions provides a conceptual explanation of how licensed SACCOS facilitate efficient mobilization and allocation of financial resources. Production Theory is linked with DEA to measure how efficiently the financial inputs namely members' savings, share capital, and total costs are converted into financial outputs namely loans disbursed, productive investments, interest revenue, and non-interest revenue. Data Envelopment Analysis (DEA) applies the assumptions of Production Theory to determine how efficiently individual licensed SACCOS convert these financial resources into desired financial outputs relative to the best-performing licensed SACCOS.

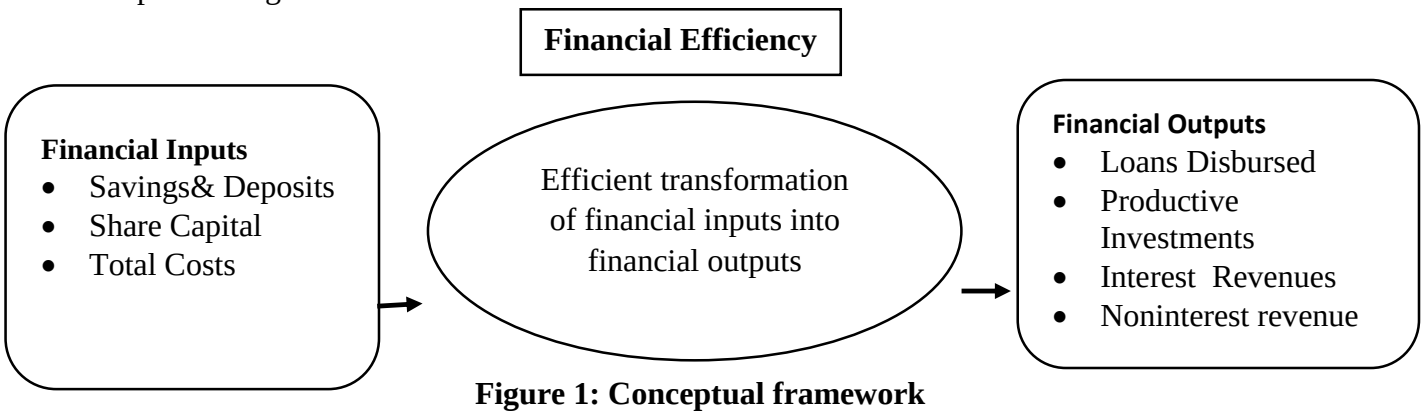


**Figure 1: Conceptual framework**

**Gaps in Literature**

Existing studies (Das et al. 2025; Purmiyati et al., 2022; Pereira et al., 2023; Barros et al., 2020; Duguma & Han, 2021) adopted either the production or the intermediation approach as a basis for selecting inputs and outputs without grounding their choices in a coherent theoretical framework. This may undermine the conceptual robustness and interpretability of efficiency estimates. Also, limited studies have comprehensively evaluated the financial efficiency level of licensed SACCOS operating under the existing Tanzanian regulatory framework (The Microfinance Act of 2018 and The SACCOS Regulation of 2019). The current study addresses these gaps in three key ways. First, it explicitly anchors the selection of inputs and outputs in the economic theory of credit unions and production theory. Second, the study uses panel data from after the enactment of the Microfinance Act (2018) and the SACCOS Regulations (2019) to capture dynamic efficiency trends and ensure the financial efficiency analysis reflects the current regulatory and supervisory framework governing licensed SACCOS in Tanzania. Third, by focusing on licensed SACCOS operating under the current Microfinance Act (2018) and the SACCOS Regulations (2019), the study enhances its policy relevance and provides up-to-date empirical evidence to inform regulators, practitioners, and policymakers.

## RESEARCH METHODOLOGY

### Research Philosophy and Design

This study was grounded in the positivist research philosophy, which emphasizes the objective measurement and empirical examination of observable phenomena through quantitative methods (Boubaker & Ngo, 2024). Consistent with this philosophy, the study employed a panel research design to evaluate the financial efficiency of licensed SACCOS over time. Panel data were obtained from the audited financial statements of selected licensed SACCOS in the Arusha and Dar es Salaam regions for 2020–2024, enabling repeated observations of the same entities over the five-year period.

### Study Area and Population

The study area was the Arusha and Dar es Salaam regions because they have a high concentration of licensed SACCOS, with approximately 40% of Tanzania's 961 licensed SACCOS (TCDC, 2024). Further, licensed SACCOS in the selected regions own 69.65% of the total outstanding loan portfolio and 69.15% of savings and deposits (TCDC, 2024). The study population was 382 licensed SACCOS. Out of 382 licensed SACCOS, the Arusha region comprised 109 licensed SACCOS, and the Dar es Salaam region comprised 273 licensed SACCOS (TCDC, 2024); see Appendix 1. The unit of analysis was licensed SACCOS from the selected regions. The unit of observation was the audited annual financial reports of licensed SACCOS from 2020 to 2024. The selection of the audited annual financial reports was based on Section 55 of the Co-operative Societies Act number 6 of 2013 in Tanzania, which requires all Co-operative societies, such as SACCOS, to keep proper accounts and other records in relation to the statement of accounts in a form that conforms to the best accounting standards and submit a copy of the audited statement of income, statement of financial position, and statement of cash flows to the Tanzania Co-operative Development Commission(TCDC) at least once a year. The year 2020 was selected following the enactment of the Microfinance Act of 2018 and SACCO's regulations of 2019, which required all registered SACCOS in Tanzania to apply for a license from TCDC. The most recent year for which data is available is 2024.

### Sample Size and Sampling Techniques

The study sample was 192 licensed SACCOS, calculated using Krejcie and Morgan (1970); see Appendix 2. The formula was appropriate because it estimates sample size from a finite population with a known population size. The study used a proportionate stratified random sampling approach to select licensed SACCOS. The eligible population was first divided into strata according to region (Arusha and Dar es Salaam) and license category (A and B). The total sample size was determined using the Krejcie and Morgan (1970) formula, and was proportionately divided among the strata according to their share of the eligible population; see Appendix 3. The researcher then randomly selected individual licensed SACCOS from each stratum. This procedure ensured adequate representation of the regions and license categories while giving every eligible SACCOS a known probability of selection.

**Types of Data and Data Collection Strategies.**

This study collected secondary data from the audited financial statements of licensed SACCOS, obtained from the Co-operative Audit and Supervision Corporation (COASCO). To ensure data accuracy and reliability, the study cross-checked all information from the audited financial statements against the notes to the financial statements and the auditor's reports before coding and entering it into statistical software for analysis. Previous studies have also used panel data, for example, Das et al. (2025), Duguma & Han (2020), and Kimanzi et al. (2021). Therefore, the current study considers five-year panel data sufficient for evaluating the financial efficiency of licensed SACCOS.

**Input and output selection**

There are various approaches for selecting inputs and outputs (Polo-Garrido & Vargas-Ulloa, 2024). The two commonly used approaches are the intermediation approach, in which the financial institution serves as an intermediary to solicit savings from savers and provide loans. The production approach views the financial institution as producing loans and savings. Other approaches are the asset-based approach, in which a financial institution is viewed as a lender, and the income approach, in which a financial institution seeks to make money from the resources it uses. The intermediation approach is closely related to SACCOS's financial objective. This study uses an intermediation approach to select the inputs and outputs. Financial efficiency measurement is also based on either input or output orientation. Input orientation has been commended for cost-minimization-focused policies, while output orientation has been commended for impact-maximization policies (Cooper *et al.,* 2011). Managers should choose an orientation based on the extent to which they can control inputs and outputs (Dia et al., 2020). Managers can control inputs more than demand for outputs, which is subject to external market forces. Therefore, this study adopted an input-oriented and intermediation approach to selecting inputs and outputs.

**Table 1: DEA input and output variables.**

| Category | Variable | Symbol | Definition |
|---|---|---|---|
| Financial Inputs | Member Savings and Deposits | MS&D | Total amount of savings and deposits mobilized from members |
| | Members Share Capital | MSC | Total members' share capital |
| | Total Costs | TC | Total operating expenses incurred |
| Financial Outputs | Loan Disbursed | LD | Total loan disbursed to members |
| | Productive Investments | PI | Total amount invested in non-loan income-generating assets |
| | Interest Revenue | IR | Total interest revenue |
| | Non-Interest Revenue | NIR | Total noninterest revenue |

**Financial Efficiency Estimation Techniques**

Data Envelopment Analysis (DEA) was used to measure financial efficiency under constant returns to scale, variable returns to scale, and scale efficiency. Justification for its use in this study:

first, unlike parametric methods, it does not require a prior specification of the production function; second, it is one of the most widely used non-parametric methods for measuring efficiency across sectors. Third, it can evaluate the relative efficiency of a firm that uses multiple inputs to produce multiple outputs. The method uses linear programming to construct an efficient production frontier and measure the efficiency of individual DMUs (Lee, 2013). Within the DEA framework, efficiency is measured as the ratio of the weighted sum of outputs to the weighted sum of inputs, with the weights determined through linear programming.

Charnes, Cooper, and Rhodes (1978) first introduced DEA, giving rise to the CCR model. Building on the efficiency concept proposed by Farrell (1957), the CCR model extended efficiency measurement from a single-input, single-output framework to one with multiple inputs and outputs by applying linear programming. The CCR model assumes Constant Returns to Scale (CRS), implying that outputs change in direct proportion to changes in inputs. However, this assumption may not hold with market imperfections or operational constraints. To address this limitation, Banker, Charnes, and Cooper (1984) developed the BCC model, which incorporates Variable Returns to Scale (VRS) and enables efficiency analysis when decision-making units operate at non-optimal scales due to market failures or other environmental factors.

**DEA Model Specification**

The Constant Returns to Scale (CRS) form of DEA is presented as (Charnes et al., 1978):

Maximize

$$h_o = \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}}$$

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1; \quad j = 1, \ldots, n \qquad (1)$$

$$u_r, v_i \geq 0; \quad r = 1,...,s; \quad i = 1,...,m$$

Where $y_{rj}$ and $x_{ij}$ are the observed positive quantities of outputs and inputs of the $r^{th}$ type for the $j^{th}$ DMU; and ur, vi> 0 are the variable weights determined through a Linear Programming (LP) optimization problem (Coelli et al., 2005). The $j^{th}$ Licensed SACCOS utilizes an m-dimensional input vector to produce an s-dimensional output vector. In this case, $(x_{i0},y_{0i})$ represents an input-output vector of the DMU. The objective function $h_0$ seeks to maximize the ratio of weighted outputs to weighted inputs while satisfying the constraint $0 < h0 < 1$. A value of h<0, (less than one) reflects relative inefficiency, whereas a value equal to 1 denotes 100% efficiency. Thus, Equation (1) establishes that the upper bound of the efficiency score is 1. One inherent limitation of Equation (1) is that the optimization problem has an infinite number of feasible solutions. To address this limitation, an additional constraint is imposed on the model$\sum vx=1$. The notations (v, u) change to (v,μ ) to represent the intended transformation. This results in the multiplier formulation of the linear programming (LP) problem.

$$\max_{\mu} Z_0 = \sum_{r=1}^{s} \mu_r y_{ro}$$
$$\sum_{r=1}^{s} \mu_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0, \quad j = 1, \ldots, n \qquad (2)$$
$$\sum vixi0 = 1$$
$$\mu_r, v_i \geq 0; r = 1,...,m$$

The above equations constitute the multiplier formulation of the DEA linear programming model. By applying the duality principle of linear programming, the corresponding dual model for $DMU_0$ can be derived as follows:

$$\min z_0 = \phi_0 \lambda \qquad (3)$$
$$\text{S.t } \sum \lambda_j y_{rj} \geq y_{r0}, \; r = 1,...,s$$
$$\phi_0 x_{i0} - \sum \lambda_j x_{ij} \geq 0, \quad i = 1,...,m$$
$$\lambda_j \geq 0, \; j=1,\ldots..,n$$

Where is N x 1 vector of constant and i $\phi$ is the efficiency score for the $i^{th}$ DMU. If i $\phi$ is equal to 1, a decision-making unit (DMU) is considered efficient when it lies on the efficiency frontier under the Constant Returns to Scale (CRS) assumption of the Charnes, Cooper, and Rhodes (CCR) model. The CRS assumption applies only when all licensed SACCOS operate at their optimal scale, meaning changes in inputs lead to proportionate changes in outputs. However, when licensed SACCOS do not operate at an optimal scale because of operational, managerial, or market constraints, the Constant Returns to Scale assumption is no longer appropriate. In such cases, the Variable Returns to Scale (VRS) model is required, as it accommodates situations in which outputs change disproportionately relative to changes in inputs. To account for the VRS in the LP, it is essential to include a convexity condition $\lambda_j$, $\sum\lambda_j = 1$. The model to include VRS, which is called Banker, Charnes and Cooper (BCC), is written as follows;

$$\min z_0 = \phi_0 \lambda \qquad (4)$$
$$\text{S.t} \quad \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0}, \quad r = 1,...,s$$
$$\phi_0 x_{i0} - \sum_{j=1}^{n} \lambda_j x \quad ij \geq 0, \quad i = 1,...,m$$
$$\sum_{j=1}^{n} \lambda \quad j = 1$$
$$\lambda_j \geq 0, \quad j = 1,...,n$$

The BCC model differs from the CCR model by allowing efficiency to be evaluated under variable returns to scale (VRS), thereby eliminating the requirement that a decision-making unit (DMU) must operate at an optimal scale to be considered financially efficient. Financial efficiency was estimated under both the CCR (Constant Returns to Scale) and BCC (Variable Returns to Scale) assumptions. Scale efficiency was calculated using the following formula.

$$FeCRS = FeVRS * SE$$
$$SE = FeCRS/FeVRS \quad (5)$$

Where the FeCRS is the financial efficiency under Constant Return to Scale assumptions, FeVRS is the financial efficiency under Variable Return to Scale assumptions, and SE is the Scale Efficiency. Estimating financial efficiency under the CCR and BCC models helps to determine whether overall financial inefficiency is attributable to managerial inefficiency, scale inefficiency**,** or a combination of both.

**Data Analysis**

Data Envelopment Analysis (DEA) model was used to estimate the financial efficiency scores under Constant Returns to Scale (FeCRS), Variable Returns to Scale (FeVRS), and Scale Efficiency (FeSE). Descriptive statistics were used to calculate the mean financial efficiency. A bootstrap confidence interval was used to test if mean financial efficiency scores under Constant Returns to Scale (FeCRS), Variable Returns to Scale (FeVRS), and Scale Efficiency (FeSE) differed significantly from the optimal efficiency score of 1. We used a random-effects GLS model with cluster-robust standard errors to measure the average annual change in financial efficiency over time. The Mann–Whitney U test was used to determine whether financial efficiency levels differ significantly between category A and category B SACCOS.

**Diagnostic Tests**

Before conducting the bootstrap confidence interval for mean efficiency and the Mann–Whitney U test, the underlying assumptions were examined to ensure the analysis was appropriate. First, the financial efficiency scores were measured on a continuous scale, ranging from 0 to 1, thereby satisfying the requirement for a continuous dependent variable. Second, the observations were independent because each licensed SACCOS constituted a distinct decision-making unit (DMU). Third, we assessed the absence of significant outliers using graphical methods, including boxplots. Finally, the normality of the financial efficiency scores was evaluated using the Shapiro–Wilk. Although the formal normality tests indicated departures from normality, the bootstrap confidence interval for mean efficiency was considered appropriate because it does not generally require the efficiency observations themselves to be normally distributed, and the study employed a sufficiently large sample, making the test robust to moderate violations of the normality assumption under the central limit theorem. Consequently, we considered all key assumptions adequately satisfied, allowing us to proceed with the bootstrap confidence interval for mean efficiency and the Mann–Whitney U test.

We also ran diagnostic tests to assess the suitability of the random-effects GLS model. The data were first declared as panel data using SACCOS's identifiers and year. The Hausman specification test supported the random-effects estimator ($\chi^2 = 14.12$, $p = 0.121$). The Variance Inflation Factor (VIF) results further confirm the absence of multicollinearity. The individual VIF values range from 1.06 to 2.92, with an average of 1.67. These values are substantially below the commonly accepted threshold of 5 suggested in the econometric literature. The Breusch–Pagan Lagrange

Multiplier test confirmed the presence of panel effects. The Wooldridge test indicated serial correlation and heteroskedasticity. A random-effects GLS model with cluster-robust standard errors accounts for panel effects and corrects for heteroskedasticity and serial correlation.

**Validity and reliability**

Several procedures ensured validity and reliability**.** Financial efficiency was measured using a well-established Data Envelopment Analysis (DEA) framework based on the financial intermediation approach. The data were collected from audited financial statements of licensed SACCOS, thereby enhancing their accuracy, consistency, and reliability. Furthermore, diagnostic tests, including multicollinearity assessment and model specification tests, were conducted to ensure the robustness and validity of the empirical findings. Consequently, the study's results are considered valid, reliable, and suitable for drawing conclusions regarding the financial efficiency of licensed SACCOS.

**Ethical Considerations**

The study adhered to established ethical principles throughout the research process. The study obtained all required research clearance and permissions from the relevant authorities and participating institutions. The study maintained confidentiality and anonymity because it involved potentially sensitive information. The study used institutional data strictly for academic purposes and reported them in aggregate form to minimize the risk of identifying individual SACCOS. The researcher further ensured secure handling of data, objective analysis, accurate reporting, and proper acknowledgment of all sources. These measures protected institutions while maintaining the integrity, transparency, and credibility of the research.

## RESEARCH FINDINGS

**Descriptive Statistics**

Table 2 presents the descriptive statistics for financial efficiency under constant returns to scale (FeCRS), Variable Returns to scale (FeVRS), and scale efficiency (FeSE) assumptions. The results show that the mean FeCRS for category A SACCOS was 0.487; for category B SACCOS, the mean FeVRS was 0.545; the mean FeVRS for category A SACCOS was 0.567; and the mean FeVRS for category B SACCOS was 0.672. Concerning scale efficiency, the mean FeSE for category A SACCOS was 0.88, while the mean FeSE for category B SACCOS was 0.82.

Theoretically, the findings indicate that under FeCRS, category A SACCOS can decrease their inputs by approximately 51.3%, while category B SACCOS could decrease their inputs by around 45.5% while sustaining the same level of outputs. Likewise, under FeVRS, category A SACCOS could reduce inputs by about 43.3%, and category B SACCOS could reduce inputs by approximately 32.8% while maintaining the same level of outputs. Also, results indicate that category A SACCOS are operating nearer to their optimal scale size as compared to category B SACCOS. Further findings indicate that the low FeCRS observed in category A SACCOS is

mainly related to managerial inefficiencies rather than scale inefficiencies. In contrast, category B SACCOS show strong managerial efficiency; they experience scale inefficiencies.

In practice, SACCOS can control unnecessary administrative expenses, improve loan appraisal and recovery, strengthen liquidity and cash-flow management, and use funds more effectively. These measures can reduce waste and transaction costs while preserving loan disbursement, savings mobilization, and other member services. Findings indicate that effective use of savings, deposits, and operating expenses is important to enhance financial efficiency.

Table 2: Summary of descriptive statistics of various financial efficiency measures

| | Category A SACCOS | | | | | Category B SACCOS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variables | Obs | Mean | Std. dev. | Min | Max. | Obs | Mean | Std. dev. | Min | Max. |
| FeCRS | 775 | 0.487 | 0.199 | 0.053 | 1 | 185 | 0.545 | 0.247 | 0.015 | 1 |
| FeVRS | 775 | 0.567 | 0.228 | 0.154 | 1 | 185 | 0.672 | 0.270 | 0.067 | 1 |
| SE | 775 | 0.88 | 0.160 | 0.111 | 1 | 185 | 0.820 | 0.183 | 0.208 | 1 |

Note: Descriptive statistics for 155 category A SACCOS and 37 category B SACCOS over the period 2020–2024.

**Financial efficiency levels of licensed SACCOS in Tanzania**

The bootstrap confidence interval for mean efficiency was used to determine whether the mean financial efficiency levels under Constant Returns to Scale (FeCRS), Variable Returns to Scale (FeVRS), and Scale Efficiency (FeSE) differ significantly from the optimal efficiency score of 1. The results presented in Table 3 show that all mean efficiency levels are substantially below the benchmark value of 1, and all associated p-values are less than 0.001. The findings indicate that the financial efficiency levels of licensed SACCOS differ significantly from the optimal efficiency level of 1 across all three efficiency measures. The significantly low financial efficiency levels indicate that licensed SACCOS have not fully realized their intermediation role. Financial inputs such as members' savings, share capital, and operating costs are not efficiently transformed into loans, investments, interest income, and non-interest income. Therefore, inefficiencies in resource allocation, cost management, and loan management reduce SACCOS's ability to maximize financial returns on the resources entrusted by their members. Thus, the hypothesis $H_1$ is accepted. These findings are consistent with studies by Nouran et al. (2021), Oteng-Abayie et al. (2016), and Marwa and Aziakpono (2015), which found average efficiency under CRS, VRS, and SE to be significantly below 1.

Table 3: Financial Efficiency Levels of Licensed SACCOS in Arusha and Dar es Salaam

| Mean Financial Efficiency | Coefficient | Std error | z | P>\|z\| |
|---|---|---|---|---|
| FeCRS | 0.38 | 0.0064899 | 59.09 | 0.000 |
| FeVRS | 0.47 | 0.0078639 | 60.29 | 0.000 |
| SE | 0.85 | 0.0062743 | 135.53 | 0.000 |

Note: A bootstrap confidence interval for mean efficiency was used to test whether the average efficiency was statistically significantly different from 1; Means and standard errors were estimated using 2,000 bootstrap replications.

**Financial efficiency trend**

We used a random-effects Generalized Least Squares (GLS) model with cluster-robust standard errors to estimate the trend in financial efficiency over the study period. The coefficient indicates the trend in financial efficiency over the period 2020–2024, while the p-value indicates whether the trend is statistically significant (Table 4). The results indicate no significant improvements in the financial efficiency of category A SACCOS and B SACCOS over the study period. The absence of a significant improvement trend implies that licensed SACCOS face challenges in converting mobilized financial resources into financial outputs. Consequently, an increase in resource mobilization was not accompanied by a proportional increase in financial outputs. Also, increasing operating costs and limited diversification of revenue sources have constrained improvements in financial efficiency. The findings reject $H_2$ and indicate no statistically significant fluctuation trend in the financial efficiency of licensed SACCOS during the study period. These findings contradict those of Mishra (2023) and Duguma and Han (2021), who found that the average efficiency of SACCOS improved steadily over time. The results therefore highlight the need for licensed SACCOS to use mobilized financial resources more effectively, improve cost control, and diversify revenue to achieve sustained improvements in financial efficiency over time.

Table 4: Trend of financial efficiency over time

| | Category A SACCOS | | Category B SACCOS | |
|---|---|---|---|---|
| | Coeff. | P>\|t\| | Coeff. | P>\|t\| |
| CRS | -0.0016 | 0.758 | -0.01403 | 0.275 |
| VRS | 0.0028 | 0.629 | -0.01487 | 0.291 |
| SE | -0.0051 | 0.210 | -0.00327 | 0.732 |

Note: Trend of financial efficiency of 155 category A SACCOS and 37 category B SACCOS over the period 2020–2024.

**Financial efficiency variations between category A SACCOS and category B SACCOS**

The Mann–Whitney U test results, as indicated in Table 5, show that category B SACCOS achieved significantly higher overall financial efficiency under the Constant Returns to Scale (FeCRS) assumption than category A SACCOS ($Z = -2.611$, $p = 0.0090$). Category B SACCOS recorded a higher mean financial efficiency score (Mean = 0.545) than category A SACCOS (Mean = 0.487). Category B SACCOS obtained a substantially higher mean rank (40) than category A SACCOS (15). Similarly, the findings reveal a statistically significant difference in

financial efficiency (FeVRS) between the two license categories (Z = −2.680, $p$ = 0.0075). Category B SACCOS achieved a higher mean financial efficiency score (Mean = 0.672) than category A SACCOS (Mean = 0.567). In addition, category B SACCOS recorded a higher mean rank (34) compared with category A SACCOS (21). In contrast, the Scale Efficiency (FeSE) indicates that category A SACCOS performed significantly better than category B SACCOS (Z = 2.611, $p$ = 0.0090). Category A SACCOS recorded a higher average scale efficiency score (Mean = 0.880) than category B SACCOS (Mean = 0.820). Furthermore, category A SACCOS achieved a considerably higher mean rank (40) than category B SACCOS (15).

The findings support $H_3$ and indicate that there are statistically significant variations in financial efficiency between category A SACCOS and category B SACCOS, the results are also consistent findings by Tesfamariam et al. (2013) who reported that larger SACCOS were more efficient than small SACCOS. Findings indicate that financial efficiency differs between category A and category B SACCOS. This suggests that category B SACCOS are more efficient in mobilizing and allocating financial resources. In contrast, category A SACCOS have an organizational size more closely aligned with their optimal operating scale. Lower scale efficiency among category B SACCOS suggests scale inefficiencies, indicating that category B SACCOS could further improve financial efficiency by adjusting their operational scale, either through expansion where increasing returns to scale prevail or through downsizing where decreasing returns to scale prevail. However, the lower scale efficiency among category B SACCOS indicates that efficient financial intermediation alone does not guarantee enhanced financial efficiency. Likewise, the higher scale efficiency of category A SACCOS reveals that operating near the optimal scale is beneficial, but without equally strong managerial capability, overall financial efficiency may remain below its potential. Thus, licensed SACCOS should combine sound managerial practices with appropriate organizational size to achieve maximum financial efficiency.

Table 5: Financial efficiency variations between category A SACCOS and category B SACCOS

| | SACCOS Category | Mean | Mean Rank | Z statistics | P-value |
|---|---|---|---|---|---|
| FeCRS | Category A SACCOS | 0.487 | 15 | -2.611 | 0.0090 |
| | Category B SACCOS | 0.545 | 40 | | |
| FeVRS | Category A SACCOS | 0.567 | 21 | -2.68 | 0.0075 |
| | Category B SACCOS | 0.672 | 34 | | |
| FeSE | Category A SACCOS | 0.880 | 40 | 2.611 | 0.0090 |
| | Category B SACCOS | 0.820 | 15 | | |

Note: The Mann–Whitney U test was used to compare the mean financial efficiency for the category A SACCOS and category B SACCOS.

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

This study evaluated the financial efficiency of licensed SACCOS in the Arusha and Dar es Salaam regions, Tanzania. The findings revealed that licensed SACCOS operated below the optimal

financial efficiency frontier. The results also indicate that category A SACCOS are predominantly limited by managerial inefficiencies, whereas category B SACCOS are mostly limited by scale inefficiencies. Licensed SACCOS have substantial opportunities to improve financial efficiency through better mobilization and use of financial resources, stronger cost management, improved loan management, and appropriate scale adjustments. The results also indicate no improvement in licensed SACCOS' financial efficiency over the study period. This underscores the need for targeted interventions to improve managerial capacity, strengthen credit risk management, control operating costs, enhance resource utilization, and diversify income sources to improve financial efficiency. Further, the findings indicate significant variations in financial efficiency between category A and category B SACCOS. Category B SACCOS show higher financial efficiency under both constant and variable returns to scale, reflecting stronger managerial performance in converting financial resources into income-generating financial services. Category A SACCOS reveal higher scale efficiency, indicating that they operate closer to the optimal operational scale; thus, improvement strategies should be tailored to the specific sources of inefficiency within each license category.

**Recommendations and Policy Implications**

Based on this study's findings, several recommendations are proposed for licensed SACCOS, regulators, and policymakers to improve financial efficiency. First, licensed SACCOS should ensure that mobilized savings and deposits are efficiently transformed into productive loans and income-generating investments while maintaining prudent lending standards. Second, they should reduce unnecessary administrative and operating expenses. Third, licensed SACCOS should diversify revenue by increasing investment in non-loan, income-generating assets. Fourth, category A SACCOS should improve managerial and operational capabilities, particularly in loan management and financial resource allocation, while category B SACCOS should optimize their scale of operations. For the regulator, first, the Tanzania Co-operative Development Commission (TCDC) should strengthen monitoring and supervisory mechanisms to promote efficient resource use and compliance with regulatory guidelines. Second, TCDC should enhance continuous capacity-building programs to improve governance, financial planning, and risk management competencies among managers and board members. Finally, TCDC should develop policies that address the challenges facing category A SACCOS and category B SACCOS specifically.

**Research contribution**

This study contributes to the financial efficiency literature in four ways. First, it provides new panel evidence, using a bootstrap confidence interval for mean efficiency, to assess whether the average efficiency of licensed SACCOS in the Arusha and Dar es Salaam regions of Tanzania from 2020 to 2024 differed significantly from 1. Second, it provides new panel evidence on the trend in the financial efficiency of licensed SACCOS in the Arusha and Dar es Salaam regions of Tanzania from 2020 to 2024, using a random-effects Generalized Least Squares (GLS) model with cluster-robust standard errors. Third, the study used the Mann–Whitney U test to compare the mean financial efficiency for category A SACCOS and category B SACCOS. Fourth, the study

contributes to the growing body of knowledge on the financial efficiency of licensed SACCOS and offers useful insights for managers, regulators, and policymakers.

**Limitations and areas for further studies**

This study provides important insights into the financial efficiency of licensed SACCOS in Tanzania; however, it has several limitations. The study was confined to licensed SACCOS in the Arusha and Dar es Salaam regions. The findings may not fully represent licensed SACCOS operating in other regions with different economic and institutional characteristics. Also, the study relied on panel data and quantitative methods; consequently, the study could not capture qualitative factors such as managerial competence, organizational culture, member satisfaction, technological adoption, and governance practices that may also influence financial efficiency. Future research may expand the geographical scope to include licensed SACCOS from all regions of Tanzania to improve the generalizability of the findings and enable regional comparisons of financial efficiency. Further studies may also consider mixed-methods approaches that combine quantitative data with qualitative information, which may provide valuable insights into the financial efficiency of licensed SACCOS.

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**Data Availability Statement**

Data that support the results of this study are available from the corresponding author upon reasonable request

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## Appendices

**Appendix 1: Population distribution across license category and regions**

| | Category A License | Category B License | Total |
|---|---|---|---|
| Dar es Salaam Region | 210 | 63 | 273 |
| Arusha Region | 99 | 10 | 109 |
| Total | 309 | 73 | 382 |

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**Appendix 2: Sample estimation**

| | |
|---|---|
| $n = \frac{\chi 2 * N * P * (1 - P)}{E^2 * (N - 1) + (\chi 2 * P(1 - P)}$ | $= \frac{3.84 * 382 * 0.5 * (1 - 0.5)}{0.05^2 * (382 - 1) + (3.84 * 0.5(1 - 0.5)}$ <br> $= 191.75 = 192$ |
| n=sample size required, N= population, $X^2$ = chi-square value at 1 degree of freedom. From a standard chi-square table, at the 95% confidence level with 1 d.f., the critical value is 3.84. P represents the proportion of the population used in the study. $E^2$ is the margin of error, which is set at a default of 0.05. | |

Formula by Krejcie and Morgan (1970).

**Appendix 3: Sample size distribution across license category and regions**

| | Category A License | Category B License | Total |
|---|---|---|---|
| Dar es Salaam Region | $\frac{210}{273} * 137 = 105$ | $\frac{63}{273} * 137 = 32$ | $\frac{273}{382} * 192 = 137$ |
| Arusha Region | $\frac{99}{109} * 55 = 50$ | $\frac{10}{109} * 55 = 5$ | $\frac{109}{382} * 192 = 55$ |
| Total | 155 | 37 | 192 |