RELATIONSHIP BETWEEN CAPITAL ADEQUACY REQUIREMENTS AND CAPITAL EFFICIENCY OF DEPOSIT-TAKING SAVINGS AND CREDIT CO-OPERATIVES SOCIETIES IN KENYA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University or for any other award.

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APPROVAL

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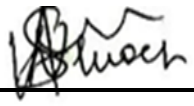

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OPERATIONAL DEFINITION OF TERMS

Capital adequacy: Refers to capital size a SACCO has to keep as necessitated by its major regulator.

Core capital: Refers to the least amount of capital that a SACCO or any other financial institution must hold in order to comply with the requirements stipulated by the regulator.

Capital efficiency: This refers to the ability of a firm to achieve maximum returns by spending an extra shilling. The capacity to transform inputs using the least resources into quality outputs.

Capital levels: This acts as the yardstick which ensures that all the financial institutions meet the prescribed capital requirements established by their primary regulator.

Capital ratios: It indicates the capital of a financial institution against it weighted risks.

DTS size: This reflects how large a deposit-taking SACCO in terms of total assets.

Deposit -taking SACCOs: It's a type of Savings and credit Co-operative Societies that offer bank-like services. They conduct business of savings and credit and in addition does business of accepting or withdrawing money. They are regulated by Sacco Society Regulatory Authority.

Institutional capital: Its capital which is part of the core capital that belongs to the financial institution.

Core capital to total assets ratio: They indicate the amount of deposit taking SACCO core capital to the entire amount of assets it owns.

Core capital to deposit ratio: This ratio is used to give an insight to the variations in core capital in relation to the total deposits held by a deposit taking SACCO.

LIST OF ABBREVIATIONS AND ACRONYMS

ACCOSCA	Africa Confederation of Co-operatives Savings and Credit Associations
BRICS	Brazil, Russia, India, China, South Africa
CBK	Central Bank of Kenya
DEA	Data Envelopment Analysis
DMU	Decision Making Units
DTSs	Deposit Takings SACCOs
ICA	International Co-operative Alliance
FDH	Free Disposal Hull
HCSE	Homoscedasticity-consistent Standard Errors
MLR	Multiple Linear Equation
MPI	Malmquist Productivity Index
PAM	Partial Adjustment Mode
PCSE	Panel Corrected Standard Errors
SACCO	Saving and Credit Co-operative
SASRA	SACCO Society Regulatory Authority
SACCOL	Savings and Credit Co-operative League of South Africa
SFA	Stochastic Frontier Analysis
TFP	Total Factor Productivity
WOCCU	World Council of Credit Unions

ABSTRACT

With the expansion of Kenya's financial system over the last two decades, the Savings and Credit Co-operative (SACCO) sector has also developed significantly. Their continued growth and its impact on the financial sector growth and economic policies, has made the sector a major target for financial control. Their regulation by SASRA means that SACCOs have to adhere to the set standards for them to operate across the country. One such a regulation is the setting of capital adequacy requirements which compels deposit-taking SACCOs (DTSs) to maintain a minimum of Ksh. 10 million of members' deposit as core capital to cushion against losses that might be experienced because of risks resulting from their operations. Consequently, by meeting the core capital of Ksh. 10 million and above results to excess idle funds which increases their liquidity. This means that these DTSs pursue a double bottom line in maintain certain liquidity levels and the same time required to generate more return for each shilling in capital availed to the firm. However, while it is prudent to mitigate against financial risk, the impact of this requirement on the efficiency of SACCO operations has not been investigated. As reflected by the presented theories and empirical literature there is inadequacy of research findings as to whether holding of these idle finds simultaneously with imposing capital adequacy requirements have an effect on the efficiency of DTSs. This study analyzed the relationship between capital adequacy requirements and efficiency of deposit-taking SACCOs in Kenya. Specifically, the study determined the efficiency of DTSs in Kenya; established the effect of capital adequacy requirements on capital efficiency of DTS; and, investigated the moderating influence of DTS size on capital adequacy requirements and capital efficiency of DTS in Kenya. Adopting a positivism research philosophy, the study involved a correlational research design. The target population included all the 174 registered deposit-taking SACCOs operating in Kenya and registered by SASRA by the end of 2018. Secondary data extracted from the audited financial statements of the 174 DTSs operating in Kenya for the period 2014-2018 were used for the study. Regression analysis was further utilized to determine the relationship between capital adequacy requirements and the capital efficiency of DTSs and to test the hypotheses. DEA model was used to examine the efficiency of each SACCO registered with SASRA for a period of five years from 2014-2018. The findings of the study revealed that the DTSs had a mean capital efficiency of 0.51. DTSs capital efficiency had a positive significant relationship with core capital, negative significant relationship with core capital to total assets, positive significant relationship with core capital to total deposits and positive significant relationship with institutional capital to total asset ratio. DTS size was found to significantly enhance the relationship between capital adequacy requirements and efficiency of DTSs. The study gives recommendations which include a review by the regulator to re-examine the capital adequacy requirements in the interest of establishing the most optimal levels that guarantee's safety of member's deposits while optimizing on efficiency; focus by the regulator on activities that improves the quality of inputs and outputs rather than only focusing on subjecting DTSs to stringent capital regulations and; DTSs should subject all DTSs to a common regulatory framework.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter encompasses the introductory section of the study. It provides the background of the study; statement of the problem; study objectives; research hypotheses; study scope; justification and, limitation of the study.

1.1 Background of the Study

Co-operatives, as financial and as self-help institutions are formed and owned by a group of people to meet their defined goals. The goals may be economical, social or cultural (International Co-operative Alliance (ICA) (2017). Co-operatives have gained acceptance as critical part of socio-economic development all over the world. In 2018, the World Council of Credit Unions (WOCCU) (2018) reported a total of 85,400 credit unions operating in over 118 countries spread over six continents. It estimated collective savings of cooperatives at $ 1.8 trillion and an asset base of $ 2.2 trillion out of which $1.6 trillion was loan portfolio. As at the end of 2018, WOCCU (2018) indicated the average global dispersion rate of the credit union scheme at 9.4 percent, a significant proportion of adult population remaining financially excluded due to their low penetration. Over the years, Savings and Credit Co-operative Society (SACCO) have emerged as one of the rapidly growing sector of co-operatives. Although it has not gained much recognition in the developed world, in third world countries, SACCOs have emerged as one of the key pillars of national economic growth and household empowerment (Biwott, Muturi, & Macharia, 2018).

In Africa, the World Council of Credit Unions (WOCCU) (2018) reported a total of 39,447 credit unions having mobilized a total of $9.6 trillion in saving and shares; $8.1 trillion in loans; $10.8 trillion in assets; and, 13.80% penetration. While the cooperative sector has generally grown, the SACCO sector in Africa has in particular experienced much more tremendous growth and transformed into business ventures across the continent following global economic reforms which began in mid-1990s, (Ng'ombe & Mikwamba, 2004). The immense growth of SACCOs in particularly in Kenya, Tanzania, Lesotho, South Africa, Malawi, Uganda, Nigeria, Ghana and in other countries of Africa have over time created need for regulation of the sector. South Africa became the first African nation to enact SACCO specific regulations designed to strengthen the safety of member deposits and advance the profitability of deposit-taking SACCOs. As a result, in 1993 the Savings and Credit Co-operative League of South Africa (SACCOL), a self-controlling agency for all SACCOs in the state, got launched (SACCOL, 2014).

Kenya boasts of a long history of cooperative growth that has made a noteworthy influence to the general economy. Cooperatives in the country have been noted to contribute to economic development by mobilizing internal savings, accounting for over 43% of the Kenya's Gross Domestic Product (GDP) (Economic Survey, 2018). Consequently, the Kenyan co-operative sector has been ranked among the best performers in Africa and in the world with a total of $5.8 trillion in saving and shares; $6.7 trillion in loans; $8.3 trillion in assets; and, 28.40% penetration (WOCCU, 2018). The sector has over the years played a significant role in the wider financial sector making it among the center of most economic policies (SASRA, 2016). As is the case with general cooperative sector, the SACCO sector has developed significantly, making the SACCOs to evolve as a vital part of Kenya's financial system. The sector by 2017 was estimated

to have total assets amounting to Ksh. 442.27 billion and total deposits of Ksh. 305.3 billion with a sign of a continuous growth momentum (SASRA, 2017).

The continued growth and influence of SACCOs on the financial and monetary systems over years created a need for a new way of monitoring and controlling their operations hence becoming a center of regulatory framework (Biwott *et al.*, 2018).This arose out of the realization that the sector's unique operating principles could not be effectively covered by the normal commercial banking regulatory framework leading to drafting of a SACCO specific legislation, SACCO Societies Act 2008. It was a requirement for the DTSs that were operational to review their policies in line with the statutory requirement demanding prudence in the management of corporate risks (SASRA, 2016).The implementation of SACCO Regulation Act and the formation of Sacco Society Regulatory Authority (SASRA) led to the introduction of prudential regulations for all DTSs. Under these regulations, all DTSs were mandated to appraise and align their strategies and operating systems to the monitoring requirements as a way of enhancing the prudent management of credit, operational, market and legal risks before SASRA could license them to operate (SASRA, 2016).

The underlying aspect of regulation of the financial sector is capital requirement. Setting capital requirements is a major policy issue for regulators across the world. It received more prominence after 2007-2008 financial crisis that led to the review of Basel capital requirements (Bichsel & Blum, 2005). Motivated by ensuring stability in the SACCOs, SASRA issued prudential guidelines which required DTSs to hold adequate levels of capital to safeguard member deposits and creditors from losses arising from corporate risks that the SACCO may face. These risks

include liquidity, credit, legislative, fluctuations in interest rates and competition risks. The regulations set by SASRA in 2010 required deposit-taking SACCOs to hold a core capital amounting to or more than Ksh. 10 million; recommended capital adequacy ratios of core capital to total assets at ten percent (10%); core capital to total deposits at eight percent (8%); and, institutional capital to total assets at eight percent (8%).

In 2017, an aggregate of 161 DT-SACCOs maintained the agreed core capital of ten million Kenya shillings and more, a decline from the 168 DT-SACCOs reported to have met this requirement in 2016. In 2016, there had been a drop in the number of DTSs with the prescribed core capital from 173 to 168 a drop of 5 deposit-taking SACCOs. DTSs having a core capital below Ksh. 5 million and functioning on limited licenses were eleven in 2017. The remaining two DTSs had a core capital ranging from Kshs. 5 Million to Kshs. 10 Million. Core capital to total assets proportion is supposed to be maintained at 10%, but 12 deposit-taking SACCOs fell below the threshold so only 146 deposit-taking SACCOs maintained the threshold. The 12 deposit-taking SACCOs were among those operating on restrictive licenses. A total of 16 DTSs maintained a core capital to total assets between 5% -10%. In relation to core capital to total deposit a sum of 163 deposit-taking SACCOs fully complied indicating a decline from the 169 deposit-taking SACCOs that fulfilled the requirement in 2016. Furthermore, 11 deposit taking SACCOs did not adhere to the requirement, which represented an increase in the non-compliant SACCOs (SASRA, 2016; SASRA, 2017). While these results represent the compliance of the entire sub-sector, individual DTSs continue to experience varied levels of compliance and deviations with the smaller DTS being the most had hit.

The parameters for monitoring growth and performance of DTSs remain to be the assets, deposits, loans, members' share capital and investments. The overall number of members

remained at 3.6 million by 2017. This was because some new members joined while others withdrew. The aggregate assets increased by 12.4 percent in 2017 to hit Ksh. 442.27 billion from Ksh. 393.29 billion in 2016. Loan portfolio similarly improved by 11.3 percent in 2017 to hit Ksh. 331.21 billion from Ksh. 297.6 billion documented in 2016. Member deposits up surged by 12.01 percent in 2017 to hit Ksh. 305.3 billion from Ksh. 272.58 billion (SASRA, 2017). However, the general assessment portrays a weakening growing in aggregate assets, gross lending and deposits in 2017. The growth rate of total assets registered in 2017 was 12.4% compared to 14.8% registered in 2016 having a drop of 2.4%. Gross loans rate of growth also dropped from 15.3% in 2016 to 11.3% in 2017 and also total deposits dropped from 14.8% in 2016 to 12% in 2016. Non-performing loan portfolio continued rising to hit Ksh. 10.7 billion shimmering a rise of 23.4 percent from Ksh. 8.6 billion in 2016. Deposits taking SACCOs were classified in tiers in relation to total assets in billion shillings and only 21 out of the 177 deposit-taking SACCOs had total assets above Ksh. 5 billion representing a proportion of 11.86%, those that had total assets between 1 billion and 5 billion were 59 having a proportion of 32.38% and the remaining 94 had total assets below 1 billion representing a proportion of 53.1%.

The main source of income for DTSs is interest earned from loans and other advances made to members. Loans remain to be the core asset and business of the SACCOs as asset portfolio amounted to Kshs. 442.27 billion in 2017 compared to 393.5 in 2016. Loan portfolio constituted of Kshs. 320.49 billion representatives of 72.46 percent of the total asset collection. Seventy-two point four six (72.46) was a slight decline from the one registered in 2016 at 73.42% of the total assets. The loan portfolio consisted of the performing loan which stood at 88.87% reflecting a healthy aggregate loan book being a decrease from one reported in 2016 as 89.19%. The decline in loan portfolio is associated with an increase in non-performing loan at 6.14 percent from 5.22

percent documented in 2016 which was over the recommended 5%. Substandard category was highly affected with over 77,869 loan accounts totaling to over 9.9 billion (SASRA, 2016). SASRA (2017) report shows that the deposit taking SACCOs affected by the non-performing loan above 10% were 56 which is alarming and those between 5% -10% were 43. Hence, the deposit taking SACCOs that had non-performing loan above the yardstick were 99 which represented 57%. The DTSs rely on member deposits, member savings and external borrowings to meet the demand for loans. The loans and advances add up to a high percentage of the DTSs' assets and as such, the DTSs require continuous monitoring of their financial soundness.

In addition to the core capital requirements, DTSs are supposed to uphold a statutory minimum ratio of 15% of its savings deposit and short-term obligations in liquid assets. In the year 2017 the liquidity was high and above the yardstick as ratio remained at 54.1 percent from 49.9 percent documented in the year 2016.Nonetheless, the number of DTSs that complied with the least set restrictions declined from 165 institutes reported in 2016 to 147 institutes in 2017(SASRA, 2017). In 2016, a total of eight DTSs reported liquidity rates below five percent reflecting an upsurge from four DTSs that recorded liquidity ratio of below 5% in the year 2015. Also, DTSs with liquidity ratios between 5% and 15% in 2015 were 8, in 2016 they were 6 and in 2017 the number increase to 19 (SASRA, 2016). In relation to external borrowing, the deposit-taking SACCOs' total loan to total deposit ratio stood at 110.94% in the year 2014, in the year 2015 the ratio stood at 108.74%, in the year 2016 the ratio stood at 108.39% and in the year 2017% the ratio stagnated at 108.4% (SASRA, 2017). While the above results represents the performance of the entire sector, individual DTSs continues to experience varied levels of compliance with the smaller DTS being the most affected.

The principal aim of SACCOs is to maximize the members' welfare. This can only be achieved if the financial sector is more efficient (Kosimbei et al., 2013). By enhancing efficiency, financial institutions, are capable of providing quality goods and services using the least cost per unit (Murkomen, 2016). Efficiency is realized when there are robust establishments with the necessary capacity to gratify market needs and adhering to legislative and provident necessities. This may have informed the founding of the SACCO Societies Regulatory Authority (SASRA) to provide statutory and prudential regulations of deposit-taking SACCOs similar to what is provided by the Central Bank to all commercial banks (Ndung'u, 2010).

The relationship between capital adequacy requirements and firm's efficiency continues to be a key area of interest in research with mixed outcomes. Regulating financial institutions through stringent capital requirements have been found to improve efficiency, and lower both capital and asset risks (Lotto, 2018). A wide-ranging compromise provides that firms having large capital and liquidity buffers are at preferably position of supporting business ventures and households during financial crisis because buffers improve the banks' capability of absorbing losses and upholding loaning during a downturn (Gudmundsson, Ngoka-Kisinguh & Odongo, 2013). Contrary to this, Mutanu (2002) concluded that capital ratio cannot be used to distinguish efficient banks from inefficient banks. By slamming increased capital ratios, banks will be strained to some level by economic burdens, which might arise because of race on loans, payments and even the debt and equity investments sources (Agoraki, Mathos, & Pasiouras, 2011; Bolt & Tieman, 2004). In such a case, banks will most probably decrease their lending, impose more interest rates on loans and offer minimal returns on member deposits as a section of their actions to reinstate a satisfactory return on the bigger capital base. Additionally, a significant query behind the policy framework on financial establishments is which size

maximizes their efficiency. Regulators in the financial sector have continued emphasizing on the size of the firms by commending the least capital base. It is anticipated that with increase in size, the financial stability and general performance is enhanced (Karray & Chichti, 2013).

1.2 Statement of the problem

While Kenya has witnessed enormous growth in SACCOs over the last decade, several DTSs have been experiencing challenges in attempt to balance between assuring safety of member's deposits while at the same time maximizing on their efficiency. The requirement that the DTSs maintain a core capital of Ksh. 10 million is meant to protect members and creditors from the risks that might accompany the failure or bankruptcy of a SACCO (SASRA, 2014). In response to the regulations set by SASRA, DTSs have increased their focus on improving their capital levels in order to ensure that they keep levels of their capital proportional to their risk exposure profile. This has forced DTSs to hold capital levels in excess of the minimum requirement, thus resulting more idle funds which increases liquidity in the sector. Imposing high capital ratios and concurrently holding of these idle funds could raise questions on the financial implications as to the efficiency of the DTSs. This study contributes to fill this gap by trying to answer the following question: what will be the effect on the efficiency of DTSs if this matching of the risk profile, excess liquidity and capital levels is not carefully taken into consideration?

Studies conducted by Pessarossi & Weill (2013); Lotto (2018); (Lawal *et al*., 2018) and Murkomen (2016) established a positive and significant relationship with capital adequacy requirements and efficiency. However, studies by Mohamed & Mohamed (2018) and (Biwott *et al.,* 2018) on capital requirements and efficiency of DTSs found a negative significant relationship with efficiency. Findings of the empirical study revealed that there is no consensus as to whether adequate capital levels leads to better efficiency. Further, no study have focused on

the administration of a capital optimization approach to manage regulatory framework and guarantee safety of members' deposits. It is on this backdrop that a study to assess the association between capital adequacy requirements and capital efficiency of DTSs in Kenya was undertaken.

1.3 Objectives of the Study

This section outlines the general objectives as well as the specific objective of this thesis.

1.3.1 General Objective

The general objective of this study was to determine the relationship between capital adequacy requirements and capital efficiency of deposit- taking SACCOs in Kenya.

1.3.2 Specific Objective

Specifically, the study sought to:

i. To evaluate the capital efficiency of deposit -taking SACCOs in Kenya.
ii. To establish the effect of capital adequacy requirements on capital efficiency of deposit-taking SACCOs in Kenya; and,
iii. To investigate the moderating influence of DTS size on the relationship between capital adequacy requirements and capital efficiency of deposit -taking SACCOs in Kenya

1.4 Research Hypotheses

i. H_{01}: Majority of DTSs in Kenya do not meet the average threshold of capital efficiency.
ii. H_{02A}: There is no significant relationship between core capital and capital efficiency of deposit taking SACCOs in Kenya.
iii. H_{02B}: There is no significant relationship between core capital to total assets ratio and capital efficiency of DTSs in Kenya.

iv. H_{02C}: There is no significant relationship between core capital to total deposit ratio and capital efficiency of DTSs in Kenya.

v. H_{02D}: There is no significant relationship between institutional capital to total deposit ratio and capital efficiency of DTSs in Kenya.

vi. H_{02E}: There is no significant relationship between capital adequacy requirements and capital efficiency of DTSs in Kenya ; and,

vii. H_{03}: There is no significant moderating influence of DTS size on the relationship between capital adequacy requirements and capital efficiency of deposit taking SACCOs in Kenya

1.5 Significance of the Study

The findings of this study will be very important to various stakeholders and other researchers.

1.5.1 Regulators

The outcomes of this research also have an impact on the policy makers when assessing and setting statutory requirements for DTSs. They will be able to put in place policies to safeguard member's confidence in investing in the SACCO sector.

1.5.2 Government

The research was necessary considering the prominence attached to financial sector in the Kenya Vision 2030. The Kenya's vision 2030 aims at forming a steady and internationally competitive financial segment that will encourage increased savings and financing Kenya's investing demands. This can only be achieved if the financial sector is more efficient. Thus, this research sought to establish how efficiency of DTS can contribute to generating information necessary for interventions to strengthen SACCOs to play a much bigger role in their contribution to realization of the aims of Kenya Vision 2030. SASRA will therefore contribute to the achievement of this goal through the advancement and development of the SACCO industry

which is vital in the mobilization of savings for national development. Additionally, SACCOs are well-placed to contribute in the realization of the sustainable development goals. They are the best means for financial deepening and providing the financial base for different development activities in many parts of the countries.

1.5.3 Researchers

This study contributed to the vast knowledge gap on the relationship between capital adequacy requirements and capital efficiency of deposit-taking SACCOs in Kenya that will be used by other researchers as literature reviews.

1.6 Scope of the Study

The aim of the research was to analyze the capital adequacy requirements of deposit-taking SACCOs in relation to the capital efficiency requirements. It covered all the licensed SACCOs engaged in deposit-taking business in Kenya as at December 2018. All the DTSs were targeted because regulation is an issue which is affecting all the DTSs in Kenya. The study covered five years for the period 2014-2018. This period was selected for the study in order to establish the effect of capital adequacy requirements on capital efficiency post the transition period upon which all DTSs were required to have fully complied. DTSs that have been on operation for at least five years since their registration were used mainly for financial data.

1.7 Limitation of the study

This study focused only on deposit taking SACCOs regulated by SASRA and considered only one variable to evaluate the capital efficiency of DTSs whereas there could be other variables. The findings of this study depended on analysis of secondary data. Thus, the findings of the study were subject to the financial statements limitation as communicated to the public where SASRA is the custodian. Additionally, accessing information from SASRA was not easy because

they were not willing to give information owing to the sensitivity of the information. This was successful by assuring SASRA that all information obtained for the study would be treated with confidentiality and strictly used for academic purposes.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter examines the existing literature on capital adequacy requirements and capital efficiency of the deposit-taking SACCOs. It consists of empirical review, theoretical review, summary of the literature and identification of research gaps and the conceptual framework of the study.

2.2 Theoretical Framework

The study pegged its variables on two theories namely: The capital buffer theory and economic efficiency theory.

2.2.1 The Capital Buffer Theory

The proponents of capital buffer theory are (Calem & Rob, 1996). They argued that financial institutions would want to hold extra capital levels to bring down the likelihood of falling beneath the stipulated regulatory limit. They predicted that the conduct of financial institutions relies upon the size of their capital support. Financial institutions holding high capital levels will seek to keep up their capital levels. Constraints on capital follow will be imposed if capital levels falls below minimum so to that the capital levels can be fill up. While on the other financial institutions with low capital levels will focus on increasing their capital levels. Therefore, financial institutions approaching the stipulated regulatory minimum may need to enhance their capital so as to avert the costs brought about by violation of this statutory requirement.

As indicated by Calem & Rob 1996, different reasons are related with banks holding buffer capital. To start with, excess capital levels function as a security. This buffer might be utilized as an assurance against cost of unforeseen risks such as credit, liquidity, investment and

competitive risks. This is in a case where an undercapitalized financial institution is in a situation of losing public confidence. Furthermore, having excess capital levels is associated with the banks' advantages hazard profile. It is normally presumed that financial institutions with an exceptionally high risk profile hold significant amount of capital levels compared with those at lower risk profile. Finally, holding excess capital levels is considered by financial institutions as a competition effect which a financial institution may utilize to imply its financial stability and dependability hence likelihood of non-failure. This way, excess capital levels may be utilized as a means of preventing financial institutions from failure due to competition on loans and deposits.

This theory suggest that the financial institutions will be stable during low liquidity periods. This means that capital reserves will be available to meet its short term obligations when they fall due using the excess capital recognized as buffer. Absence of buffer capital could mean a likely drop from the prescribed capital levels for these institutions. Therefore, this theory is relevant to the study by explaining why individual DTSs might choose to keep higher than the set least capital. More capital tends to protect member payments and cushions lenders against any loss arising from business risk that SACCOs face. Non-adherence to the capital guidelines is regarded a key non-compliance of regulations issued by SASRA. The revocation of some DTSs licenses is a pointer to this fact. DTSs that remain undercapitalized for lengthy periods are shut down. This therefore makes capital adequacy requirements a significant factor in the study which was tested further.

2.2.2 Economic Efficiency Theory

Economic efficiency theory originated from (Debreu, 1951).It states that organizations should realize their yield at the least price per unit created. The proposition of economic efficiency is

anchored in ancient microeconomic theory, which points out on marketing and economic consumption of resources. In line with this theory, full efficiency could be possibly attained by way of maximum production. While in the short run, full productivity could be possibly attained at the production point. This is the point at which all inputs are exhaustively used. Nonetheless, over the long run, expansion of the readily available inputs leads to optimal levels of efficiency.

Economic efficiency can be discussed from two viewpoints; technical efficiency and price efficiency. The price (allocative) highlights that for banks to efficiently function, all their products must be priced optimally as this is expected to decrease unfair rivalry in the marketplace and lead to a decrease in interest rate spreads. The technical efficiency (productive efficiency) is attained at the moment the firm utilizes all of its capitals efficiently, yielding the maximum yield through the minimum input. The productive efficiency is widely used as a measure of efficiency because of the challenges in determining the input prices in financial institutions.

Also, this theory comprises of two hypothesis; the X-efficiency and scale efficiency suppositions. The X-efficiency theory contends that banks that have competent administration practices govern their costs and can make profits, shifting them nearer the best-practice, lesser destined cost curve (Jeon & Miller, 2005). The scale-efficiency supposition claims some banks attain improved operation scale and, consequently, reduced costs. Reduced costs result in increased turnover and quicker growth for the scale-efficient bank. Therefore, it was expected that DTS which complied with the prudential requirements outlined by SASR would demonstrate high level of efficiency. However, the actual direction of causation between capital adequacy requirements and efficiency may differ from one DTS to another.

This theory formed the basis for the current study on efficiency of DTS in Kenya. It also guided the current investigation by underlining the importance of utilizing resources (inputs) to achieve higher returns. That DTSs economic growth rate may well be determined by the proportions of major inputs; total deposits, operating expenses and external borrowing, depending on how they are utilized. If utilized properly in optimal proportions, then the economic growth rate of the DTSs will be higher and vice versa. Additionally, this theory is also important to this study because the moderating variable DTS size is hypothesized as vital to a firm's attainment of efficiency and eventual economies of scale. It is expected that large DTSs are more efficient due to economies of scale.

2.3 Conceptualization of capital adequacy and Capital Efficiency

Various authorities have conceptualized the concepts of capital adequacy and capital efficiency in different ways. These conceptualizations have provided the lenses through which this study looks at these concepts.

2.3.1 The Concept of Capital Adequacy

Capital adequacy indicates the proportion ratio of an institution's capital to its risk weighted assets(Olweny, & Mamba, 2011). The capital base that an institution has can be utilized to quantify its monetary adequacy and soundness. The adequacy and dependability of the monetary framework is significant on the grounds that it limits economy decline identified with money-related emergency (Kipruto *et al.*, 2017). Prudential guidelines are intended to shield the monetary framework from such challenges by making banks to contribute cautiously. One type of prudential guideline is capital prerequisites. The motivation behind capital guideline is to ensure banks keep level of their capital relative to their danger presentation profile (Lotto, 2018).

Capital adequacy is seen as a tool used to measure bank's solvency and ability to absorb risks. It notifies whether banks have enough capital to support the risks in their balance sheet (Lawal *et al.,* 2018). Adequate capital is important in upholding safety and financial stability of financial institutions since it represents the buffer that averts any unanticipated losses that banks may experience that might touch on members' funds. Financial institutions that have advanced capital buffers incline towards the absorption of negative shocks and consequently reduce the possibility of failure (Sentero, 2013).

DT-SACCOs employ CAEL rating model to screen and give an account of the financial constancy, reliability, wellbeing and overall performance. CAEL stands for capital adequacy, asset quality, earnings and liquidity. (SASRA, 2017).

Thus this study defined capital adequacy as the capital size that a deposit taking SACCO has to keep as necessitated by its regulator. It provides added protection to member's deposit and creditors in situation where a deposit taking SACCO is exposed to business risks.

2.3.2 The Concept of Capital Efficiency

Efficiency is a key concept for financial institutions. Capital efficiency refers to the capability to yield returns with a base degree of inputs. It alludes to what in particular happens when the correct mix of resources are utilized underway, while guaranteeing that expenses are kept up at the ideal level (Murkomen, 2016). Efficient banking sector is capable of withstanding undesirable tremors and guarantee the firmness of the banking sector. Consequently, efficiency of financial institutions should be constantly assessed and maintained at the highest possible levels (Papanikolaou & Delis, 2009). Productive DTSs look at the maximization of their member's welfare by encompassing to generate more surpluses while limiting expenses. To do

this, they pick the blend of inputs that limit their expenses while creating however much yield as could reasonably be expected. Thusly, they work effectively (Kosimbei *et al.,* 2013).

Parametric or non-parametric estimation techniques are commonly used to measure the different levels of efficiency between firms within a sample (Mirie 2014). The parametric methodologies incorporate; deterministic frontier approach, stochastic frontier analysis and thick frontier analysis. The non-parametric company performance measures are data envelopment investigation (DEA), and free disposal frame (FDH).

Throughout the long term, the Data Envelopment Analysis (DEA) technique created by Charnes, Cooper and Rhodes (1978) has progressively become the favored methodology for productivity assessment. DEA is used to examine the efficiency of one firm in relation to that of another. It is a linear programming method used to show the difference in efficiencies between two firms dealing with the same type of goods or services. Relative ratios are obtained from weighting inputs and outputs for different firms then the one with the highest ratio is used as the standard to check inefficient firms (Mirie 2004). The method neither specifies inputs nor outputs but requires that those chosen for analysis fall within the framework of the firms being compared. This study focused on capital efficiency because it is narrowed to the input-output dimension of efficiency. Thus this study defined capital efficiency as the capability of a firm to achieve maximum returns by spending an extra shilling. In this case, how are DTSs focusing on administration of a capital optimization approach to enhance efficiency in the sector while at the same time guarantee safety of members' deposits?

2.4 Empirical review

Different studies have been carried out on different aspects of capital adequacy and capital efficiency.

2.4.1 Capital Efficiency in Deposit-taking Institutions

(Mohammed *et al*., 2017) studied the effect of cost efficiency on bank capital utilizing data from BRICS (Brazil, Russia, India, China, and South Africa). A panel data set of information of 1190 banks from the states in the BRICS tag covering a period of 8 years from 2007-2015 in China were used. Secondary data was used for the study period. The study used Hirschman-Herfindahl index to measure banking industry structure and panel regression model was utilized in analyzing the association that exists among the independent and dependent variables. The researchers found that holding higher capital had a positive significant relationship with efficiency of banks. They found that the banks which were holding high capital levels were more efficient and charged lower financial intermediary cost. The study also found out that banks expanded the expense of financial intermediation when emergency arises. Nonetheless, they found out efficiency significantly helped banks not to charge generally expanded expenses for intermediation during the emergency. This implied that efficiency is crucial in enhancing financial stability of monetary institutions. Therefore, the current study sought to determine how imposing of capital adequacy requirements would affect the efficiency of DTSs.

(Ahmad & Razali, 2017) studied determinants of efficiency of Islamic Banks in Indonesia for the period 2004-2014. The investigation targeted all the functional Islamic banks at the time of study, however a sample size of eleven Islamic banks were used for analysis. Secondary data

obtained from the financial statements of Islamic banks was utilized. It utilized DEA approach to estimate the efficiency of Islamic of banks and multiple regression to analyze the bank related influences affecting the efficiency of these institutions. The study found out that the efficiency rankings of Islamic banks ranges from 0.61 to 0.96 with a mean efficiency of 0.76. The study went further to analyze the relationship between bank explicit elements and the efficiency of the said banks. They found that productivity, financing power, capitalization and non-financing costs influence efficiency positively and that GDP development, swapping scale and exchange opportunity influences efficiency negatively. Using secondary data, the current study used the same methodology (DEA) in evaluating the efficiency of DTSs and (multiple regression) analyzing the relationship that exists between the independent variables and the dependent variable.

Sufian (2009) examined the contributing factors to bank efficiency in Malaysia through the period of 1999-2008. It targeted all the commercial banks using an aggregate of 237 bank years' observations. Secondary data obtained from the annual reports of each individual bank was used. DEA approach was employed in approximating the production efficiency of all banks. In addition, bootstrap regression analysis was utilized to evaluate the factors influencing the efficiency scores generated using DEA. In his study, he specifically focused on domestic and foreign banks. The most efficient banks were found to be the foreign banks as opposed to the domestic banks. The study's results from the DEA indicated an improvement in efficiency of the banking sector in the country over the tested time. Further, the findings from the multivariate regression analysis revealed that size, on-interest revenue and capitalization had a positive relationship and statistically significant with production efficiency. While, credit risk had a negative insignificant relationship with bank efficiency. The current study utilized similar

methodology in estimating the efficiency of DTSs in Kenya focusing specifically on capital efficiency.

(Amer *et al.,* 2011) studied the contributing factors to operating efficiency for ordinary and extremely modest banks in Egypt for the period 2001-2008. The arithmetic technique exploits the advantages of the Partial Adjustment Mode (PAM) utilizing a sample size of 24 profitable banks. The results of the findings showed that in the extremely modest banks, operational efficacy is definitely and expressively influenced by the banks' asset quality, capital adequacy, credit risk, and liquidity. This implies that exceedingly modest banks in Egypt are differentiated from low modest banks by carefully drafted financial policies. They concluded that functional efficiency is definitely affected by the capital adequacy of banks. This conclusion was compared in Kenyan context by examining the link between capital adequacy requirements and efficacy of DTSs in Kenya using a different methodology; DEA approach and multiple regression analysis.

(Nand & Singh, 2014) analyzed the efficiency of commercial banks in India between the years 2006-2010. A sample size of 10 commercial banks (public and private banks) were used as decision-making units. Secondary data related to various inputs and outputs were obtained from Reserve Bank of India website. DEA approach was utilized in estimating the efficiency of commercial banks. Their study found mean efficiency of public sector banks to be 0.95 while that of private sector banks was 0.98. They attributed increase in efficiency of commercial banks to banking sector deregulation. However, the efficiency scores of some other banks were below satisfactory levels. This was attributed to huge amount of operating expenses. The study also indicates that efficiency of private sector banks functioned better than public sector banks in the period. The current study employed a similar methodology in estimating the efficiency of DTS in Kenya.

Tesfay (2016) conducted a study on the determinants of commercial banks efficiency in Ethiopia. A sample size of eight commercial banks were used by way of purposive sampling technique. The study used secondary source of data which extracted from published financial statements of commercial banks. The researcher utilized DEA to evaluate efficiency. In addition to DEA, Tobit regression was utilized to investigate the factors influencing efficiency. The results revealed that member deposit and liquidity requirements have a positive and significant relationship with commercial banks efficiency. On the other hand, quality of loan; expenditures; bank size; and diversification were statistically insignificant. The study recommended that banks should focus on collecting more deposits by coming up with new strategies to enhance efficiency in the sector. The study and the current study have similarities in utilization of the same tool (DEA) to analyze data and draw findings on efficiency. Secondary data was used in both studies.

Biwott and Nyakang'o (2017) assessed the changes in the efficiency of DTSs in Kenya over a four-year period (2010-2014). This was the period when a new regulatory framework was being enacted. A sample size of sixty one licensed DTSs was used. The study used secondary data which were obtained from the financial statements published with SASRA. Data envelopment technique (DEA) and Malmquist index techniques and Malmquist Total Factor Productivity (TFP) index were used. The study found that the introduction of prudential regulation for the cooperative sector did not translate to better efficiency for both large and small DTSs over the transition periods. Additionally, the source of productivity changes among the DTSs was evidently associated with improved shift towards the efficient frontier more that the shift in the efficient frontier itself. This study limited itself to the efficiency of the DTS during the transitional period when they were implementing the regulatory requirement. The current investigation investigated the trend of efficiency post the transition period.

Waweru *et al.,* (2017) studied the impact of alternative financing on the connection between firm size and efficiency of small and medium enterprises (SMEs) in Kenya. The target population was all manufacturing SMEs in Kenya. Both the qualitative and quantitative research approaches were used. DEA approach was used to measure efficiency of SMEs and multiple regression model was utilized to estimate efficiency of SMEs. This study found out that the Kenyan SMEs in the manufacturing sector reflect an average efficiency of 0.92, with efficiency scores ranging from 0.12 to 1. The study also looked at establishing the relationship between specific firm characteristics and efficiency of SMEs. The study concluded that SME characteristics size, age and managerial competency are positively and significantly related to efficiency and that size, age and competency are characteristics of SME firms. Lastly, they concluded that alternate finance may influence firm size links with efficacy and managerial competency relationships with efficiency.

Njoroge (2013) examined the determinants of efficiency of DTSs in Nairobi County for a three-year period from 2010 to 2012. All the DTSs in Nairobi County were used as the study population. The secondary data was extracted from audited financial statements. The study used descriptive research design. DEA got employed to determine the technical efficacy of the SACCOs. The data collected was then analyzed by a linear regression equation to test the extent of relationship. From the findings, the SACCOs had an average efficiency of 0.639 and a standard deviation of 0.135.Additionaly, it found out that factors such as size, capital, and credit hazard and supervision quality influences SACCOs' efficiency. The researcher found out that size, capitalization and supervision positively and significantly impacted efficiency of SACCOs whereas credit hazard negatively influenced the efficacy of SACCOs. The study suggested that there exists a necessity to comprehend the changes that technology had caused in the financial

segment so as to scrutinize in detail how the current and upcoming technological advances can impact its imminent evolution. This study focuses only on SACCOs operating in Nairobi County hence limits the generalization of the findings to other DTSs not studied. The current study focused on all the licensed DTSs in Kenya.

Mirie (2014) study sought to establish how members' income and conduct of SACCOs affects the relationship between characteristics and efficiency of SACCOs in Kenya for the year 2009-2013. It targeted all DTSs. DEA was to generate efficacy scores and multiple regression evaluation was utilized to analyze the association among efficiency, characteristics and conducts. This study found out that the DTSs in Kenya reflected an average efficiency of 0.775, with lows of 0.555 and maximum of 1. The study further established that characteristics of SACCO precisely size and age had a significant positive impact on the efficiency of DTSs. Efficiency was negatively related to strength of bond of association and adoption of technology while, managerial competency was not significantly related to efficiency. The current study focused on all the regulated DTSs using a similar methodology in evaluating efficiency.

2.4.2 Effect of Capital Adequacy Requirements on Capital Efficiency

Pessarossi and Weill (2013) examined if capital requirements affected efficiency for Chinese banks between 2004−2009, taking into account a total of 294 bank observations. This era coincided with the pioneer execution of capital prudential requirements in China. The data used all the commercial banks operating in China. The researchers utilized the Stochastic Frontier method to analyze the cost efficiency in China banking sector. The study revealed that capital ratio had a positive and significant relationship on bank efficiency. They noted that an upsurge in the capital proportion enhances the efficiency. This impact, however, was dependable on the bank's possession type, but not on its size. This study suggested that capital requirements

reinforce financial steadiness by offering a big capital buffer and also enhances bank effectiveness by lessening moral hazard among stockholders and creditors. This conclusion was put to the test using DTSs in Kenya by comparing the relationship between capital adequacy requirements and efficiency using multiple linear regression.

Mohamed & Mohamed (2018) assessed the efficiency and capital adequacy of banks in Egypt. The researchers used a sample of forty banks encompassing Islamic banks, conventional institutions with Islamic openings pre and post the worldwide fiscal predicament from 2002 to 2015. They used secondary data. The study utilized DEA approach to generate efficiency scores of banks and panel regression model to assess the efficiency of banks and capital ratios. During the pre-financial predicament, the study findings found a positive significant relationship among the banks' efficiency and capital levels, credit hazard, success, bank scope and the class of supervision. Whilst during the post financial crisis, the findings showed a negative significant connection with capital adequacy ratios. The researchers concluded that the efficiency of banks governs the capital level and risk banks can bear. Capital growth offers an added defense against any added risks. This study was relevant since it focused on efficiency and capital ratios which were further analyzed in the current study.

Caggian & Calice (2011) examined the influence of increased capital ratios on cumulative yield in an all-inclusive panel of African countries for the period 1980-2008. The study used a multi-variate logit classical for a board of 19 states. The outcomes of the experiential examination showed positive net profits from capital tightening. The researchers recommended that from the outcomes, there are significant net macroeconomic profits from building the capital levels of African banking structures from present levels. The study concluded that, by reinforcing the

flexibility of its investment structures, the new international standards may result in lasting welfare advantages for African economies. Nevertheless, the adjustment of the current capital levels and its effectiveness in influencing bank conduct in the Kenyan situation necessitated additional investigation.

(Lawal *et al*., 2018) investigated the effect of capital adequacy on the operational efficiency of Nigerian banks. The study population was made up of 15 banks where secondary data was 10 years from 2007-2016 was employed. Quantitative research design was employed. Panel least squares regression model was employed for analysis. The findings showed that capital ratios had a positive significant effect on the operational efficiency of banks. This meant that banks should meet the minimum capital base all the time to be able to perform its statutory role of financial intermediation and remain financially stable to withstand both internal and external shocks within the financial system. The study concluded that regulatory compliance with the capital adequacy must be taken seriously by all the banks and regulatory agencies so as to promote sound financial system stability. This study was limited to the issues surrounding capital requirements, measurement and its efficiency for safe and sound banking system but definitely other causal factors exist on operational efficiency alongside this key variable not considered by this study.

Lotto (2018) examined the impact of statutory regulatory requirements on banks' operational efficiency in Tanzania. Secondary data from audited financial statements for all 36 commercial banks operating for the period 2009-2015. This was the period when notable changes in bank transitions happened in Tanzania. The researcher employed robust random-effect regression to analyze the relationship between statutory regulatory requirements and operational efficiency.

Findings showed that statutory regulatory requirements had a positive and significant with bank operational efficiency. This implied that Tanzanian commercial banks proved more efficient when placed under more rigorous capital regulations. It might likewise suggest that the intensified guidelines on capital levels impact the bank's choice to review their interior processes plan concerning robust corporate authority, risk valuation approaches, credit appraisal measures, hiring of more competent workers, and improved internal control measures. Additionally, the findings showed that liquidity had a positive relationship with bank operating efficiency This study confirmed the findings of Pessarossi & Weill (2013) that there is a positive and significant effect among the statutory regulatory requirements and bank efficiency. The current study focused only on the concept of capital requirements in relation to capital efficiency.

Murkomen (2016) studied the influence of capital regulatory requirements on operational efficiency of commercial banks in Kenya for the period 2011-2015. She adopted a descriptive research design taking into consideration all 41 commercial banks functioning in Kenya as at the year 2015. Fixed impacts regression model was used for data analysis .The findings showed that capital adequacy requirement is positively related to the operational efficiency. She further pointed out that high efficiency of banks is majorly associated with the core capital levels. The study recommended that banks are required to develop the levels of capital requirements and specifically on core capital levels in order to improve their effectiveness. This study focused on capital requirements to measure quantify bank efficiency. The current study explored this requirement focusing on DTSs with a different methodology, DEA approach to measure efficiency.

Sentero (2013) conducted a study on the influence of capital adequacy requirements on the efficiency of banks in Kenya for the period 2005-2012. The researcher used a descriptive

research framework on all the banks operating in Kenya. Secondary data collected from the financial statements of the individual banks were utilized. DEA techniques was utilized to estimate efficiency and multiple regression model was utilized in analyzing the relationship between the independent variables and the dependent variable. The findings revealed that the commercial banks had an average efficiency of 0.63.Further, findings of the research showed a significant relationship between capital ratios and efficiency of banks in Kenya. The researchers suggested that stricter regulations might be effective for the steadiness of banks, however not for their efficiency. Regulating banks could not only decline their efficiency but will likewise upsurge the likelihood of an investment turmoil. The current study adopted a similar methodology in investigating the relationship between capital adequacy requirements and efficiency of DTSs in Kenya.

Biwott *et al.,* 2018 examined the influence of capital regulatory requirements on technical efficiency of DTSs in Kenya for the period 2011-2016. All the licensed DTSs as at 2016 were used. The researchers obtained secondary data from the annual financial statements of these DTSs from SASRA. DEA was used to determine efficiency while regression analysis was employed to analyze the influence of complying with capital adequacy ratio on efficiency of DTSs in Kenya. The study findings showed that DTSs had a mean efficiency of 0.54. The study found that compliance with the minimum capital requirements ratio had a negative influence the technical efficiency of DTS. Additionally, maintaining core capital to total assets ratio greater than 10% bears a significant negative influence on the allocation decisions of DTS managers leading to lower technical efficiencies. This was the period when regulatory reforms were enforced on DTSs. The current study assessed this effect when all the DTSs were expected to have complied with the regulatory reforms.

Mutanu (2002) studied capital allocation and effectiveness of banking institutions in Kenya for the period 1999 to 2001. The researcher used a census study of all quoted banks at the Nairobi Securities Exchange (NSE) was taken into consideration. The sample was further divided into larger and smaller banks in terms of total assets. Data analysis was carried out using stochastic frontier approach to measure efficiency. The study focused on bank's employment of capital and how its allocation on a bank's business activities and assets influences efficiency. Using the efficient cost frontier approach, she found out that low capitalized banks proved to be more efficient that those with huge capital bases. The findings rendered the use of capital ratio to measure the banks' efficiency ineffective and also indicated that banks over rely on customer deposits as a funding source as opposed to other sources. Like banks, DTSs operate using a similar model and most SACCOs in Kenya rely on member deposits to fund their operations. The overreliance on member or customer deposits can adversely impact their operations if banking or SACCO control organs like the Central Bank of Kenya or SASRA set up regulations that require them to keep a significant amount of customer deposits as liquid assets. The adequate capital requirements by SASRA that necessitates SACCOs to keep a core capital level of at least Ksh. 10 million is likely to have a significant effect on their efficiency. This study investigated the effect this had on capital efficiency of SACCOs in Kenya.

2.4.3 The Moderating Influence of DTS Size on the Relationship between Capital Adequacy Requirements and Capital Efficiency

Razmi *et al.,* 2014 studied the influence of firm size on the efficiency of the companies listed Tehran Stock Exchange between 2007 and 2011. The target population was all the companies listed in Tehran Stock Exchange. A sample size of 75 companies got utilized in the study. Data

Envelopment Analysis technique was utilized in evaluating the efficiency firms and multiple linear regression was used in analyzing the relationship. The results showed a significant negative relationship between firm size and efficiency. This means that with an increase in firm size the more it lowers the efficiency. The current studied the influence of DTS size on the relationship between capital requirements and efficiency of DTSs in Kenya. It attempted to increase the predictive power of the results by introducing DTS size as the moderator.

Karray & Chichti (2013) did a study on the impact of bank size on efficiency. The study used secondary data obtained from 402 business banks from 15 nations over the period 2000-2003. Data envelopment approach was utilized in the study in the evaluation of efficiency. The sample was further categorized into classes based on the asset base in four size classes: class 1 (exceptionally little banks); class 2 (little banks); class 3 (medium measured); and class4 (enormous banks). They found that banks had a mean efficiency of 0.54. In addition to that, the results revealed that that huge banks are the most efficient over the whole time of study and with every single utilized model. Lastly, it was found out that the class 2 (very little banks) experienced significant issues of inefficiency including an absolute normal misuse of assets that surpassed 46% of their really levels. The effect of DTSs size on the relationship between capital adequacy requirements tested by classifying DTSs based on their asset base.

Aggrey *et al*. (2010) sought to determine the relationship between company size and efficiency in East Africa producing industries for the period 2002-2003.An aggregate of 403 industries were utilized as the sample size involved rural assembling industries across Kenya, Tanzania and Uganda. These industries were randomly selected from the sampling frame. The data used for the study was obtained from survey conducted by World Bank. Researchers used DEA approach to generate efficiency scores and fixed effect regression to estimate the relationship between firm

size and efficiency. The findings showed that firm size had a negative effect with efficiency of assembling firms. They presumed that small firms gain more benefits from lessening regulatory requirements imposed on them. Their findings support the contentions from the property right and agency theories. In conclusion, they presumed that little firms are more efficient than huge firms due to their adaptability and straightforwardness of authoritative structures and dynamic cycle.

Papanikolaou & Delis (2009) studied the factors influencing bank efficiency for the period 1994-2005 using a panel of 364 banks from selected 10 EU countries. The study employed DEA to derive efficiency scores and double bootstrapping procedure was employed to analyze the relationship that exists between the variables. Bank-explicit, industry explicit, macroeconomic and size of the bank were used as the determinants for deciding bank efficiency. The results of the examination demonstrated that bank size had a positive impact on bank efficiency. This suggested big banks have the ability to employee more proficient directors who prevail in their endeavor to build up scale and degree economies. The findings of the investigation may likewise have significant effect to different factors of bank productivity, not considered in the current examination. The current study explored impact of DTS size on the relationship between capital regulatory requirements and capital efficiency of DTSs Kenya.

Li & Qin (2018) examined the relationship between capital ratios, bank size and risk profile of banks utilizing a sample 16 banks in China from 2005 to 2017. The relationship capital ratios, size and the risk profile was analyzed using least square panel model. The findings of the examination show that expanding the capital levels can lessen the risk bearing of the banks. The

size of the bank has a noteworthy negative relationship with the risk profile of banks. The capital level had a positive relationship with the risk profile of banks on expanding the bank size. This infers that to some extent, the size of the bank hinders the limitation of the capital levels on the risk profile of the banks. The investigation concluded that China's policy makers ought to completely consider the function of various bank sizes in risk taking and embrace a separated statutory regulatory framework.

2.5 Critique of existing literature

A number of studies have been done relating to the determinants of efficiency. Specifically, several authors have discussed the various factors affecting efficiency ((Ahmad & Razali, 2017; Sufian (2009); Amer *et al.,* 2011; Tesfay (2016) and; Njoroge (2013)). They have tied their findings on how these various factors affects efficiency of the aforementioned financial institutions. This study however focused on evaluating the efficiency scores of the deposit taking SACCOs in Kenya. Additionally, this study specifically focused on capital efficiency of DTSs. None of the above studies focused on this type of efficiency.

In relation to capital adequacy requirements and efficiency, most of the studies discussed have been carried out in commercial banks(Pessarossi and Weill (2013); Mohamed & Mohamed (2018); (Lawal et al., 2018); Lotto (2018);. Murkomen (2016; Sentero (2013) and Mutanu (2002)). It is evident that research in the area of capital adequacy requirements and efficiency had not been done in a comprehensive approach in deposit taking SACCOs.Studies have concluded that there is a positive and significant relationship between capital adequacy and efficiency. Specifically; (Pessarossi and Weill (2013); Mohamed & Mohamed (2018); (Lawal et al., 2018); Lotto (2018); Murkomen (2016) and Sentero (2013)). Other studies concluded that capital adequacy and efficiency had a negative relationship on efficiency((Biwott *et al.,* 2018)).

The above studies focused mainly on the relationship between capital adequacy requirements and efficiency. A critical look at the above studies revealed that no study has focused majorly on the effect of core capital to total assets ratio; core capital to total deposit ratio, and institutional capital to total deposit ratio on the capital efficiency of DTSs.

Studies on firm size have mainly focused on firm size in relation to efficiency. The above empirical review studied these relationship without an attempt to improve the predictive power of the results by introducing an appropriate moderator variable. This study introduced DTS size as a moderator to the relationship between capital adequacy requirements and efficiency of DTSs in Kenya.

2.7 Research Gaps

Existing empirical evidence on the link between capital adequacy requirements and efficiency of financial institutions is dominated by those carried out during the transitional period when the financial institutions were implementing the regulatory requirement (Biwott *et al*., 2017; Njoroge, 2013; Pessarossi *et al.*, 2013; Murkomen, 2016; Babel *et al*., 2012). The implementation period upon which all DTS should have attained full compliance lapsed in June 2014, the effects of compliance to the stringent capital requirements on their inherent efficiency still remains unassessed**.** The current study sought to investigate the trend of efficiency post the transition period. Also, many of the studies done in Kenya and other regions outside Kenya, like BRICS have largely focused on efficiency of commercial banks (Mutanu, 2002; Sentero, 2013; Murkomen, 2016; Babel *et al*., 2012; Rahman *et al*., 2017). There was a need to conduct a study to find out the influence of capital adequacy requirements on the efficiency of DTSs in Kenya. It was evident that, in spite of DTSs being important actors in the delivery of financial services,

there was limited research on the relationship between capital adequacy requirements and their efficiency. Lack of understanding into the relationship of the current DTSs capital regulatory requirements on the efficiency of such a key sector in the economy will mean a continued operation of the DTSs in a regulatory framework whose effects remains uncertain and in an efficiency path whose end results and outcomes remain unidentified. It is against these research gaps that this study will be undertaken.

2.8 Conceptual Framework

The conceptual framework is a diagrammatical representation of the connection between the independent variables, moderating variables and the dependent variable of the research. Figure 2.1 shows the conceptual framework of the study**.**

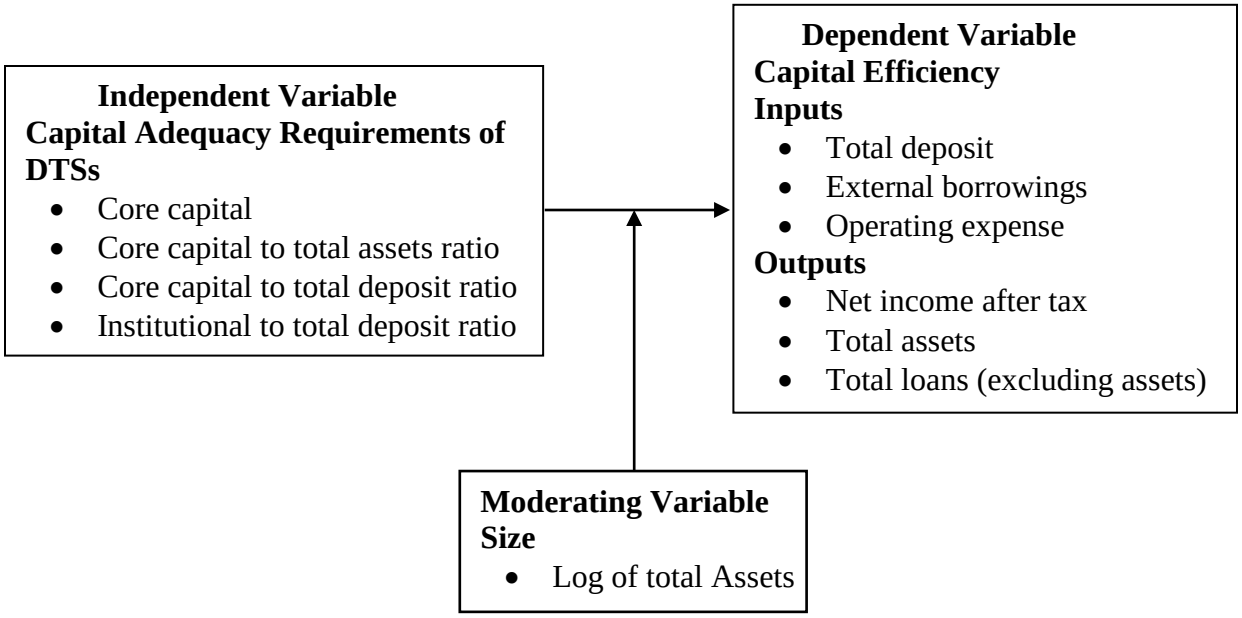

Figure 2.1: Conceptual Framework

The dependent variable is efficiency of DTSs. This was measured using DEA model. The fundamental DEA model is founded on a yield ratio index quantified by the ratio of weighted outputs to weighted inputs. The higher the degree of efficiency of DTSs, the greater the stability and financial soundness of SACCOs. SACCOs by their nature can be viewed as intermediary institutions since their core mandate relates to mobilizing the savings and providing advances. In this context, total deposits, external borrowing and operating expense formed the input set with net income after tax, total assets and total loans excluding assets forming the output set.

Table 2.1: Summary of Banking Inputs and Outputs Applied by previous Authors

Author	Method	Input	Output
Biwott& Nyakang'o (2017)	DEA	Total deposits, Total capital and Labour costs	Gross loans and investments
Njoroge (2013)	DEA	Savings and Total expense	Loans and Total income
Nandkumar & Singh (2014)	DEA	Deposits, Number of employees and operating expenses	Investment, Other Income and advance
Sufian (2009)	DEA	Total deposits, capital and labour	Total loans, Investments, on-interest income
Tesfay (2016)	DEA	Deposits and Interest Expense	Loans and Interest Income

The independent variable in this research was the capital adequacy requirements of DTSs. In Kenya, capital adequacy requirements are described based on financial institutions. For instance, banks are obligated to hold a least core capital of Ksh.10 billion. The minimum requirements for capital adequacy ratios are; core capital to total risk weighted assets of 8%, total capital to total risk weighted assets of 12%, and core capital to total deposits of 10% (Muli, 2017; CBK, 2008). In accordance with banks, DTSs consistently are needed to have a least center capital of Ksh. 10

million or more. The capital sufficiency proportions will be estimated as; core capital to total assets 10%, core capital to total deposits at 8% and institutional capital to total assets at 8% (SASRA, 2008).

The influence of the independent variable on the dependent variable is not only direct, but also enhanced through the moderating variable. Size was the moderating variable that was used to determine the moderating influence of DTS size on the association between capital adequacy requirements and capital efficiency of DTSs in Kenya. The firm size was measured by total natural log of assets (Karray & Chichti, 2013).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodology that the researcher used to attain the objective of the investigation. It includes research philosophy; research design; study area; sampling design. It also includes variables and their measurement procedures; method of data collection; data processing and analysis; and ethical consideration made in the study.

3.2 Research Philosophy

Research philosophy is the underlying belief and assumption about the development of knowledge. The choice of a research philosophy dictates the research design to be adopted (Saunders, Lewis & Thornhill, 2009).The study adopted positivism research philosophy. The philosophy of positivism is concerned with observation of social realities. It focuses on facts that are gathered by way of experience and direct observation and can be empirically measured through experiments, surveys, statistical analysis and quantitative methods. It looks at the theories that are in existence and tries to test the hypotheses that have been developed (Saunders, Lewis & Thornhill, 2009). Thus, the study was pegged on existing theories, formulated and tested hypotheses, and utilized inferential statistical data analysis techniques.

3.3 Research Design

The researcher employed correlation research design. A correlational design involves a kind of research design where a researcher seeks to understand what kind of associations naturally occurring variables have with each another (Kothari, 2014). This kind of design can be used to

ascertain the presence and strength of possible connections between variables in a study. In considering relationships among variables, correlational research design lends itself to an array of analytical approaches which include correlation analysis, regressions, path analyses, various nonparametric analyses that are based on similarity of ranks, correspondence analysis, or canonical analysis, to name a few. This study employed ANOVA in order to establish the relationship between the study variables: capital adequacy requirements and capital efficiency of DTSs in Kenya.

3.4. Target Population

The target population for this research were all the DTSs in Kenya controlled by SASRA. There were 174 DTSs permitted to undertake DT business in Kenya for the financial year ending December 2018.

3.5 Sampling and Sampling design

The sampling frame for this study was all the 174 licensed deposit taking SACCOs in Kenya as at December 2018 as per Appendix I. The researcher employed census method. Census investigates all the individual elements that make up a population or a total enumeration rather than a sample. This method is highly recommended especially where it is practical to do so since it eliminates errors that are associated with sampling (Saunders, Lewis & Thornhill, 2009). Census method was used because regulation is an issue which is affecting all the DTSs in Kenya.

3.6 Data Collection Instrument

The researcher utilized secondary data extracted from audited financial statements submitted to SASRA. The data was collected for the five-year period between 2014 and 2018. Data collection templates were designed covering both the independent variables (core capital, core capital to total assets ratio, core capital to total deposit ratio and institutional to total deposit ratio) and dependent variable (capital efficiency) as indicated in Appendix I.

3.7 Validity and Reliability

Validity of a research instrument evaluate the level to which the instrument measures what is designed to measure (Mohajan, 2017). Reliability shows the extent to which measurement scores are free from random errors and hence ensures consistent measurement across time in the instrument (Gay, *et al.,* 2009). Granted that this study used secondary data, to ensure validity and reliability were adhered to, diagnostic tests were conducted to determine if the regression assumptions were met.

3.8 Data Collection Procedure

The researcher sought approval and authorization from The Co-operative University of Kenya (Board of Post- Graduate Studies) to conduct the research. The research authorization permit was obtained from National Commission for Science, Technology and Innovation before the commencement of the data gathering exercise. The researcher thereafter wrote to SASRA requesting for access to annual financial statements for five years from 2014 to 2018. The researcher paid a physical visit to SASRA offices and used data collection template in Appendix 1 to collect relevant data. Secondary data was extracted from audited annual reports of DTSs filed with the regulator through desk search techniques. Data was organized in panels so as to investigate the conduct of DTSs over time and across space.

3.8.1 Operationalization and Measurement of Variables

Table 3.1 Operationalization and Measurement of Variables

Variable	Type	Operational Definition	Measurement	Data to be collected	Hypothesized Direction
Efficiency of DTSs	Dependent variable	Taken as relative weights of inputs and outputs (Biwott & Nyakang'o, 2017)	$\text{Efficiency} = \frac{\text{Weighted Output}}{\text{Weighted Input}}$	Secondary	Positive influence
Capital adequacy requirements	Independent variable	Taken as the capital adequacy ratios set by SASRA (SASRA, 2017).	-Core capital of not less than Ksh.10 million -Core capital to total asset ratio-10% -Core capital to total deposit ratio-8% -Institutional capital to total deposit ratio-8%	Secondary	Positive influence
Size	Moderating variable	It is measured by the total assets of the organization (Karray & Chichti, 2013).	Log of total assets	Secondary	Positive Moderating influence

3.9 Data Processing and Analysis

Gathered information was scrutinized for errors of omissions before being keyed into the excel spreadsheet. The data was organized using Excel program in a format that could be analyzed. Ratio analysis was used to calculate the capital adequacy ratios. A two-stage analysis was employed in the research. The first stage utilized DEA approach to measure efficiency. In the second stage, a multiple regression analysis was utilized in regressing DEA efficiency score on

capital adequacy requirements. The mathematical linear programming problems was solved using the DEA Computer Program Version 2.1. The pooled data forming the panel model was then incorporated into STATA 14 for data analysis. Thereafter, diagnostic tests were carried out for the data set to ascertain if the econometric assumptions of regression were being met. Lastly, the results obtained from the analytical models were applied in testing the research hypothesis, to establish direction and the strength of the association among the variables of the study.

3.9.1 Empirical Model

DEA Model

The first objective of the study was to investigate the efficiencies of DTS. The researcher employed Data Envelopment Analysis (DEA) model to examine the efficiency of each SACCO listed in SASRA and for a period of five years from 2014-2018.

Model 1: Estimation of DTSs Capital Efficiency

Equation 3. 1: DEA Statistical Model for Efficiency Maximization

$$E_I = Maximize \sum_{k=1}^{o} U_k Y_{ki} / \sum_{j=1}^{i} V_j X_{ji} \quad \textbf{3.1}$$

Subject to:

Equation 3. 2: DEA Statistical Model for Efficiency Subject

$$E_I = Maximize \sum_{k=1}^{o} U_k Y_{ki} / \sum_{j=1}^{i} V_j X_{ji} \leq 1, j = 1, \ldots n \; and \; V_j \text{and } U_k \geq 0 \quad \textbf{3.2}$$

Where:

O = number of outputs for deposit taking SACCOs using i different inputs;

i = number of inputs used by each deposit taking SACCOs to produce o different outputs;

yki = is the amount of the k^{th} output for the i^{th} deposit taking SACCOs;

xji = is the amount of the j^{th} input used by the i^{th} deposit taking SACCOs;

uk = is the output weight;

vj = is the input weight,

Model 2: Relationship between capital adequacy requirements and capital efficiency

The model herein describes the relationship between capital adequacy requirements and efficiency of DTSs. Bivariate analysis between each independent and dependent variable followed by a multivariate analysis to ascertain the combined influence of the capital adequacy requirements on efficiency of DTSs in Kenya was performed. The bivariate regression equations are presented in models 2a to 2d while the combined multivariate regression is presented in model 2e.

Model 2a: Relationship between core capital and capital efficiency of DTSs

Equation 3. 3 presents the bivariate regression model for efficiency on core capital

$$E_{it} = \alpha_{it} + \beta_1 C1_{it} + \varepsilon_{it} \quad \text{.....3.3}$$

Where:

E_{it}= Efficiency of DTSs (i) at time (t) (Where, $0 <= \varepsilon_i <= 1$);

α_i = Intercept, a sample-wide constant

β = coefficients for the respective determinants

C_1 = core capital

ε_i = error term

Model 2b: Relationship between core capital to total assets and capital efficiency of DTSs

Equation 3. 4 presents the bivariate regression model for efficiency on core capital to total assets

$$E_{it} = \alpha_{it} + \beta_2 C2_{it} + \varepsilon_{it} \quad \text{.....} \quad \textbf{3.4}$$

Where:

C_2 = core capital to total asset ratio

The rest of the terms remain as defined in equation 3.3

Model 2c: Relationship between core capital to total deposits and capital efficiency of DTSs

Equation 3. 5 presents the bivariate regression model for efficiency on core capital to total deposits

$$E_{it} = \alpha_{it} + \beta_3 C3_{it} + \varepsilon_{it} \quad \text{.....} \quad \textbf{3.5}$$

Where:

C_3 = core capital to total deposit ratio

The rest of the terms remain as defined in equation 3.3

Model 2d: Relationship between institutional capital to total assets and capital efficiency of DTSs

Equation 3.6 presents the bivariate regression model for efficiency on institutional capital to total assets

$$E_{it} = \alpha_{it} + \beta_4 C4_{it} + \varepsilon_{it} \quad \text{.....} \quad \textbf{3.6}$$

Where:

C=institutional capital to total deposit ratio

The rest of the terms remain as defined in equation 3.3

Lastly, multiple regression analysis was applied for the overall objective as shown below:

Model 2e: Relationship between capital adequacy requirements and capital efficiency of DTSs

Equation 3.7 presents the multiple regression model for efficiency on capital adequacy requirements

$$E_{it} = \alpha_{it} + \beta_1 D_{it} + \beta_2 C1_{it} + \beta_3 C2_{it} + \beta_4 C3_{it} + \beta_5 C4_{it} + \varepsilon_{it} \quad \text{.....3.7}$$

Where:

$C_1, C_2, C_3, C_4 =$ as defined in equation 3.3, 3.4, 3.5 and 3.6 respectively

D = Dummy variable- Assuming the value of 1 for DTS meeting capital adequacy requirements and 0 for DTS not meeting the requirements

The rest of the terms remain as defined in equation 3.3

Model 3: Moderation effect of DTS size on the relationship between capital adequacy requirements and capital efficiency of DTSs

The study sought to establish the moderating effect of DTS size on the relationship between capital adequacy requirements and capital efficiency of DTSs in Kenya. DTS size was based on total assets. The study employed Hierarchical Multiple Regression (HMR) model fitting strategy using moderated multiple regression (MMR).MMR is a type of regression model that have

moderator variables and their interactions with other predictor variables(Helm & Mark, 2012). Moderators can strengthen, weaken or reverse the nature of relationship. In this case, (HMR model 1, 2 & 3) in the step-wise MMR were adopted to find out whether including certain predictors and moderator impact R^2 (the predictive power of the equation) sufficiently or not. This method was adopted since it takes into consideration the value of R square which explains when or under what conditions an effect can occurs. This was accomplished in three steps:

Step 1: Apply the Multiple Linear Regressions (MLR). The equation for step 1 for the moderating effect is represented in the combined equation 3.7 above.

Step 2: Introduce the moderator as a predictor variable to the MLR in step 1 above. The Equation for step 2 is:

$$E_{it} = \alpha_{it} + \beta_1 D_{it} + \beta_2 C1_{it} + \beta_3 C2_{it} + \beta_4 C3_{it} + \beta_5 C4_{it} + \beta_6 T_{it} + \varepsilon_{it} \quad \text{.....3.8}$$

Where:

T_i = Moderating variable – T index of DTS size

The rest of the terms remain as defined in equation 3.3 and 3.7

Step 3: Introduce the moderator as an interaction variable with the significant Multiple Linear Regressions variables in step 2 with the moderator. In step 3, the overall model should be significant in addition to F and at least one of the predictor variables.

The equation for step 3 is

$$E_{it} = \alpha_{it} + \beta_1 D_{it} + \beta_2 C1_{it} + \beta_3 C2_{it} + \beta_4 C3_{it} + \beta_5 C4_{it} + \beta_6 T_{it} + \beta_7 C1_{it}(T_{it}) + \beta_8 C2_{it}(T_{it}) + \beta_9 C3_{it}(T_{it}) + \beta_{10} C4_{it}(T_{it}) + \varepsilon_{it} \quad \text{..... 3.9}$$

Where: Definition of terms remain as given in equation 3.8

3.10 Diagnostic Tests

It is important that the data be subjected to the relevant diagnostic test due to the characteristics of time series data. The diagnostic tests are performed so as to evaluate the validity of the model (Everitt & Skrondal, 2010). The assessment is performed by checking the model's underlying statistical assumptions so as to avoid type I and type II errors that occur during the interpretation stages of the model. This study used formal statistical hypothesis test to check for normality, multicollinearity, heteroscedasticity, autocorrelation, multicollinearity, and linearity.

3.10.1 Testing for Normality

The tests of significance on normally tests are tied up on the presumption that the error time is normally distributed and has a constant variance (Razali & Wah, 2011). Tests for normality include Kolmogorov-Smirnov test, kurtosis, Skewness, jarque bera, scatter diagrams and Shapiro-Wilk test. This study used the jarque bera test so as to establish whether there is normal behavior of variables (total deposits, total assets, total loans, net income after tax, operating expenses and external borrowing). This was completed with Q-Q plots and a visual histogram of the residuals. This study used jarque bera test because it's effective and direct since it captures a combination of skewness and kurtosis which are the two aspects that capture divergence from a normal distribution.

3.10.3 Testing for Heteroscedasticity

Heteroscedasticity refers to the disturbance of regression which do not have similar variances across observations (Gujarati, 2003). This study applied the Breusch-Pagan test for heteroscedasticity. Therefore, at 95% of level of significance if the F statistics rejects the null

hypothesis, it will imply existence of heteroscedasticity. For corrections where necessary, options including logarithmical data; weighted least squares; nonlinear transformation; PCSE (panel corrected standard errors); or HCSE (homoscedasticity-consistent standard errors) were utilized to correct heteroscedasticity if found. This study used Breusch-Pagan test because it's widely accepted and easy to use.

3.10.4 Testing for Autocorrelation

Across periods, time series data displays serial correlation or autocorrelation of disturbances (Greene, 2008) .The autocorrelation function can be used to detect non-randomness in data and in time series modelling. This study used the Durbin-Watson test to ascertain if there is association amid the errors in different observations. The test helps in determining whether there is correlation between the errors in different observations.

3.10.5 Test for Multicollinearity

(Gujarati, 2003) defines multicollinearity as the existence of linear relationship between the independent variables. In the presence of multicollinearity, the coefficient estimates of the multiple regressions may change erratically due to small changes in the model. The Variance Inflation Factor (VIF) and Tolerance tests were used to measure the degree of multicollinearity. The Variance Inflation Factor greater than 10 (vif>10) or Tolerance statistics values that are less than 0.10 (1/vif<0.10) will be indicative of presence of multicollinearity. VIF shows the magnitude of inflation of the variance of the coefficient estimate as a result of multicollinearity.

3.11 Ethical Considerations

The researcher sought approval and authorization from The Co-operative University and National Commission for Science, Technology and Innovation to conduct the research on the Relationship between Capital adequacy requirements and the Capital efficiency of DTSs in Kenya. The study involved the use of secondary data and was designed to uphold privacy and confidentiality of the information.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the findings of the study. The research analyzed the relationship between capital adequacy requirements and efficiency of deposit-taking SACCOs in Kenya. Specifically, the study sought to evaluate the efficiency of DTSs in Kenya; establish the effect of capital adequacy requirements on capital efficiency of DTS; and, investigated the moderating influence of DTS size on capital adequacy requirement and capital efficiency of DTS in Kenya. Secondary data extracted from the audited financial statements of the 174 DTSs operating in Kenya for the period 2014-2018 were used for the study .The study adopted a two staged methodology for analysis; in the first stage efficiency scores were generated using the DEA approach. In the second stage, a multiple regression analysis was conducted to regress DEA efficiency scores on capital adequacy requirements. The data was analyzed using DEA Software Version 2.1 and STATA 14 software. The first part of the analysis therefore focused on providing the summary descriptive statistics of the variables, followed by inferential analysis that used both multiple linear regression as well as stepwise regression models.

4.2 Descriptive Statistics

Descriptive statistics were utilized in describing the research variables from the selected profile. The study sought to determine the efficiency of DTSs. This study employed DEA approach using three inputs (total deposit, operating expenses and external borrowing) and three outputs (total assets, total loans and net income after tax).

4.2.1 Summary of the Descriptive Statistics

4.2.1.1 Summary Statistics for the input variable

A summary of the descriptive statistics for the inputs of the study are represented in table 4.1.

Table 4.1 Summary statistics for input variable

Variable	Obs	Mean (Ksh. Billions)	Std. Dev. (Ksh. Billions)	Min (Ksh. Billions)	Max (Ksh. Billions)
Total deposits	857	16.90	35.2	0.034	342
Operating expenses	857	0.666	1.84	0	37.6
External borrowing	857	1.29	3.5	-121247	34.5

On average the overall mean of total deposits totaled Ksh.16.9 billion with a standard deviation of Ksh.35.2 billion. The total deposit also varied from Ksh. 34 million to Ksh. 342 billion over the years. An indication of the continued public confidence in the institutions to invest their savings. Operating expenses' mean was Ksh. 666 million with a standard deviation of Ksh. 1.84 billion. The minimum reported value was zero meaning that some DTSs had no operating expenses. This shows the degree to which some DTSs have reduced their operating expenses. External borrowing on the other hand had a mean of Ksh.1.29 billion with a standard deviation of Ksh. 3.5 billion. External borrowing varied from Ksh -121247 to Ksh. 34.5 billion an indication that over the years the some DTSs had been operating on debt. This means that some DTSs had not been able to finance their debts. The standard deviation was considerably greater than the mean for the three variables which shows that the data was vastly spread.

4.2.1.2 Summary Statistics for the output variable

Table 4.2 Summary Statistics for output variable

Variable	Obs	Mean (Ksh. Billions)	Std. Dev. (Ksh. Billions)	Min (Ksh. Billions)	Max (Ksh. Billions)
Total assets	857	23.9	48.5	0.0939	469
Total loans	857	18	36.4	0.015	316
Net Income After Tax	857	0.757	2.13	0.000	2.67

Table 4.2 presents the descriptive statistics for the output variable. Total assets had a mean and standard deviation of Ksh. 23.9 billion and 48.5 billion respectively. This varied between Ksh.93.9 million to Ksh. 469 billion. This indicates that total assets has been rising at a positively significant rate and the general implication of the foregoing is that the DTSs are growing their assets. The mean of total loans is Ksh. 18 billion with a standard deviation of Ksh. 36.4 billion. The maximum value of Ksh. 316 billion is a confirmation of the higher demand of loans in DTSs. Lastly, net income after tax had a mean of Ksh .757 million with a standard deviation of Ksh. 2.13 billion. The minimum net income after tax was nil indicating that some DTSs reported losses over the years.

4.2.2 Trend Analysis of Inputs and Outputs

4.2.2.1 Trend Analysis of Inputs

The trend of inputs during the review period is shown Figure 4.1

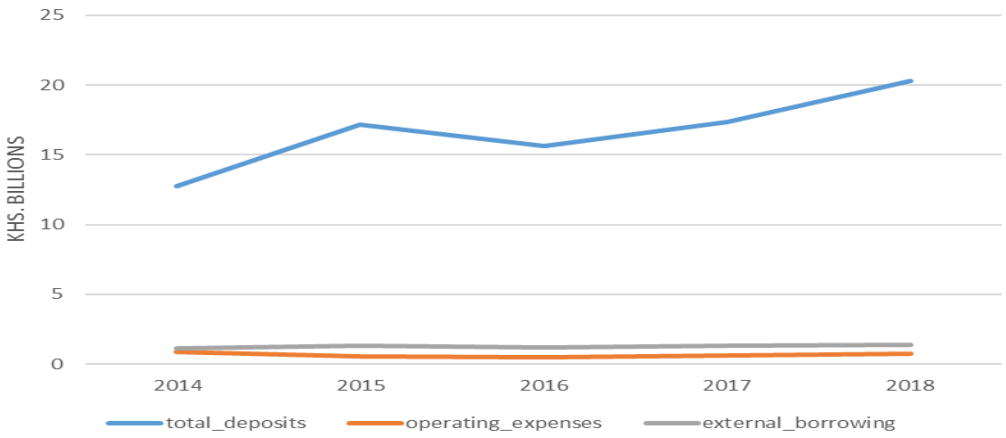

Figure 4.1: Trend Analysis of Inputs

As shown in figure 4.1, the study found that the average yearly total deposits grew from Ksh. 13 billion in 2014 to Ksh. 20.3 billion in 2018. It is worth noting that over the period of study, total deposits were increasing. The increase was gradual over the period, a pointer to the continued trust by members to invest their savings in SACCOs. External borrowing and operating expenses

on the other hand, fluctuated over the period. This was interpreted to mean that DTSs were generally reducing their reliance on external borrowing and had embarked on strategic measures to reduce on their operating costs.

4.2.2.2 Trend Analysis of Outputs

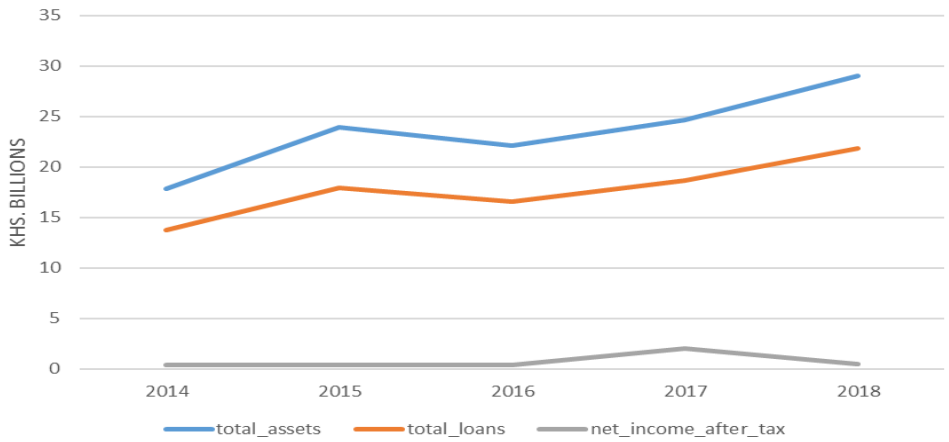

Figure 4.2 Trend Analysis of Outputs

On receiving inputs, DTSs transform them into outputs. It is notable that the total loans grew from an average of Ksh.14.9 billion in 2014 to Ksh.22.3 billion in 2018. The increase was gradual over the study period, which was interpreted to be indicative of continued demand for the financial credit facilities offered by DTSs. On the other hand, total assets grew from an average of Ksh.18.1 billion in 2014 to Ksh.29.8 billion in 2018, interpreted to be a pointer to DTSs having increased their market share. Similarly, net income registered a steady advancement from a regular Ksh. 400 million in 2014 to Ksh. 500 million in 2018.

4.3 Efficiency of DTSs in Kenya over the period 2014-2018

4.3.1 Efficiency of DTS registered

In investigating efficiency of DTSs, DEA approach was employed to assess the efficiency of each DTS registered with SASRA for the five-year period under study. Effectively, total deposits, operating expenses and external borrowing were selected as inputs while total assets,

total loans and net income after tax were selected as outputs of the study. The focus on the inputs and outputs was based on the appreciation of the studies that adopted this method. Studies that adapted the same method in analyzing efficiency in financial institutions include Biwott and Nyakang'o (2017), Njoroge (2013), Nandkumar & Singh (2014) and Tesfay (2016).

Using the efficiency scores computed on the basis of both the input and output variables, the findings were as summarized in Appendix 1.The data in appendix 1 indicates the presence of a moderate increase in efficiency over the period of study from 0.468 in 2014 to a high of 0.505 in 2018. An average of 50.6% (0.506) over the five years was interpreted to indicate that DTSs were able to increase their outputs (loan to members, their market share and their surpluses) by 49.4% without any additional increase in inputs (total deposits, operating expenses and external borrowing). Notably, 2018 recorded the highest efficiency average mean of 57.1% despite being an election period, which was interpreted to be an indication that SACCO sector was resilient to political risks. This implied that political dynamics could not be influencing allocative decisions in the sector.

4.3.2 Efficiency Frequency Distribution

Table 4.3 Efficiency Frequency Distribution

Class	Frequency	Percent	Cumulative Percent
Up to 0.3	13	7.47	7.47
.3000-.3999	41	23.56	31.03
.4000-.4999	38	21.84	52.87
.5000-.5999	30	17.24	70.11
.6000-.6999	31	17.82	87.93
.7000-.7999	15	8.62	96.55
.8000-.8999	5	2.87	99.43
Above 0.9	1	0.57	100
N	174	100	
Maximum	1	Skewness	0.2283
Minimum	0.2204	Kurtosis	-0.6038
Mean	0.5057	Std Deviation	0.1571

In order to make more inferences from the variables, frequency distribution table was tabulated to show how frequencies are distributed over values. As it can be seen from table the efficiency is moderately distributed with the mean of 0.51 efficiency level, with a standard deviation of 0.15. With an average efficiency score of 0.51, it means that these particular DTSs ought to decrease their inputs by 49% so as to attain 100 percent efficiency. Table 4.3 further shows that the DTS with the lowest efficiency of 0.22 has an improvement gap of 0. 78 points.

In terms of efficiency, the study hypothesized that: $H_{01:}$ *Majority of DTSs in Kenya do not meet the average threshold of capital efficiency.* Where, the average is defined as 0.5. To test this hypothesis, chi square test was conducted. The results for Chi squared for the capital efficiency (difference of those below and those above 0.5 threshold) equals 0.575 with 1 degrees of freedom. The two-tailed P value equals 0.448. Since the p value (0.448) is more than the significance level (0.05), the study failed to reject the null hypothesis and conclude that the difference is not statistically significant.

4.3.1 Summary Descriptive Statistics for Study Variables

A summary of the descriptive statistics of the study variable is presented in table 4.4.

Table 4.4 Summary Descriptive Statistics of Study Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Efficiency	857	0.5131	0.1964	0.0203	1
CC (Ksh. Billions)	857	3.41	0.69	0	0.061
CC/TA	857	0.1606	0.094	-0.2662	0.7849
CC/TD	857	0.2577	0.2446	-0.4787	3.778
IC/TA	857	0.0828	0.0887	-0.322	0.6623

The findings summarized in Table 4.4 clearly shows that the value of the arithmetic mean for the efficiency scores was $M = 0.5131$, therefore over the period the DTSs were fairly efficient. The mean efficiency of 51.31 per cent is an indication that the DTSs were doing fairly well in

complying with the prudential regulations set by SASRA, however, their standard deviations of 19.64 percent was low and meant that the level of efficiency was close from one DTS to the other. The most efficient DTS yielded a maximum efficiency level M = 1, 49 times more than the DTS with the least efficiency, at M=0.0203.

Core capital (CC) had a mean of Ksh. 3.41 billion with a standard deviation of Ksh. 6.9 billion indicating that the level of compliance with prudential regulations was spread from each other over the years. According to SASRA 2014, DTSs at all times are required to maintain the prescribed core capital of not less than Ksh.10 million before a license is issued. Having attained a mean of Ksh. 3.41 billion in their core capital, could imply that the DTSs have complied with the core capital requirements as one of the main regulatory tools by SASRA.

Core capital to total assets (CC/TA), core capital to total deposits (CC/TD) and institutional capital to total assets (IC/TA) had a mean of 16.06, 25.77, and 8.28 per cent respectively. DTSs are required to maintain capital adequacy ratios of CC/TA, CC/TD and IC/TA of 10%, 8% and 8% respectively. Therefore, over the period of study the DTSs were maintaining the capital adequacy ratios as required by the regulator. The findings of the study also showed that some DTSs reported negative capital adequacy ratios (M = -0.2662, -0.4787 and -0.322) an indication that some DTSs were financing their operations through deposit liabilities.

On the overall, the average ratio of CC/TA, CC/TD and IC/TA were 16.06, 25.77, and 8.28 percent respectively. On the other hand, DTSs are required to maintain outlay adequacy ratios of CC/TA, CC/TD and IC/TA of 10%, 8% and 8% respectively. It is evident that there was a significant improvement in the number of DTSs meeting the set capital adequacy ratios. Increased compliance with the capital adequacy ratio is an indication that most DTSs were in a

better position to safeguard member deposits and creditors from losses arising from corporate risks that the SACCO may face resulting to efficiencies in the sector. Therefore, this could be a pointer of a sound financial position for DTS sub sector.

4.4 Diagnostic Tests Results

Diagnostic tests were performed so as to appraise the validity of the model.

4.4.1 Testing for Normality

Jarque Bera test was used to establish if a data set is normally distributed. The results were summarized in the table below:

Table 4.5: Jarque Bera Test Statistic Data

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
My Residuals	857	0.0000	0.0009	63.44	0.0000

From the results summarized in the table 4.5 above, the p-value was found to be less than 0.05. Thus, the null hypothesis that each component was normally distributed was rejected at five per cent level of significance for all the models. In as much as the Jarque bera test was rejected, the researcher went further and run a histogram and Q-Q plot. The results are shown on the figure 4.3 and 4.4 below:

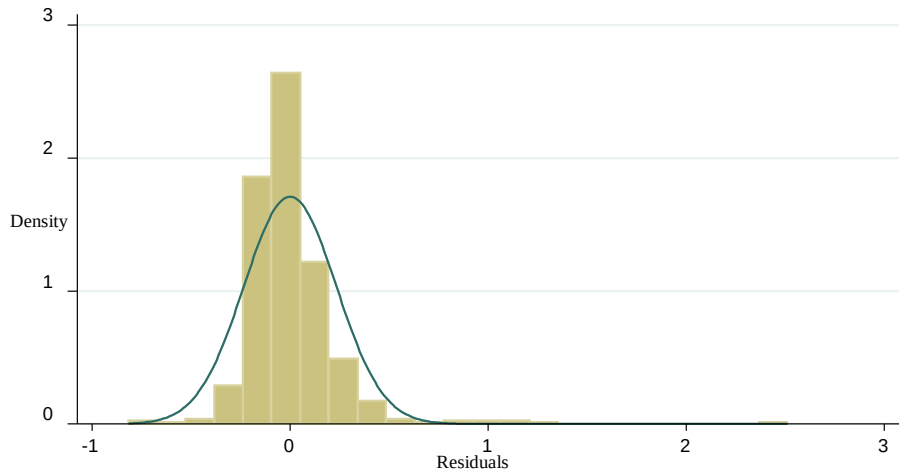

Figure 4.3: Normality test for visual representation using the histogram

The visuals provided that the data was normally distributed. The fail test could be attributed to outliers which can be seen from the histogram.

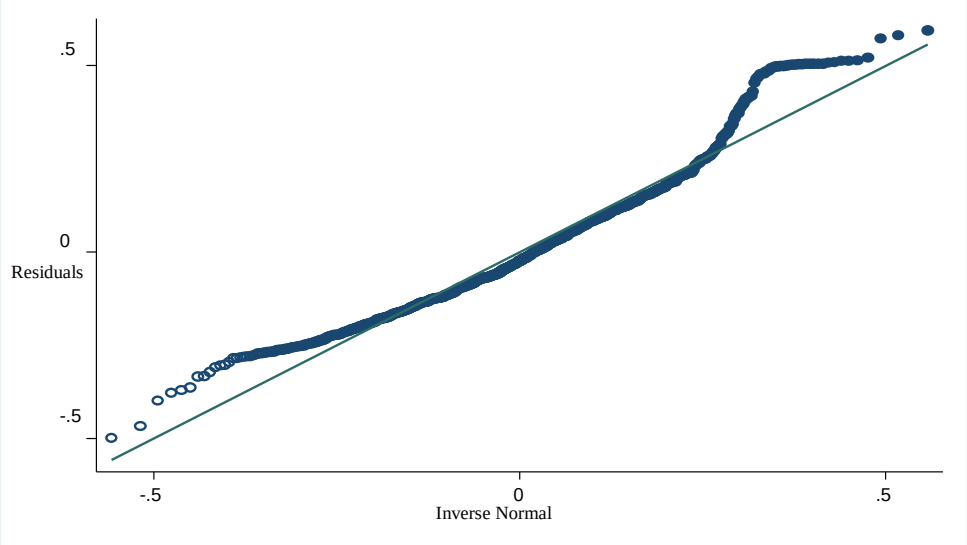

Figure 4.4: Normality test using Q-Q plot

From the above Q-Q plot, it can be noticed that the points fall along the middle line of the graph, but curve off in the extremities. This means that the data have more extreme values that exhibit the nonnormal distibution of data.

4.4.2 Test for Autocorrelation

Durbin-Watson test was conducted in order to establish whether there was serial correlation (autocorrelation) in the residuals of the panel data models. The Durbin-Watson ranges in value from 0 to 4. A value closer to 2 signals non-correlation, a value closer to 0 designates positive autocorrelation and a value closer to 4 designates negative correlation. The findings of this test were therefore presented in table 4.6 below:

Table 4.6: Durbin Watson Test for Autocorrelation

Durbin-Watson d-statistic (7, 857) = 1.090

From this test, it can be observed that the DW statistics was not close to prescribed value of two. This therefore indicates that there was serial correlation in the residuals of the model. The model was consider insufficient for drawing conclusions due to the violation of the assumptions of non-serial correlation of the error term. A generalized least squares (GLS) was therefore adopted to correct the violations. The results were presented on the table 4.7 below:

Table 4.7: Cochrane- Orcutt AR (1) regression

Anova

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.6075	4	.6518	24.31	0.0000
Residual	22.8225	851	.02681		
Total	25.4300	855			
	R-squared	0.1025			
	Adjusted R-squared	0.0983			
	Root MSE	.16376			

t-test Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	T	Sig.
(Constant)	.4887	.0173	.4547	28.15	0.000
CC	0.000	0.000	0.000	3.35	0.001
CCTA	-.6163	.1603	-.9309	-3.84	0.000
CCTD	.2030	.0410	.1225	4.95	0.000
ICTA	.6928	.0173	.4568	5.76	0.000
Rho	.4549				

Durbin- Watson statistics (original) = 1.090
Durbin- Watson statistics (transformed) = 2.0780

The GLS model fitted allowed for the autocorrelation of the residuals simultaneously to obtain estimated beta coefficients of the error term. From the results, it can be noted that the transformed DW statistics is slightly above 2 (*d=2.08*). The transformed residuals did not lead to much different results. This means that despite adopting the GLS model to correct the violations, the autocorrelation problem was not completely eliminated.

4.4.3 Test for Linearity

The linear correlation of the independent variables on the dependent variable was established using Pearson's correlation coefficient. The linearity results are shown in Table 4.8 below:

Table 4.8 Pearson's Correlation Coefficient

	Efficiency	CC	CCTA	CCTD	ICTA	Size
Efficiency	1.0000					
CC	0.2123*	1.0000				
	0.0000					
CCTA	0.2052*	0.1308*	1.0000			
	0.0000	0.0001				
CCTD	0.2201*	0.0793*	0.8221*	1.0000		
	0.0000	0.0202	0.0000			
ICTA	0.2850*	0.2118*	0.7573*	0.5542*	1.0000	
	0.0000	0.0000	0.0000	0.0000		
Size	0.1693*	0.6545*	-0.2150*	-0.1813*	0.0517*	1.0000
	0.0000	0.0000	0.0000	0.0000	0.0304	

From table 4.8, the outcomes show that there is noteworthy positive linear correlation among all variables ($p<0.05$), except in the case of size and core capital to total assets and size and core capital to total deposits where the relationship is negative though significant.

4.4.4 Test for Heteroscedasticity

Breusch-Pagan test was conducted with the aim of establishing whether there was constant or lack of constant variance in the residuals of the fitted model. Accordingly, the presence of constant variance is referred to as homoscedasticity, while absence of constant variance is referred to as heteroscedasticity. The findings of these tests were therefore summarized in the table below:

Table 4.9: Test for Heteroscedasticity

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity
Ho: Constant variance
Variables: fitted values of efficiency
chi2(1) = 2.09
Prob > chi2 = 0. 1486

The results show that the p-value for the Breusch-Pagan test was 0. 1486, which was more than 0.05 level of significance therefore resulting in the acceptance of the null hypothesis that states that there is constant variance. Therefore, the data is not heteroskedastic.

4.4.5 Test for Multicollinearity

Tests for multicollinearity were conducted to determine the existence of a significant correlation amidst the independent variables (predictors) of the model. This was therefore accomplished by using variance inflation factor and tolerance tests. Accordingly, the outcomes summarized in the table to clearly show that the values of variance inflation Factor were within the range of 1 to 10 therefore meet the conditions of multicollinearity (Gujarati, 2012). This indicates that there were no notable connections amidst the predictors of the model.

Table 4.10: Tests for Multicollinearity

Variable	**VIF**	**1/VIF**
CC*Size	8.74	0.1144
CC/TA*Size	6.32	0.1582
CC/TA	4.97	0.2012
CC/TD	8.76	0.1142
CC/TD*Size	9.53	0.1049
CC	5.77	0.1733
IC/TA*Size	7.91	0.1264
IC/TA	8.96	0.1116
Size	5.27	0.1898
Core capital dummy	1.31	0.7634
Mean VIF	6.754	

4.5 The relationship between capital adequacy requirements on efficiency of DTSs in Kenya

The second objective was to examine the relationship between capital adequacy requirements on efficiency of DTSs in Kenya. First the researcher performed bivariate analysis between each independent and dependent variable followed by a multivariate analysis to ascertain the combined influence of the capital adequacy requirements on efficiency of DTSs in Kenya. The bivariate analysis was done in four stages (relationship between core capital and efficiency, relationship between core capital to total assets and efficiency, relationship between core capital to total deposits and efficiency and relationship between institutional capital to total assets and efficiency).

4.5.1 Relationship between Core Capital and Efficiency

Thus, the first step determined whether a relationship between core capital and efficiency existed. The outcomes are shown in table 4.11:

Table 4.11: Relationship between Core Capital and Efficiency of DTSs

Anova

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.4879	1	1.4879	40.34	0.0000
Residual	31.5400	855	.0369		
Total	33.0279	856			
	R-squared	0.0451			
	Adjusted R-squared	0.0439			
	Root MSE	.1921			

t-test Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	T	Sig.
(Constant)	0.4926	.0073	.4782	67.30	0.000
Core capital	.0000	.0000	.0000	6.35	0.000

a) Dependent Variable: Efficiency; Predictors: Core capital

The functional model for this relationship was:

$$E_{it} = 0.49 + CC$$

Where E_{it} represents Efficiency and **CC** represents core capital.

From table 4.11, the results of regression of efficiency on core capital reveal a significant regression equation (F (1,855) =40.34, p=0.000 and an R^2 of 0.0451. The predicted model efficiency is equal to 0.4926+0.000 core capital. The null hypothesis for the study H_{01A}: There is no significant relationship between core capital and capital efficiency of DTSs in Kenya is therefore rejected. The R^2 of 0.0451 showed that 4% of capital efficiency can be explained by the aspect of core capital, the rest can be expounded by factors not encompassed in the model.

4.5.2 Relationship between Core capital to Total assets and Efficiency

Secondly, the research sought to analyze the influence of core capital to total assets on this relationship.

The findings are shown in table 4.12.

Table 4.12: Relationship between Core Capital to Total Assets and Efficiency of DTSs

Anova

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.3904	1	1.3904	37.57	0.0000
Residual	31.6375	855	. 0370		
Total	33.0279	856			
	R-squared	0.0421			
	Adjusted R-squared	0.0410			
	Root MSE	.1924			

t-test Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	T	Sig.
(Constant)	0.4443	.0130	.4187	34.13	0.000
CCTA	0.4287	.0699	.2914	6.13	0.000

a) Dependent Variable: Efficiency; Predictors: Core capital to total assets

The functional model for this findings was:

$$E_{it} = 0.44 + 0.43CCTA$$

Where **CCTA** represents core capital to total assets.

The results of regression of efficiency on core capital to total assets reveal a significant regression equation (F (1,855) =37.57, p=0.000 and an R^2 of 0.0421. The predicted model efficiency is equal to 0.4443+0.4287 core capital to total assets. The null hypothesis for the study H_{01A}: There is no significant relationship between core capital to total assets and capital efficiency of DTSs in Kenya is therefore rejected. The R^2 of 0.0421 showed that 4% of capital efficiency can be explained by the aspect of core capital to total assets, the rest can be explained by factors not included in the model.

4.5.3 Relationship between Core Capital to Total Deposits and Efficiency

Thirdly, the study analyzed the relationship between core capital to total deposits and efficiency of DTSs in Kenya. Table 4.13 shows the results of the finding.

Table 4.13: Relationship between core capital to total deposit and efficiency

Anova

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.6007	1	1.6007	43.55	0.0000
Residual	31.4272	855	.0368		
Total	33.0279	856			
	R-squared	0.0485			
	Adjusted R-squared	0.0474			
	Root MSE	.1917			

t-test Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	T	Sig.
(Constant)	0.4676	.00951	.4489	49.14	0.000
CCTD	0.1768	.0268	.1242	6.60	0.000

a) Dependent Variable: Efficiency; Predictors: Core capital to total deposits

The functional model for this relationship was:

$$E_{it} = 0.47 + 0.18CCTD$$

Consequently, the results of regression of efficiency on core capital to total assets reveal a significant regression equation (F (1,855) =43.55, p=0.000 and an R^2 of 0.0485. The predicted model efficiency is equal to 0.4476+0.1768 core capital to total deposits. The null hypothesis for

the study H_{01A}: There is no significant relationship between core capital to total deposits and capital efficiency of DTSs in Kenya is therefore rejected. The R^2 of 0.0485 showed that 5% of capital efficiency can be explained by the aspect of core capital to total deposits, the rest can be explained by factors not included in the model.

4.5.4 Relationship between Institutional Capital to Total assets and Efficiency

Additionally, the study sought to analyze the influence of institutional capital to total assets on this relationship. The results are shown in table 4.14.

Table 4.14: Relationship between Institutional Capital to Total Assets and Efficiency

Anova

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.6834	1	2.6834	75.61	0.0000
Residual	30.3445	855	.0355		
Total	33.0279	856			
	R-squared	0.0812			
	Adjusted R-squared	0.0802			
	Root MSE	.1884			

t-test Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	T	Sig.
(Constant)	0.4609	.0088	.4436	52.33	0.000
ICTA	0.6312	.0726	.4887	8.70	0.000

a) Dependent Variable: Efficiency; Predictors: Institutional capital to total assets

The following is the functional model:

$$E_{it} = 0.46 + 0.63ICTA$$

From table 4.14, the results of regression of efficiency on institutional capital to total assets reveal a significant regression equation (F (1,855) =75.61, p=0.000 and an R^2 of 0.0802. The predicted model efficiency is equal to 0.4609+0.6312 institutional capital to total assets. The null hypothesis for the study H_{01A}: There is no significant relationship between institutional capital to

total assets and capital efficiency of DTSs in Kenya is therefore rejected. The R^2 of 0.0802 showed that 8% of capital efficiency can be explained by the aspect of institutional capital to total assets, the rest can be explained by factors not included in the model.

Lastly, the general objective of the study was to investigate the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. A multiple regression model was fitted combining all the capital adequacy requirements (Core capital, core capital to total assets, core capital to total deposits and institutional capital to total assets) to facilitate this analysis. A dummy variable was included to investigate the effect of core capital compliance on efficiency. The results for the overall regression model are shown in table 4.15.

Table 4.15: Model Summary and ANOVA table for the relationship between capital adequacy requirements and efficiency of DTSs

Anova

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	4.0597	5	0.8119	23.85	0
Residual	28.9682	851	0.0340		
Total	33.0279	856			
	R-squared	0.1229			
	Adjusted R-squared	0.1178			
	Root MSE	0.1845			

t-test Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	T	Sig.
(Constant)	0.4767	0.0408	0.3966	11.68	0.000
CC (Ksh. Trillion)	0.0000	9.38	2.75	4.9	0.000
CC/TA	-0.4909	0.1567	-0.7986	-3.13	0.002
CC/TD	0.1889	0.0465	0.0977	4.07	0.000
IC/TA	0.6638	0.1131	0.4420	5.87	0.000
Core capital dummy	-0.0041	0.0448	-0.0919	-0.09	0.928

a) Dependent Variable: Efficiency.
b) Predictors: (constant), core capital dummy, CC, CC/TA, CC/TD, IC/TA

In the overall objective, the model fitted was fairly good with a predictive power of 12.29 %(R-squared=0.1229) indicating that the variations in the dependent variable are accounted for by the

variations in the independent variable. However, 87.71% of variations in efficiency of DTSs are explained by variables not captured in the model. Further, the results show that the model had an F value of 23.85 with a p value of 0.000 thus resulting to rejection of the null hypothesis. An indication that the overall model is statistically significant.

Core capital ($\beta 1 = 0.00$, p-value < 0.05), core capital to total assets ($\beta 1 = -0.49$, p-value < 0.05), core capital to total deposits ($\beta 1 = 0.19$, p-value < 0.05) and institutional capital to total assets ($\beta 1 = 0.66$, p-value < 0.05) were found to have a significant relationship with the efficiency of DTSs at 5% significance level. However, a negative relationship between core capital to total assets and efficiency of DTSs was found despite being statistically significant. This meant that DTSs that were maintaining core capital to total assets ratio greater than 10% on average were 4.9% ($p < 0.000$) less efficient than their non-compliant counterparts.

Lastly, core capital dummy had a negative co-efficient of -0.004 with a p value of 0.928 which is greater than our significance level of 0.05. This indicates that core capital dummy had a negative but not significant relationship between capital adequacy requirements and efficiency of DTSs. Specifically; despite being not significant, DTSs that achieved compliance by maintaining a core capital of 10M and above were 0.04 less efficient compared to those DTSs not meeting the prescribed threshold of 10M holding other variables constant. This implies that achieving compliance by maintaining a core capital of 10M and above does not necessarily improves the efficiency of DTSs.

Therefore, it can be noted that efficiency of DTSs had a positive significant relationship with core capital, negative (-0.4909) significant relationship with core capital to total assets, positive (0.1889) significant relationship with core capital to total deposits and positive (0.6638) significant relationship with institutional capital to total asset ratio. This therefore means that capital adequacy requirements had a significant influence on the efficiency of DTSs. This finding could be attributed to the realization that this research was conducted at a period upon which all DTSs were required to have achieved full compliance.

The functional model for these findings was:

$$E_{it} = 0.48 + CC - 0.49CCTA + 0.19CCTD + 0.66ICTA - 0.004D$$

Where E_{it} is Efficiency, **CC** is core capital, **CCTA** is core capital to total assets ratio, **CCTD** is

core capital to total deposits ratio **ICTA** is institutional capital to total deposits ratio, **D** is dummy assuming two DTSs in should take 1 for DTSs meeting the core capital requirement of Ksh. 10 million and above and 0 for DTSs not meeting the core capital requirement of Ksh. 10 million.

4.6 The Moderating Effect of DTS Size on the Relationship between Capital Adequacy Requirements and Efficiency of DTSs

The next step in the analysis focused on measuring the moderating effect of DTS size on the relationship between capital adequacy requirements and efficiency of DTSs. Size of DTSs was measured using total assets. The study hypothesized that: $H_{02:}$ There is no significant moderating influence of DTS size on the relationship between capital adequacy requirements and efficiency of deposit taking SACCOs in Kenya.

4.6.1 Multiple regression for the relationship between capital adequacy requirements and efficiency of DTSs

The results for the first step are presented in table 4.15. The coefficient of determination (R^2) of 0.1229 showed that capital adequacy requirement (core capital, core capital to total assets ratio, core capital to total deposits ratio and institutional capital to total assets ratio) on their own, have an explanatory power extend to 12.3% to the change in efficiency of DTSs in Kenya.

4.6.2 Interaction of moderator in multiple regression model for the relationship between capital adequacy requirements and efficiency of DTSs

The second step is the introduction of size (total assets) as an independent variable. The following equation was fitted:

$$E_{it} = \alpha_{it} + \beta_1 D_{it} + \beta_2 C1_{it} + \beta_3 C2_{it} + \beta_4 C3_{it} + \beta_5 C4_{it} + \beta_6 T_{it} + \varepsilon_{it} \quad \text{..... (Table 4.16)}$$

Where $\boldsymbol{C1}$ represents core capital, $\boldsymbol{C2}$ represents core capital to total assets, $\boldsymbol{C3}$ represents core capital to total deposits, $\boldsymbol{C4}$ represents institutional capital to total assets and $\boldsymbol{T}$ represents the DTS size.

The results are shown in table 4.16

Table 4.16: Model Summary and ANOVA Table for the Moderator as a Predictor

Anova					
Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	4.3822	10	0.4382	14.2	0
Residual	23.2306	847	0.0385		
Total	33.0279	857			
	R-squared	0.1587			
	Adjusted R-squared	0.1475			
	Root MSE	0.1756			

t-test Coefficients		
	Unstandardized Coefficients	Standardized Coefficients

Variable	B	Std. Error	Beta	T	Sig.
(Constant)	0.7811	0.0991	0.5865	7.88	0.000
CC(Ksh. Trillions)	0.0000	0.0000	5190	6.3	0.000
CC/TA	-0.3801	0.1602	-0.6947	-2.37	0.018
CC/TD	0.1844	0.0485	0.0892	3.8	0.000
IC/TA	0.5179	0.1169	0.2884	4.43	0.000
Core capital dummy	-0.0219	0.0457	-0.1116	-0.48	0.631
Size	-0.0133	0.0040	-0.0211	-3.36	1

a) Dependent Variable: Efficiency.
b) Predictors: (constant), core capital dummy, CC, CC/TA, CC/TD, IC/TA
c) Predictors: (constant), core capital dummy, CC, CC/TA, CC/TD, IC/TA, Size

On adding DTS size as an independent variable to the model, found to be significant (F (10, 847) = 14.2, p =0.000). The nature of the correlation between capital adequacy requirements and efficiency of DTSs in Kenya changed, table 4.15 indicates that the, R^2 before the introduction of DTS size was 0.1229. However, upon the introduction of DTS size as predictor, the R^2 significantly changed from 12.3% to 15.9 % (table 4.16) an increase of 3.6% this means that capital adequacy requirements and DTS size can explain up to 15.9% of the efficiency of DTSs in Kenya.

4.6.3 DTS size moderated multiple regression for the relationship between capital adequacy requirements and efficiency of DTSs

Lastly, DTS size was introduced to the model as an interaction variable. The following equation was fitted:

$$E_{it} = \alpha_{it} + \beta_1 D_{it} + \beta_2 C1_{it} + \beta_3 C2_{it} + \beta_4 C3_{it} + \beta_5 C4_{it} + \beta_6 T_{it} + \beta_7 C1_{it}(T_{it}) + \beta_8 C2_{it}(T_{it}) + \beta_9 C3_{it}(T_{it}) + \beta_{10} C4_{it}(T_{it}) + \varepsilon_{it}$$

…….. (Table 4.17)

Table 4.17 demonstrates the outcomes of regression analysis for the interaction effect of DTS size.

Table 4.17: Model Summary and Anova Table for the Moderating Effect

Anova

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	6.0927	6	1.0155	28.15	0
Residual	30.3351	841	0.0361		
Total	36.4278	857			

R-squared	0.2182
Adjusted R-squared	0.2131
Root MSE	0.1845

t-test Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	T	Sig.
(Constant)	1.1658	0.2082	0.7570	5.6	0.000
CC (Ksh. Trillions)	0.0000	117	360	-1.11	0.268
CC/TA	-1.0811	2.0775	-5.1595	-0.52	0.603
CC/TD	-0.8858	0.6612	-2.1839	-1.34	0.181
IC/TA	1.8108	1.5944	-1.3192	1.14	0.256
Core capital dummy	-0.0176	0.0454	-0.1068	-0.39	0.698
Size	-0.0303	0.0040	-0.0480	-3.36	0.001
CC*Size	0.0000	0.0000	12,400	1.72	0.086
CC/TA*Size	0.0282	0.0911	-0.1506	0.31	0.757
CC/TD*Size	0.0478	0.0292	-0.0096	0.0292	0.102
IC/TA*Size	-0.0554	0.0695	-0.1920	-0.8	0.426

a) Dependent Variable: Efficiency.
b) Predictors: (constant), core capital dummy, CC, CC/TA, CC/TD, IC/TA, Size, CC*Size, CC/TA*Size, CC/TD*Size, IC/TA*Size

With the addition of the interaction term**,** the model further improved. The overall predictive power (R-Square) of the model improves by5.9 % from the initial adjusted R^2 of 14.8 percent to a new high of 21.8% (table 4.17). The model was also found to be significant (F (6, 841) = 28.15, p =0.000). Introducing DTS size to moderate capital adequacy requirements will significantly impact efficiency negatively, since Sig P<0.05 at step 3 and incremental deviation is positive. This implied that *T* (DTS Size) has some predictive value, but negatively moderates the relationship between capital adequacy requirements and their efficiency. This means that one unit of DTS size deceases efficiency index by 0.03. Further, the increases in the equation predictive power of DTS size by 5.9% is consistent stepwise, where increase is 12.3% in step one, 3.6% in

step 2 and 5.9% in step three. The results of the multiple regression analysis gives evidence that while DTS size is a predictor of the relationship between capital adequacy requirements and their efficiency, it also significantly moderates the relationship.

Table 4.18 presents the R square summary table indicating R square change for the hierarchical moderation steps.

Table 4.18: Summary of R-Square

Equation/ Model	R Square	Adjusted R Square	R Square Change	Std. Error of the Estimate	Sig. F Change
Model for step 1	0.1229	0.1178	.1229	4.0596	0.000
Model for step 2	0.1587	0.1475	.0358	4.3822	0.000
Model for step 3	0.2182	0.2131	.0595	6.0927	0.000

As shown in table 4.18, the R^2 increased significantly (R^2 = 15.9 %, p value= 0.000) on adding DTS size as predictor of the equation. With the introduction of the interaction term to the model, the equation increased but was still significant, revealing (R^2= 21.8%, p value= 0.000). This indicated that T (DTS size) has some predictive value and it enhances the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. As the value of interaction term is significant and R^2 change is also significant, is an indication that the null hypothesis (H_{02}) is rejected and concluded that there is a significant and enhancing moderating influence of DTS size on the correlation amidst capital adequacy requirements and efficiency of DTSs.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter highlights the discussions; summary of major findings of the study; conclusions; and, the recommendations. The summary was done in line with the objectives of the research based on the output of statistical analyses guided by test of the research hypothesis of the study.

5.2 Discussion of Results

This section provides the relevant discussions of the various outcomes for each objective considering the literature review. The study sought to evaluate the efficiency of DTSs in Kenya; establish the effect of capital adequacy requirements on capital efficiency of DTS; and, investigated the moderating influence of DTS size on capital adequacy requirement and capital efficiency of DTS in Kenya.

5.2.1 Measuring Efficiency of DTSs in Kenya

DEA approach yields efficiency scores that ranges from 0 and 1. This study consisted of six variables: total deposits operating expenses and external borrowing were DEA inputs while total assets, total loans and net income after tax were DEA outputs. The study findings indicated that there was a moderate upsurge in efficiency over the study period. The study found efficiency scores for DTSs over the study period to range from 0.22 to 1 reflecting a fairly average efficiency of 0.51.

On DEA findings, related studies have adopted similar methodology in research works such as by (Ahmad & Razali, 2017) who assessed the determinants of efficiency of Islamic Banks. This study employed DEA approach using two inputs (fixed assets and deposits) and one output

(financing income). In their study they found a mean efficiency of 0.76, with efficiency scores ranging from 0.61 to 0.96.This was a case where the Islamic banks performed well their financial intermediary role despite their incapability of entering large markets which influenced their ability to transform their inputs into outputs. (Nand & Singh, 2014) studied the technical and scale efficiency of banks in India and compared the efficiency of public and private sector banks. The study considered three inputs (deposits, number of employees and operating expenses) and three outputs (investments, other incomes and advances). Their study found mean efficiency of public sector banks to be 0.95 while that of private sector banks was 0.98. They concluded that the performance of private sector banks was better than those in the public sector.

Waweru, Wanjau, Waweru and Kinyanjui (2017) studied efficiency levels of SMEs in the manufacturing sector, comparing it with that of SACCOs in Kenya. Using DEA approach, production costs, labour costs, operating expenses and finance costs were used as inputs while production, gross profit, return on investment and dividends as outputs. They found that the SMEs had a mean efficiency of 0.92 which was higher compared to those of SACCOs. Mirie (2014) on the other hand explored how the income of members and behavior of SACCOs influenced the efficiency of DTSs in Kenya. Similarly, DEA approach was employed to evaluate efficiency using member deposits and borrowings as the inputs while outputs were loans to members and other earning asset. In his study Mirie (2014) found a mean of 0.775, standard deviation of .095, with minimum of 0.555 and maximum of 1 efficiency in the SACCOs in Kenya. In addition, Njoroge (2013) in studied the determinants of efficiency of SACCOs in Nairobi County. DEA approach was applied where the inputs of the study were savings and total expenses while the outputs being loans and total income. From the findings, the SACCOs had an

average efficiency of 0.639 with a standard deviation of 0.135. He concluded that the SACCOs were generally operating above average under the period of study.

In the context of the current findings, the focus was on the efficiency of DTSs in relation to capital adequacy requirements. Over the five year period, the mean capital efficiency of the sampled DTSs was 0.51. Comparing to the findings of (Ahmad & Razali, 2017), (Nand & Singh, 2014) and (Waweru *et* al., 2017) who studied the efficiency of banks and SMEs in manufacturing sector respectively, it can be concluded that banks could be relatively better in terms of efficiency compared to DTSs. Mirie, (2014) who determined the relationship between SACCO characteristics (size, age, bond of association and managerial competency) and efficiency of all the regulated SACCOs in Kenya for a five year period found a mean efficiency of 0.775. This study was focusing on all the regulated SACCOs in Kenya, by comparing their findings with the current study it can be seen that that the DTSs were fairly efficient under the period of study. Further, Njoroge (2013) did a study on the determinants of efficiency of SACCOs in Nairobi County using the same methodology found a mean efficiency 0.639. His study focused only on DTSs within Nairobi County thus his findings cannot be conclusively used to generalize the findings of the current study. On average, the efficiency scores derived from all the DTSs under the study period were not satisfying. This could mean that on average the SACCO sub sector is operating below the desired level of efficiency.

Further, by classifying DTSs into two categories; those that meet the core capital of 10 Million and above and those DTSs not meeting the prescribed threshold, multiple regression model was estimated. From the results, compliance with the core capital of 10 Million and above had a

negative insignificant influence on the efficiency of DTSs. This implies that achieving compliance by meeting the core capital of 10 Million and above does not necessarily improves efficiency. Consequently, DTSs having a core capital of 10 Million and above have excess funds liquidity than they should hold. DTSs on average already hold capital levels excess of the minimum requirement. Holding of these idle funds and simultaneously imposing the capital adequacy requirements could raise questions on the financial implication as to the efficiency of DTSs. First, the use of strict capital regulations on DTSs hinders their ability to use inputs in optimal proportions to allocate their scarce inputs in situations that could generate higher returns. Stringent regulations comes with a cost on the economy as DTSs will try to pass on to their members the higher cost of funding.

According to Caggian & Calice (2011) , the subsequent cost would decrease the degree of utilization and interest in the economy. This, would therefore, results to lower returns. Secondly, holding too much idle funds may imply inefficient utilization of resources. Excess liquidity results to idle resources with no returns and increases costs of retaining it in DTSs. This undermines the efficiency of DTSs by not availing funds necessary for efficient service provision of the sector. According to (SASRA, 2015) meeting the liquidity ratios is an indication that DTSs are able to meet their short term obligations, a situation which is contrary to the current findings. The relationship between liquidity and efficiency may be expected to be positive because more liquid DTSs are able to provide loans on demand by members without delay (Odunga et al., 2013). In conclusion, the benefits associated with high capital and liquidity requirements could be minimal. SASRA issued prudential guidelines with the intention to safeguard member deposits and creditors from losses arising from corporate risks that the DTSs

may face however, achieving compliance above the prescribed limit could be counterproductive and tends to lower efficiency of DTSs. The study hypothesized that Majority of DTSs in Kenya do not meet the average threshold of capital efficiency where average efficiency was defined as 0.5. The study's results did not support this hypothesis. DTSs with capital efficiency scores below 0.5 were not statistically different from those with capital efficiency scores above 0.5.

5.2.2 Relationship between Capital Adequacy Requirements and Efficiency of DTSs

The capital adequacy requirements were measured as; core capital of Ksh. 10 million or more, core capital to total assets at 10%, core capital to total deposits at 8% and institutional capital to total assets at 8%. On running the bivariate analysis, the study findings showed that efficiency of DTSs had a positive significant relationship with core capital(CC),positive significant relationship with core capital to total assets (CCTA), positive significant relationship with core capital to total deposits(CCTD) and positive significant relationship with institutional capital to total asset ratio(ICTA). The four capital ratios did not portray a major challenge to most of the DTSs under the study period. A majority of them met the required ratios. This could be attributed to the fact that the study focused on DTSs post the implementation period upon which all DTS were supposed to have attained full compliance.

The findings also indicate that the capital buffer theory may be applicable to DTSs in Kenya. The theory predicts that financial institutions approaching the monitoring minimum capital ratio might have to boost capital and reduce risk in order to avoid regulatory costs caused by a breach of capital requirements (Calem & Rob 1996). It predicts that the behavior of financial institutions depends on the size of their capital buffer: banks with high capital buffers will aim at maintaining their capital buffers while banks with low capital buffers will aim at rebuilding an

appropriate capital buffer. Evidently, DTSs in Kenya have built up buffer capital which would make them hold distinct levels of capital.

Consistently with other studies, the empirical findings shows a positive significant relationship with efficiency of DTSs in Kenya. This study supports the findings of Pessarossi & Weill (2013) who studied the relationship between capital ratio and bank efficiency Chinese banks using the stochastic frontier approach. This was the period when capital adequacy requirements were implemented in their country. They found out that there is a positive and significant relationship between capital ratio and bank operating efficiency. They provided evidence that banks with higher capital ratios have greater efficiency. Their study showed that capital adequacy requirements strengthen financial stability by providing larger a capital buffer and improves banks efficiency. This upholds the capital buffer theory which holds that banks would prefer to hold buffer of excess capital to lower the probability of falling below the prescribed statutory requirement and signify their financial stability (Calem & Rob, 1996).

Similarly, all DTSs in Kenya are required to align their policies and operating systems to the regulatory requirements before they could be licensed to operate (SASRA, 2012). Under these regulations, DTSs were mandated to appraise and align their strategies and operating systems to the monitoring requirements as a way of enhancing the prudent management of credit, operational, market and legal risks before SASRA could license them to operate. This means that DTSs should work towards complying with the capital adequacy requirement so as to promote sound financial system.

Lotto (2018) studied on the effect of capital adequacy requirement on bank's operating efficiency in Tanzania during the transitional period when banks were implementing the regulatory requirement. Applying random-effect regression model, their findings showed a significant correlation between capital ratio and bank operational efficiency. They found out that Tanzanian commercial banks proved to be more efficient when placed under more rigorous capital regulations. Strict capital regulations improved operating efficiency. An indication that the intensified guidelines on capital requirements impact the bank's choice to revisit their operating strategies. In the case of DTSs in Kenya, this adjustment of capital adequacy requirements from the regulator often accompanied with penalties of revocation of licenses, may have forced DTSs to comply with requirement. Non-adherence to the capital guidelines is regarded a key non-compliance of regulations issued by SASRA.

Murkomen (2016), on the other hand, examined the impacts of capital requirements on operating efficiency of banks in Kenya using fixed effects regression model. She found out that showed that capital adequacy requirement was one of the factors influencing operational efficacy of commercial banks in Kenya. The outcomes of the study further showed that the more prominent the core capital of a bank, the higher the operating efficiency. Consequently, DTSs in Kenya are required to build up sufficient capital that can reasonably cushion member deposits and creditors from losses and the continuity of the SACCO is assured.

In the multivariate model where all the independent variables were run concurrently; core capital, core capital to total deposits and institutional capital to total assets were found to have a positive significant relationship with efficiency. However, the results on negative but significant

relationship between core capital to total assets and efficiency were inconsistent with the results of bivariate analysis. This means that the DTSs that maintained the capital ratio of 10% were less efficient compared to the non-compliant DTSs. For instance, one percent increase in core capital to total assets is associated with a decrease of efficiency by forty nine percent. This could mean that by maintaining high capital ratios, DTSs would be constrained. They would lock up funds that would have been loaned out and invested for higher yields. In this case; DTSs tend to lend less, charge more loans and pay less on deposits as a way to maintain an acceptable return on the larger capital base(Gudmundsson, Ngoka-Kisinguh & Odongo, 2013). This implies that high capital ratios are likely to be associated with lower returns which negatively influence the efficiencies of DTSs. Contrary to the theories supporting capital adequacy and existing empirical evidence where a positive influence was expected, in other studies, compliance with the prescribed capital requirements ratio also had a statistically negatively influence on efficiency.

The current findings are similar to that of (Biwott *et* al., 2018) who carried out a study on the influence of capital adequacy requirements on technical efficiency of DTS in Kenya using the same methodology. In their study, they found that maintaining core capital to total assets ratio greater than 10% had a negative influence on the efficiency of DTSs. They concluded that meeting or exceeding the prescribed ratio of 10% was a hindrance to the efficient allocation of resources by DTSs. Strict capital regulations has negative influence on the allocation decisions of DTS managers leading to lower technical efficiencies. Regulators therefore, may be required to review capital adequacy ratio in the interest of setting the most favourable measure that guarantee's safety of members deposits while maximizing on growth and capital efficiency.

5.2.3 Moderation Effect of DTS Size on the Relationship between Capital Adequacy Requirements and Efficiency

To accomplish objective three of this study, a three-stage process were performed on the variables. The first stage involved use of multiple linear regression, the next step was to establish the interaction effect of the moderating variable and lastly involved the size moderated multiple linear regression model for efficiency on capital adequacy requirements. Findings of the study indicated there is a significant and enhancing moderating effect of DTS size on the relationship between capital adequacy requirements and efficiency of DTSs. This confirms that DTS size moderates the relationship between capital adequacy requirements and efficiency of DTSs and it has negative but significant effects on efficiency of DTSs. Moreover, it is worth noting that despite the enhancing moderating effect of DTS size on the relationship between capital adequacy requirements and efficiency of DTSs, the negative coefficient of size means that a unit increase in size was associated with a decrease in efficiency by 0.0303 units despite being significant.

The results suggest that DTSs in Kenya have fully optimized their scale of operation. Continued expansion would therefore be lowering efficiency. Intuitively, we can expect smaller DTSs to generate inefficiency scores lower than those of larger DTSs. This was contrary to the expected positive influence of size on the resulting efficiencies as advocated by the Economic Efficiency theory which underlines the importance of the principle of economies of scale in efficiency measurement (Debreu, 1951). It would be expected that larger DTSs will be more efficient than the smaller DTSs due to economies of scale. While DTS size based on total assets may be seen as a source of efficiency by the proponents of economies of scale theory, it is however evident

that it does not positively moderates the relationship between regulation and efficient utilization of resources in the DTS context.

The findings support that of Razmi et al., 2014 who studied the effect of firm size on the efficiency in the firms of Tehran Stock Exchange. They found a negative significant relationship between efficiency and the size of firm. They provided evidence that the larger the company, the more its efficiency decreases. The largest firms appeared to be less efficient than the small firms. Similarly, (Aggrey et al., 2010) in their study of the relationship between firm size and technical efficiency in East Africa manufacturing firms found a negative significant association between firm size and technical efficiency . They argued that small firms are more efficient than large firms because of their flexibility and simplicity of organizational structures and decision making process. They concluded that small firms benefit from less regulatory obstacles.

However, Karray & Chichti (2013) disagreed these arguments in their study on the effect of bank size on technical efficiency commercial banks in developing countries. Their findings showed an inverse relationship between efficiency and the size of banks. They found that large banks are more efficient than small banks. The small banks were struggling from serious problems of technical inefficiency (converting inputs to outputs) which resulted to a total average waste of resources that exceeded 46% of their actually levels. Moreover, the study of Papanikolaou & Delis (2009) provides empirical evidence on the existence of a positive and significant relationship between bank size and bank efficiency EU countries. They establish that large banks are able to hire more efficient managers who succeed in their attempt to establish scale and scope economies. Their point of argument was that large banks are able to develop technical, financial,

better market experience, diversification of customer base and resources hence enhancing their efficiency.

Further, by moderating the relationship between capital adequacy requirements and efficiency of DTSs, the model did not generate significant changes in the coefficient of the core capital dummy .It was still not statically insignificant with an inverse relationship on the relationship. This meant that as DTS size increases, larger compliant DTS did not enjoy better capital efficiency than the small non-compliant DTSs. This was in contrary to the expected significant positive influence of size on the resulting efficiencies as advanced by the proponents of economies of scale theory as discussed earlier in the previous findings.

5.3 Summary of Findings

The next section of the chapter presents summary of findings.

5.3.1 Efficiency of DTSs in Kenya

The research examined the relationship between capital adequacy requirements and efficiency of DTSs in Kenya for the period 2004-2018. The efficiency scores of the DTSs in Kenya ranged from 0.22 to 1 with an average efficiency of 0.51. The study found that the DTSs were fairly efficient under the period of study. This could suggest that these DTSs were struggling to produce more outputs than the inputs they had. Further, the findings revealed that core capital dummy had a negative insignificant influence on the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. Stringent capital regulations tends to dis-enhance efficiency of the DTSs. This is an indication that compliance with the prescribed capital adequacy requirements by DTSs is negatively affecting the resulting efficiency of DTSs in Kenya.

5.3.2 Relationship between Capital Adequacy Requirements and Efficiency of DTSs in Kenya

The study investigated the relationship between capital adequacy requirements on the efficiency of DTSs in Kenya. The results showed that efficiency of DTSs had a positive significant relationship with core capital, negative significant relationship with core capital to total assets, positive significant relationship with core capital to total deposits and positive significant relationship with institutional capital to total asset ratio. Such a significant relationship may be attributed to the fact that this study was carried out at a period upon which all DTSs had achieved full compliance. The results were counter intuitive as core capital to total assets had a negative significant relationship with efficiency of DTSs. DTSs that were maintaining core capital to total assets ratio greater than 10% on average were 49% ($p< 0.000$) less efficient than their non-compliant counterparts holding all other factors constant.

The results of the core capital dummy had a negative but not significant effect on the relationship between capital adequacy requirements and efficiency of DTSs. An indication that DTSs meeting the core capital of 10M and above did not enjoy better efficiency compared to those DTSs not meeting the prescribed threshold despite not being significant. With the current findings, stringent capital regulations hinders efficiency as it translates to more funds and increased liquidity. Holding of these idle funds has implications as to the efficiency of the financial intermediation process of the DTSs in Kenya. Therefore, intensified guidelines on capital requirements could be an indication that majority of the DTSs are at a better position of achieving the prescribed core capital by the regulator while lessening capital adequacy requirements could be efficiency enhancing.

5.3.3 Moderating effect of DTS Size on the Relationship between Capital Adequacy Requirements and Efficiency

The study investigated the moderating effect of DTS size on the relationship between capital requirements and efficiency of DTSs in Kenya. Logarithm of total assets was used as a measure of size in the study. The results indicated that there is a significant and enhancing moderating effect of DTS size on the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. The results were counter intuitive as core capital dummy had a negative insignificant relationship with efficiency of DTSs. As DTS size increases, larger compliant DTS did not enjoy better capital efficiency compared to the small non-compliant DTSs. This means that irrespective of size the benefits of regulation will accrue to both large and small DTSs. While large DTSs have higher access to resources and better market experience through economies of scale, smaller DTSs have the other tradeoffs in terms of simplicity of organizational structures and decision making process.

5.4 Conclusions

The research explored the relationship between capital adequacy requirements on the efficiency of DTSs in Kenya. In the first stage efficiency scores were generated using the DEA approach, the outcomes revealed that there had been a moderate increase in efficiency over the study period. These DTSs were found to be fairly efficient with an average efficiency of 0.51. This implies that on average the DTSs sector is operating below the desired efficiency. The core capital dummy had a negative insignificant relationship with efficiency holding other factors constant .The study therefore concluded that subjecting of capital requirements for the DTSs does not translate to better efficiency. The strict capital regulations did not lead to better

transformation of inputs (total deposits, operating expenses and external borrowing) to outputs (total assets, total loans and net income after tax).

In the second stage of study, the examination tried to analyze the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. In particular, the examination zeroed in on core capital, core capital to total assets, core capital to total deposits and institutional capital to total assets. The study found a positive significant relationship with core capital, core capital to total deposits and institutional capital to total assets while core capital to total assets had a negative significant relationship. In the case of core capital to total assets the relation was found to be indirect implying that as core capital to total assets ratio increases, efficiency of a DTSs decreases. The results were counter intuitive and may be explained by the fact that through capital regulation, the DTSs pursue a double bottom line in assuring safety of member's deposits while maximizing on their efficiency. Complying with the capital adequacy requirements indicates less provision while achieving compliance tends to lower efficiency. The level of pressure is often more on DTSs that are non-compliant and less for highly capitalized entities that have shown consistency in compliance. The study therefore concluded that DTSs must focus on administration of a capital optimization approach to manage regulatory framework and guarantee safety of members' deposits.

Lastly, on the moderating effect of DTS size the study concluded that DTS size a significant and enhancing moderating effect of DTS size on the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. Despite the enhancing moderating effect, DTS size has an inverse relationship between capital adequacy requirements and efficiency of DTSs. Evidently, DTS size denotes a significant impact on the manner capital adequacy requirements

set for DTS influences the resulting efficiency. It can be concluded that larger DTSs did not enjoy better efficiency compared to the smaller DTSs.

5.5 Recommendations of the Study

Based on the objectives of the study, the following recommendations were reached.

First, the study sought to evaluate the efficiency of DTSs in Kenya. The study found that on average the DTSs were fairly efficient. The study recommends that the regulator should not only focus on strengthen the capital requirements as a basis of ranking the DTSs financial stability. However, they should also focus on activities that assure quality especially in the use of inputs to produce outputs. The policy focus should be on how to enable DTSs to gather inputs and covert it to outputs using the least amount of resources. At the same time, the safety of members' deposits should be guaranteed.

Secondly, the study analyze the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. The goal of the regulator ought not to be to set capital requirements in a manner that dispenses with the probability of failure, but instead to adjust on safeguarding member's deposit through prudent management and optimizing on their efficiency. This study therefore recommends the regulator to re-examine the capital adequacy requirements in the interest of establishing the most optimal levels that guarantee's safety of member's deposits while optimizing on efficiency.

Lastly, the study analyzed the moderating effect of DTS Size on the relationship between capital adequacy requirements and efficiency. The study found that DTS size negatively moderates the

relationship between capital adequacy requirements and efficiency of DTSs. Empirical evidence suggests that larger compliant DTS did not enjoy better efficiency than small DTS. This means that the large DTSs did not benefit from the economies of scale. It is therefore recommended that the regulator should subject all DTSs irrespective of their size to a common regulatory framework.

5.6 Suggestions for Further Research

This study focused on the relationship between capital adequacy requirements and efficiency of DTSs in Kenya. The study was limited to capital adequacy ratios only and it neglected many other variables that influence efficiency of DTSs. Therefore, future researches can include such variables as liquidity ratios, and asset quality ratios. Since the research compared minimum the capital adequacy ratio only, further research can be done using other ratios to see if effectiveness will remain the same. This may also result to an improved R square. Additionally, this study is based on secondary data collected from annual reports from SASRA for the period 2014-2018, a further study is recommended to include primary data. Secondary data may not be strictly accurate and comparable even if audited. Further, this study focused on only SACCOs regulated by SASRA. No studies has been done to assess the efficiency of the rest of cooperatives operating in Kenya under the supervision of the Ministry of Industrialization and Enterprise Development.

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APPENDICES

Appendix I: Secondary Data Collection Sheet

Secondary data for all the DTSs as at 2017 were considered as follows:

Name of the SACCO……

Date Licensed…….

		2014		2015…		2016		2018	
Inputs	Total Deposits	Jan	Feb…	Jan	Feb…	Jan	Feb…	Jan	Feb…
	External Borrowing								
	Operating Expenses								
Output	Net Income after tax								
	Total Assets								
	Total loans								
Capital adequacy Requirements	Core capital of net less 10 million								
	Core capital to total assets ratio-10%								
	Core capital to total deposits ratio-8%								
	Institutional Capital to total deposits ratio-8%								

Appendix II: List of Licensed Deposit-Taking SACCOs in Kenya

S/NO.	NAME OF SACCOs
1	2NK SACCO SOCIETY LTD
2	AFYA SACCO SOCIETY LTD
3	AGRO-CHEM SACCO SOCIETY LTD
4	ALL CHURCHES SACCO SOCIETY LTD
5	ARDHI SACCO SOCIETY LTD
6	ASILI SACCO SOCIETY LTD
7	BANDARI SACCO SOCIETY LTD
8	BARAKA SACCO SOCIETY LTD
9	BARATON UNIVERSITY SACCO SOCIETY LTD
10	BIASHARA SACCO SOCIETY LTD
11	BINGWA SACCO SOCIETY LTD
12	BORESHA SACCO SOCIETY LTD
13	CAPITAL SACCO SOCIETY LTD
14	CENTENARY SACCO SOCIETY LTD
15	CHAI SACCO SOCIETY LTD
16	CHUNA SACCO SOCIETY LTD
17	COSMOPOLITAN SACCO SOCIETY LTD
18	COUNTY SACCO SOCIETY LTD
19	DAIMA SACCO SOCIETY LTD
20	DHABITI SACCO SOCIETY LTD
21	DIMKES SACCO SOCIETY LTD
22	DUMISHA SACCO SOCIETY LTD
23	EGERTON SACCO SOCIETY LTD
24	ELGON TEACHERS SACCO SOCIETY LTD
25	ELIMU SACCO SOCIETY LTD
26	ENEA SACCO SOCIETY LTD
27	FARIDI SACCO SOCIETY LTD
28	FARIJI SACCO SOCIETY LTD

29	FORTUNE SACCO SOCIETY LTD
30	FUNDILIMA SACCO SOCIETY LTD
31	GASTAMECO SACCO SOCIETY LTD
32	GITHUNGURI DAIRY & COMMUNITY SACCO SOCIETY LTD
33	GOODWAY SACCO SOCIETY LTD
34	GUSII MWALIMU SACCO SOCIETY LTD
35	HARAMBEE SACCO SOCIETY LTD
36	HAZINA SACCO SOCIETY LTD
37	IG SACCO SOCIETY LTD
38	ILKISONKO SACCO SOCIETY LTD
39	IMARIKA SACCO SOCIETY LTD
40	IMARISHA SACCO SOCIETY LTD
41	IMENTI SACCO SOCIETY LTD
42	JACARANDA SACCO SOCIETY LTD
43	JAMII SACCO SOCIETY LTD
44	JITEGEMEE SACCO SOCIETY LTD
45	JUMUIKA SACCO SOCIETY LTD
46	KAIMOSI SACCO SOCIETY LTD
47	KATHERA RURAL SACCO SOCIETY LTD
48	KENPIPE SACCO SOCIETY LTD
49	KENVERSITY SACCO SOCIETY LTD
50	KENYA ACHIEVAS SACCO SOCIETY LTD
51	KENYA BANKERS SACCO SOCIETY LTD
52	KENYA CANNERS SACCO SOCIETY LTD
53	KENYA HIGHLANDS SACCO SOCIETY LTD
54	KENYA MIDLAND SACCO SOCIETY LTD
55	KENYA POLICE SACCO SOCIETY LTD
56	JOINAS SACCO SOCIETY LTD
57	KIMBILIO DAIMA SACCO SOCIETY LTD
58	KINGDOM SACCO SOCIETY LTD

59	KIPSIGIS EDIS SACCO SOCIETY LTD
60	KITE SACCO SOCIETY LTD
61	KITUI TEACHERS SACCO SOCIETY LTD
62	KMFRI SACCO SOCIETY LTD
63	KOLENGE TEA SACCO SOCIETY LTD
64	KONOIN SACCO SOCIETY LTD
65	KORU SACCO SOCIETY LTD
66	KWALE TEACHERS SACCO SOCIETY LTD
67	KWETU SACCO SOCIETY LTD
68	K-UNITY SACCO SOCIETY LTD
69	LAMU TEACHERS SACCO SOCIETY LTD
70	LAINISHA SACCO SOCIETY LTD
71	LENGO SACCO SOCIETY LTD
72	MAFANIKIO SACCO SOCIETY LTD
73	MAGADI SACCO SOCIETY LTD
74	MAGEREZA SACCO SOCIETY LTD
75	MAISHA BORA SACCO SOCIETY LTD
76	MARSABIT TEACHERS SACCO SOCIETY LTD
77	MENTOR SACCO SOCIETY LTD
78	METROPOLITAN NATIONAL SACCO SOCIETY LTD
79	MILIKI SACCO SOCIETY LTD
80	MMH SACCO SOCIETY LTD
81	MOMBASA PORT SACCO SOCIETY LTD
82	MUDETE TEA GROWERS SACCO SOCIETY LTD
83	OLLIN SACCO SOCIETY LTD
84	MURATA SACCO SOCIETY LTD
85	MWALIMU NATIONAL SACCO SOCIETY LTD
86	MWIETHERI SACCO SOCIETY LTD
87	MWINGI MWALIMU SACCO SOCIETY LTD
88	MUKI SACCO SOCIETY LTD

89	MWITO SACCO SOCIETY LTD
90	NACICO SACCO SOCIETY LTD
91	NAFAKA SACCO SOCIETY LTD
92	NANDI FARMERS SACCO SOCIETY LTD
93	NANYUKI EQUATOR SACCO SOCIETY LTD
94	NAROK TEACHERS SACCO SOCIETY LTD
95	NASSEFU SACCO SOCIETY LTD
96	NATION SACCO SOCIETY LTD
97	NAWIRI SACCO SOCIETY LTD
98	NDEGE CHAI SACCO SOCIETY LTD
99	NDOSHA SACCO SOCIETY LTD
100	NG'ARISHA SACCO SOCIETY LTD
101	NOBLE SACCO SOCIETY LTD
102	NRS SACCO SOCIETY LTD
103	NUFAIKA SACCO SOCIETY LTD
104	NYAHURURU UMOJA SACCO SOCIETY LTD
105	NYALA VISION SACCO SOCIETY LTD
106	NYAMBENE ARIMI SACCO SOCIETY LTD
107	NYATI SACCO SOCIETY LTD
108	NEW FORTIES SACCO SOCIETY LTD
109	ORIENT SACCO SOCIETY LTD
110	PATNAS SACCO SOCIETY LTD
111	PRIME TIME SACCO
112	PUAN SACCO SOCIETY LTD
113	QWETU SACCO SOCIETY LTD
114	RACHUONYO TEACHERS SACCO SOCIETY LTD
115	SAFARICOM SACCO SOCIETY LTD
116	SHERIA SACCO SOCIETY LTD
117	SHIRIKA SACCO SOCIETY LTD
118	SIMBA CHAI SACCO SOCIETY LTD

119	SIRAJI SACCO SOCIETY LTD
120	SKYLINE SACCO SOCIETY LTD
121	SMART CHAMPIONS SACCO SOCIETY LTD
122	SMART LIFE SACCO SOCIETY LTD
123	SOLUTION SACCO SOCIETY LTD
124	SOTICO SACCO SOCIETY LTD
125	SOUTHERN STAR SACCO SOCIETY LTD
126	SHOPPERS SACCO SOCIETY LTD
127	STAKE KENYA SACCO SOCIETY LTD
128	STIMA SACCO SOCIETY LTD
129	SUKARI SACCO SOCIETY LTD
130	SUBA TEACHERS SACCO SOCIETY LTD
131	SUPA SACCO SOCIETY LTD
132	TAI SACCO SOCIETY LTD
133	TAIFA SACCO SOCIETY LTD
134	TARAJI SACCO SOCIETY LTD
135	TEMBO SACCO SOCIETY LTD
136	TENHOS SACCO SOCIETY LTD
137	THAMANI SACCO SOCIETY LTD
138	TRANSCOUNTIES SACCO SOCIETY LTD
139	TRANS NATION SACCO SOCIETY LTD
140	TIMES U SACCO SOCIETY LTD
141	TOWER SACCO SOCIETY LTD
142	TRANS- ELITE COUNTY SACCO SOCIETY LTD
143	UFANISI SACCO SOCIETY LTD
144	UCHONGAJI SACCO SOCIETY LTD
145	UKRISTO NA UFANISI WA ANGALICANA SACCO SOCIETY LTD
146	UKULIMA SACO SOCIETY LTD
147	UNAITAS SACCO SOCIETY LTD
148	UNI-COUNTY SACCO SOCIETY LTD

149	UNITED NATIONS SACCO SOCIETY LTD
150	UNISON SACCO SOCIETY LTD
151	UNIVERSAL TRADERS SACCO SOCIETY LTD
152	VIHIGA COUNTY FARMERS SACCO SOCIETY LTD
153	VISION POINT SACCO SOCIETY LTD
154	VISION AFRICA SACCO SOCIETY LTD
155	WAKENYA PAMOJA SACCO SOCIETY LTD
156	WAKULIMA COMMERCIAL SACCO SOCIETY LTD
157	WANAANGA SACCO SOCIETY LTD
158	WANANCHI SACCO SOCIETY LTD
159	WANANDEGE SACCO SOCIETY LTD
160	WASHA SACCO SOCIETY LTD
161	WAUMINI SACCO SOCIETY LTD
162	WEVARSITY SACCO SOCIETY LTD
163	WINAS SACCO SOCIETY LTD
164	YETU SACCO SOCIETY LTD
165	AIRPORTS SACCO SOCIETY LTD
166	AINABKOI SACCO SOCIETY LTD
167	ECO-PILLAR SACCO SOCIETY LTD
168	GOOD FAITH SACCO SOCIETY LTD
169	COMOCO SACCO SOCIETY LTD
170	TELEPOST SACCO SOCIETY LTD
171	NANDI HEKIMA SACCO SOCIETY LTD
172	TRANSNATIONAL TIMES SACCO SOCIETY LTD
173	NYAMIRA SACCO SOCIETY LTD
174	BANANA HILL SACCO SOCIETY LTD

Source: SASRA (2017).

Appendix IV: List of DTS and their Efficiency Scores

DTS	**2014**	**2015**	**2016**	**2017**	**2018**
2NK	1	0.4686	0.4849	0.5809	0.5296
AFYA	0.3879	0.4467	0.4541	0.5423	0.4376
AGROCHEM	0.5471	0.6163	0.6344	0.6318	0.6556
AINABKOI	1	0.4516	0.6889	0.8345	0.169
AIRPORTS	0.3273	0.4248	0.4583	0.4759	0.5804
ALL CHURCHES	0.3354	0.6299	0.6021	0.5197	0.6063
AMICA	0.3288	0.3138	0.3779	0.3563	0.3565
ARDHI	1	0.5443	0.5654	0.5623	0.5445
ASILI	0.3746	0.3548	0.3998	0.6174	0.4944
AZIMA	0.5149	0.5238	1	0.5997	0.733
BANDARI	0.6658	0.7249	0.7264	0.705	0.6017
BARAKA	0.5705	0.2887	0.3238	0.3864	0.3408
BARATON	0.4114	0.4524	0.4941	0.5404	0.6686
BIASHARA	0.3797	0.4217	0.4298	0.5018	0.4611
BIASHARA TOSHA	0.3569	0.431	0.549	0.3794	0.1589
BI-HIGH	1	0.7483	0.6984	0.696	0.4176
BINGWA	0.5475	0.6212	0.7555	0.7577	0.8536
BORESHA	0.3885	0.4184	0.4409	0.5209	0.3868
CAPITAL	0.3589	0.3066	0.3139	0.4045	0.4414
CENTENARY	0.4035	0.4326	0.4321	0.4911	0.4656
CHAI	0.4103	0.4282	0.4383	0.5263	0.4928
CHUNA	0.56	0.5931	0.6574	0.5622	0.4083
COMOCO	0.342	0.2829	0.3343	0.4283	0.294
COSMOPOLITAN	0.5336	0.6008	0.5869	0.6632	0.6123
COUNTY	0.3058	0.204	0.2605	0.2579	0.2345
DAIMA	0.2171	0.2718	0.2647	0.2753	0.2696
DHABITI	0.4773	0.3036	0.308	0.3749	0.3064

DIMKES	0.4907	0.5235	0.4966	0.5397	0.4948
DUMISHA	0.3444	0.3213	0.4111	0.4161	0.4486
ECO-PILLAR	0.2207	0.192	0.1925	0.3045	0.2025
EGERTON	0.4309	0.4569	0.4166	0.4678	0.4057
ELGON TEACHERS	0.7099	-	0.4083	-	-
ELIMU	0.3799	0.3762	0.3724	0.5491	0.5472
ENEA	0.2213	0.3165	0.321	0.4329	0.5986
FARIDI	0.4239	0.6375	0.6385	0.6277	0.6588
FARIJI	0.2512	0.3261	0.3611	0.3014	0.2693
FORTUNE	0.4266	0.7129	0.7247	0.7092	0.6984
FUNDILIMA	0.5033	0.6129	0.6342	0.633	0.6232
GITHUNGURI DAIRY	0.5363	0.5904	0.5851	0.6263	0.592
GOOD HOPE	0.3427	0.4783	0.4714	0.6492	0.555
GOODWAY	0.3581	0.4393	0.4575	0.5207	0.4724
GUSII MWALIMU	0.719	0.6754	0.6704	0.6928	0.665
HARAMBEE	0.4074	0.3603	0.436	0.4354	0.3596
HAZINA	0.9038	0.7627	0.7536	1	0.7557
ILKISONKO	0.5835	1	0.9597	0.7666	0.7795
IMARIKA	0.4359	0.5116	0.519	0.5862	0.5218
IMARISHA	0.6489	0.5843	0.6129	0.6917	0.5635
IMENTI	0.6994	0.6487	0.6491	0.6524	0.5811
INVEST & GROW	0.6022	0.2219	0.7126	0.882	0.664
JACARANDA	0.3806	0.2825	0.3095	0.4042	0.2323
JAMII	0.6034	0.6268	0.7266	0.8581	0.6415
JITEGEMEE	0.3603	0.2466	0.3365	0.3436	0.1733
JOINAS	0.3196	0.4571	0.6505	0.4564	0.4413
JUMUIKA	0.2974	0.3013	0.3276	0.5043	0.3008
KAIMOSI	1	1	0.4269	0.4667	0.5387
KENPIPE	0.659	0.6797	0.6815	0.7146	0.6644
KENVERSITY	0.5583	0.5912	0.6337	0.7587	0.6113

KENYA ACHIEVAS	0.1821	0.2164	0.2397	0.28	0.2126
KENYA BANKERS	0.4236	0.4455	0.4489	0.522	0.3985
KENYA HIGHLANDS	0.7249	0.4118	0.6833	0.5259	0.7179
KENYA MIDLAND	0.5925	1	1	0.3928	0.7183
KENYA POLICE	0.7499	0.7199	0.5991	0.7142	0.6403
KIMBILIO DAIMA	0.2872	0.328	0.3653	0.4541	0.3719
KINGDOM	0.5496	0.5826	0.5971	0.6155	0.6269
KIPSIGIS EDIS	0.4064	0.7052	0.636	1	1
KITE	0.1941	0.4221	0.4662	0.4635	0.3552
KITUI TEACHERS	0.405	0.4925	0.4978	0.6655	0.5756
KMFRI	0.366	0.3529	0.3837	0.4117	0.362
KOLENGE	0.395	0.2552	0.2554	0.5391	0.2278
KORU	0.246	0.3878	0.3816	0.4743	0.3361
K – PILLAR	0.4232	0.3711	1	0.5628	0.5048
K-PILLAR	0.4232	0.3711	1	0.5628	0.5048
K-UNITY	0.5665	0.5566	0.5595	0.5326	0.5514
KWETU	0.2071	0.2233	0.2015	0.2772	0.2361
LAINISHA	1	1	1	0.9348	0.8599
LAMU TEACHERS	1	0.2686	0.2977	0.3217	0.2033
LENGO	0.2208	0.2391	0.2436	0.2708	0.2229
MAFANIKIO	0.4026	0.719	0.7194	0.6662	0.6801
MAGADI	0.3724	0.6061	0.5875	0.6301	0.7331
MAGEREZA	0.4727	0.4706	0.4154	0.6905	0.8418
MAISHA BORA	0.632	0.7858	0.8573	0.9968	0.6613
MENTOR	0.6139	0.5576	0.4574	0.563	0.4711
METROPOLITAN	0.7307	0.6762	0.6928	0.9536	0.7306
MILIKI	0.1084	1	0.0203	0.5596	0.0895
MMH	0.5488	0.5514	0.5678	0.6852	0.6818
MOMBASA PORT	0.7713	0.8503	0.7449	0.7689	0.9659
MUDETE TEA GROWERS	0.2875	0.2448	0.2667	0.5717	0.3455

MUKI	0.4882	0.3848	0.3741	0.4367	0.3904
MWALIMU NATIONAL	0.6063	0.531	0.416	0.5111	0.3996
MWIETHERI	1	0.6361	0.6674	0.5867	0.681
MWINGI MWALIMU	0.4841	0.3947	0.436	0.4785	0.4642
MWITO	0.749	0.6306	0.679	0.6928	0.6199
NACICO	0.4874	0.3774	0.3853	0.4621	0.4028
NAFAKA	0.4444	0.5034	0.5136	0.5117	0.4645
NANDI FARMERS	0.2255	0.3549	0.4243	0.53	0.2954
NANDI HEKIMA	0.3231	0.4648	0.7701	0.781	1
NANYUKI EQUATOR	0.3164	0.5728	0.6734	0.98	0.5781
NASSEFU	0.3969	0.4666	0.5342	1	1
NATION	0.8305	1	0.6961	0.8128	0.6776
NAWIRI	0.2132	0.2624	0.2796	0.3903	0.407
NDEGE CHAI	0.4639	0.4509	0.4798	0.5558	0.4007
NDOSHA	0.2942	0.4244	0.4483	0.4938	0.3014
NEW FORTIS	0.6521	0.7911	0.7225	0.6804	0.6672
NEXUS SACCCO	0.8602	1	0.6482	0.6814	0.7518
NG'ARISHA	0.3141	0.359	0.3265	0.4353	0.4247
NITUNZE	0.8848	0.1861	0.2579	-	-
NOBLE	0.4751	0.4367	0.425	0.6441	1
NRS	0.5051	0.5304	-	0.915	0.2918
NUFAIKA	0.5219	0.5861	0.5741	0.4967	0.3624
NYALA VISION	0.4079	0.2642	0.2558	0.3807	0.2576
NYAMBENE ARIMI	0.3249	0.345	0.4335	0.4488	0.4337
NYAMIRA TEA FARMERS	0.2841	0.284	0.3234	0.3741	0.3191
NYATI	-	-	0.6054	1	0.7007

OLLIN	0.5894	0.6528	0.6488	0.6125	0.4577
ORIENT	0.4564	0.5809	0.5089	1	1
PATNAS	0.2666	0.2094	0.2509	0.2002	0.1751
PRIMETIME	0.3727	0.4622	0.4407	0.3096	0.3019
PUAN	0.3538	0.3738	0.3646	0.6129	0.3912
QWETU	0.3121	0.3833	0.3915	0.3733	0.3778
RACHUONYO TEACHERS	0.4473	0.4589	0.5126	0.5292	0.3011
SAFARICOM	0.6058	0.6584	0.6538	1	0.7877
SHERIA	0.6449	0.5936	0.6018	0.822	0.6337
SHIRIKA	-0.5065	0.4302	0.6146	0.6218	
SHOPPERS	0.6005	0.5459	-0.5607	0.5093	
SIMBA CHAI	0.5595	0.7703	0.7614	1	0.6873
SIRAJI	0.332	0.371	0.3484	0.3401	0.3516
SKYLINE	0.4422	0.583	0.5889	0.5447	0.5991
SMART CHAMPION	0.7002	0.5285	0.6077	0.6706	0.4124
SMARTLIFE	0.4782	0.5463	0.5863	0.7504	0.5653
SOLUTION	0.5636	0.5125	0.4425	0.5564	0.3944
SOTICO	0.4879	0.4524	0.4621	0.5214	0.4505
SOUTHERN STAR	0.2906	0.3132	0.3088	0.3354	0.3305
STAKE KENYA	0.2583	0.2965	0.3101	1	0.3176
STIMA	0.5461	0.5659	0.5513	0.6494	0.5173
SUBA TEACHERS	0.3665	0.5332	0.5054	0.5382	0.5111
SUKARI	0.3332	0.5591	0.3979	0.3846	0.2395
SUPA	0.3454	0.4304	0.4266	0.5228	0.5417
TABASAMU	0.1396	0.3511	0.1943	0.2205	0.221
TAI	0.3557	0.3429	0.3554	0.4249	0.4164
TAIFA	0.234	0.4473	0.4255	0.5408	0.599
TAQWA			0.6459	1	0.615

	-	-			
TARAJI	0.2442	0.2644	0.262	-	0.3981
TELEPOST	0.2837	0.315	0.3823	0.3195	0.2084
TEMBO	0.3679	0.913	0.6311	0.832	0.8323
TENHOS	0.3197	0.4028	0.4219	0.3813	0.3037
THAMANI	0.2491	0.2814	0.2987	0.4064	0.6025
TIMES U	0.3184	0.3728	0.3691	0.4064	0.4172
TOWER	0.5505	0.6912	0.6639	0.7865	0.6628
TRANSCOUNTIES	0.5418	0.6054	0.6173	0.5601	0.5338
TRANS-ELITE COUNTY	0.2068	0.3654	0.3728	0.5487	0.4012
TRANSNATIONAL	0.3621	0.4577	0.4289	0.5201	0.4538
UCHONGAJI	1	0.5148	0.531	0.6155	0.4095
UFANISI	0.3641	0.4507	0.4521	0.6004	0.5292
UKRISTO NA UFANISI	0.5346	0.5956	0.6059	0.6534	0.5874
UKULIMA	0.6267	0.5136	0.5202	0.6532	0.6622
UNAITAS	0.4689	0.5464	0.5682	0.8086	0.8354
UNI–COUNTY	0.296	0.3327	0.3581	0.429	0.4036
UNISON	0.4501	0.4083	0.3934	0.5057	0.4225
UNITED NATIONS	0.6674	0.7384	0.744	0.7254	0.7353
UNIVERSAL TRADERS	0.3124	0.3499	0.3628	0.4295	0.3492
VICTAS	0.3719	0.6648	0.765	0.8032	0.418
VIHIGA COUNTY	0.2697	0.2263	0.2538	0.584	1
VISION AFRICA	0.2989	1	0.3113	1	0.7303
VISION POINT	0.5719	0.2325	0.4281	0.6306	0.6447
WAKENYA PAMOJA	0.2439	0.2116	0.2152	0.2461	0.2235
WAKULIMA COMMERCIAL	0.5781	0.651	0.6558	0.6085	0.6357
WANAANGA	0.6134	0.6605	0.638	0.5027	0.4799

WANANCHI	0.3067	0.2722	0.3304	0.3878	0.3961
WANANDEGE	0.2398	0.2997	0.3353	0.3884	0.4426
WASHA	0.2423	0.406	0.4025	0.5294	0.5239
WAUMINI	1	0.673	0.8984	1	0.7299
WEVARSITY	1	0.4513	0.439	0.426	0.3978
WINAS	0.5855	0.7457	0.6746	0.7866	0.7281
YETU	0.4605	0.5146	0.6172	0.5874	0.7826
Mean	**0.468101**	**0.48532**	**0.498752**	**0.571079**	**0.505218**

Appendix V: Frequency Distribution of Efficiency Scores

Year	Class	Frequency	Percent	Cumulative Percent
2014	.1000-.1999	4	2.34	2.34
	.2000-.2999	28	16.37	18.71
	.3000-.3999	42	24.56	43.27
	.4000-.4999	32	18.71	61.99
	.5000-.5999	26	15.20	77.19
	.6000-.6999	16	9.36	86.55
	.7000-.7999	8	4.68	91.23
	.8000-.8999	3	1.75	92.98
	.9000+	12	7.02	100.00
	Total	171	100.00	
2015	.1000-.1999	2	1.17	1.17
	.2000-.2999	25	14.62	15.79
	.3000-.3999	32	18.71	34.50
	.4000-.4999	35	20.47	54.97
	.5000-.5999	33	19.30	74.27
	.6000-.6999	22	12.87	87.13
	.7000-.7999	12	7.02	94.15
	.8000-.8999	1	0.58	94.74
	.9000+	9	5.26	100.00
	Total	171	100.00	
2016	.1000-.1999	3	1.74	1.74

	.2000-.2999	16	9.30	11.05
	.3000-.3999	35	20.35	31.40
	.4000-.4999	40	23.26	54.65
	.5000-.5999	22	12.79	67.44
	.6000-.6999	35	20.35	87.79
	.7000-.7999	13	7.56	95.35
	.8000-.8999	2	1.16	96.51
	.9000+	6	3.49	100.00
	Total	172	100.00	
2017	.1000-.1999	0	0.00	0.00
	.2000-.2999	8	4.68	4.68
	.3000-.3999	21	12.28	16.96
	.4000-.4999	28	16.37	33.33
	.5000-.5999	45	26.32	59.65
	.6000-.6999	32	18.71	78.36
	.7000-.7999	13	7.60	85.96
	.8000-.8999	8	4.68	90.64
	.9000+	16	9.36	100.00
	Total	171	100.00	
2018	.1000-.1999	5	2.91	2.91
	.2000-.2999	18	10.47	13.37
	.3000-.3999	30	17.44	30.81
	.4000-.4999	34	19.77	50.58

.5000-.5999	27	15.70	66.28
.6000-.6999	31	18.02	84.30
.7000-.7999	15	8.72	93.02
.8000-.8999	5	2.91	95.93
.9000+	7	4.07	100.00
Total	172	100.00	

NB: Discrepancies can be observed in the number of DTSs because of the missing values in the respective values

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **302301**

Date of Issue: **16/March/2020**

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Appendix VII: Proposed Research Budget

No.	Item Description	Sub-Total	Total
1.	**Proposal writing**		
	Research from various libraries	3,500	
	Stationery, Computer, Photocopy, Printing and Binding	10,000	**13,500**
2.	**Data Collection**		
	Hiring of 2 assistants@ 7,000	14,000	**14,000**
4.	**Data Analysis**		
	SPSS and Excel	20,000	**20,000**
5.	**Final Draft Printing and Binding**		
	Typing, Photocopy, Binding	10,000	**10,000**
6.	**Transport/Miscellaneous**		
	Transport	5,000	
	Telephone	1,500	
	Stationery	3,000	
	Computer Services/Internet Services	5,000	**14,500**
	Grand Total		**72,000**

Appendix VIII: Research Schedule

	2019/2020									
DATE/ ACTIVITY	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT
Problem Identification										
Review of General Literature										
Proposal Writing and Presentation										
Data Collection										
Data Analysis and Processing										
Report Writing and Presentation										