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Risk Management, Regulatory Compliance, and SACCO Sustainability: Does Technology Implementation Matter? Evidence from Greater Bushenyi District

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Abstract

This study investigated whether technology implementation moderates the relationship between risk management, regulatory compliance, and financial sustainability in Savings and Credit Cooperative Organisations (SACCOs) in Uganda's Greater Bushenyi District.

A quantitative study was undertaken with 251 respondents from SACCO branches in the Greater Bushenyi District. SmartPLS-SEM software was used to analyze data in the Resource-Based View (RBV) paradigm, testing both direct and moderating effects.

The findings revealed that risk management influences financial sustainability ($\beta = 0.286$, $p < 0.001$), and regulatory compliance was found to have no direct influence ($\beta = 0.079$, $p = 0.209$). Technology implementation was found to be insignificant on the risk management sustainability relationship ($\beta = -0.145$, $p = 0.036$), suggesting that it weakens rather than strengthens the relationship. Also, technology did not significantly impact the relationship between compliance and sustainability ($\beta = 0.076$, $p = 0.265$). This is one of the first studies to reveal a negative moderating effect of technology on the risk management-sustainability relationship in rural SACCOs, calling into question the idea that technology always improves governance capacities and emphasizing the importance of the implementation environment.

Keywords: SACCOs, Risk Management, Regulatory Compliance, Technology Implementation

1. INTRODUCTION

Saving and credit cooperative organisations (SACCOs) have emerged as key vehicles for financial inclusion, particularly in developing nations where traditional banking infrastructure is lacking (Kumar & Rao, 2022). SACCOs in Uganda are lifelines for rural communities, providing loans, savings, and insurance to low-income people and small businesses (Bank of Uganda, 2023). Financial sustainability is crucial for the long-term survival of these organizations, enabling them to cover operational and financial expenses without donor subsidies (Mersland & Strøm, 2020). Despite their social goal, many SACCOs

in Sub-Saharan Africa continue to face issues, including portfolio risk, high administrative costs, and liquidity shortages (Otto and Ukpere, 2021). As a result, scholars and practitioners have shifted their focus to two key organizational capabilities: risk management and regulatory compliance. Effective risk management, including credit risk assessment and internal controls, decreases default rates and stabilizes cash flows (Njuguna & Mwangi, 2019). Similarly, adherence to central bank regulations, such as interest rate ceilings, capital adequacy standards, and consumer protection laws, boosts institutional legitimacy and depositor confidence (Kassim and Rahman, 2020).

However, new empirical research indicates that risk management and regulatory compliance are insufficient to ensure financial sustainability, particularly in dynamic rural economies (Agyemang et al., 2022). The regulatory load frequently raises operating expenses without yielding proportional returns, while traditional risk management is reactive rather than predictive (Chen & Lee, 2021). This contradiction has shifted emphasis to technology implementation as a potential regulating mechanism.

According to the resource-based view (RBV), technology can be considered a strategic organizational resource that enhances the efficiency and effectiveness of governance-related competencies (Barney, 1991; Wade and Hulland, 2020). SACCOs can reduce transaction costs, accelerate risk detection, and streamline compliance reporting using modern technological tools such as mobile banking platforms, automated loan-tracking systems, biometric identification, and regulatory technology (RegTech) (Mwangi & Ouma, 2023; Gupta & Tham, 2024). Technology does not operate in isolation in highly regulated but resource-constrained contexts; instead, it integrates with existing risk and compliance frameworks to deliver superior performance outcomes (Wang & He, 2022).

While technology adoption in microfinance has been extensively researched, the majority of previous research, such as (Lee & Shin 2019; Ofori-Sasu et al., 2021; Mwangi & Ouma, 2023) has seen technology as an independent variable with direct implications on financial sustainability. Only a few studies (Wang & He, 2022; Nair & Meenakumari, 2023) examined technology as a moderator, and none have focused especially on rural SACCOs in Uganda. This gap is especially noteworthy given the specific operational context of rural Ugandan SACCOs, where infrastructure deficits, low digital literacy, and changing regulatory requirements present unusual implementation issues (Nakato & Ssekakubo, 2022; Banda et al., 2025).

1.2 Problem statement

Despite the recognized value of risk management, regulatory compliance, and technology, many SACCOs in Uganda's Greater Bushenyi District continue to struggle financially. Preliminary evidence suggests that, while most SACCOs have implemented basic risk policies, their financial sustainability measures, such as operational self-sufficiency and return on assets, remain below industry norms (UBRA, 2023). The primary issue is not a lack of governance systems, but a lack of strategic technological integration.

While technology implementation in microfinance has been extensively researched, the majority of previous research, namely, (Lee & Shin, 2019; Ofori-Sasu et al., 2021; Mwangi & Ouma, 2023) has seen technology as an independent variable with direct implications on financial sustainability. Only a few studies (Wang & He, 2022; Nair & Meenakumari, 2023) have looked at technology as a moderator, and none have focused especially on rural SACCOs in Uganda. This gap is especially noteworthy given the specific operational context of rural Ugandan SACCOs, where infrastructure deficits, low digital literacy, and changing regulatory requirements present unusual implementation issues (Nakato & Ssekakubo, 2022; Banda et al., 2025).

Therefore, this study investigated the technology implementation moderation relationship between risk management, regulatory compliance, and financial sustainability of SACCOs in Uganda's Greater Bushenyi District.

1.3 Research questions

The following are the research questions used in this study.

1. Does risk management influence the financial sustainability of SACCOs in the greater Bushenyi district, Uganda?
2. To what extent does regulatory compliance influence the financial sustainability of SACCOs in the greater Bushenyi district, Uganda?
3. What is the moderating relationship of technology implementation between risk management and regulatory compliance on the financial sustainability of SACCOs in the greater Bushenyi district, Uganda?

1.4 Research objectives

1. To determine the risk management influence on the financial sustainability of SACCOs in the greater Bushenyi district, Uganda.
2. To investigate the regulatory compliance influence on the financial sustainability of SACCOs in the greater Bushenyi district, Uganda.

3. To examine the moderating relationship of technology implementation between risk management and regulatory compliance on the financial sustainability of SACCOs in the greater Bushenyi district, Uganda.

2 Literature Review

2.1 Financial Sustainability

Mersland and Strom (2020) define financial sustainability as a SACCO's ability to generate enough revenue from operations to cover all costs, including loan losses, administrative expenditures, and financing charges, without relying on external grants or donor subsidies. A financially sustainable SACCO can continue to operate indefinitely while expanding its outreach to underserved communities (Chauhan, 2021). According to (Chikalipah, 2017) posits that financial sustainability is commonly measured using a variety of metrics: Operational self-sufficiency (OSS), defined as the ratio of operating revenue to operating expenses, with values greater than 100% suggesting viability. Return on assets (ROA) is a metric that measures how efficiently SACCOs generate profit from their asset base. Portfolio at risk (PAR) represents the percentage of outstanding loans that are more than 30 days past due and serves as a proxy for credit risk exposure. Financial self-sufficiency (FSS) accounts for inflation and subsidies, making it a more cautious indicator of long-term viability (Otto & Ukpere, 2021).

SACCOs in Sub-Saharan Africa confront distinct obstacles in establishing financial sustainability. The high transaction costs result from serving geographically dispersed rural populations with inadequate infrastructure (Zineelabidine et al., 2024). Loan default rates are frequently high due to agricultural revenue instability, a lack of formal collateral, and knowledge asymmetries about borrower trustworthiness (Muruku et al., 2024). Furthermore, many SACCOs operate on a small scale, prohibiting them from reaching economies of scale in administration and loan processing (Agyemang et al., 2022).

In Uganda, savings and credit cooperative organizations (SACCOs) are central in poverty alleviation. However, the Bank of Uganda (2023) has recorded diminishing sustainability margins among rural SACCOs, which it attributes to high operational expenses, inadequate product diversification, and increased competition from mobile network operators offering digital credit products. A constant issue in SACCOs literature is the trade-off between financial sustainability and social outreach. According to Mersland and Strøm (2020), at times SACCOs prioritize wealthier clients over poorer households to achieve financial sustainability. Other studies argue that only financially stable SACCOs can accomplish long-term social effects because donor-dependent institutions are inherently

unstable (Otto & Ukpere, 2021). This study does not directly address this trade-off, but it accepts that financial sustainability is an essential (but not sufficient) prerequisite for long-term social outreach in rural Uganda.

2.2 Regulatory Compliance and Financial Sustainability

Regulatory compliance is a SACCO's adherence to laws, rules, norms, and specifications that are pertinent to its operations. These restrictions are often issued by central banks or specific microfinance regulating bodies (Meagher, 2002). Licensing requirements, capital adequacy standards, interest rate limitations, consumer protection rules, anti-money laundering processes, and periodic reporting mandates are all examples of compliance obligations (Kassim and Rahman, 2020).

According to the new SACCOs regulations in Uganda, some SACCOs with voluntary savings exceeding UGX 1.5 billion and institutional capital above UGX 500 million are required to be licensed and supervised by the Bank of Uganda under the MDI Act 2022 (Bank of Uganda, 2025). This Act mandates all SACCOs to submit regular financial reports, adhere to consumer protection rules, and pass frequent inspections.

Compliance with regulations provides various benefits to SACCOs. First, licensed and regulated SACCOs gain institutional legitimacy, increasing stakeholder confidence. Second, compliance instils discipline in management, encouraging better record-keeping, risk management, and governance processes. Third, licensed SACCOs may obtain access to refinancing and technical assistance programs that are not available to unregulated SACCOs (Lee & Shin, 2019). However, there are major costs associated with compliance. Staffing compliance departments, creating reports, keeping records, and being ready for inspections are all examples of administrative costs. Opportunity costs arise when compliance diverts management's attention away from strategic efforts. In some circumstances, rules like interest rate caps might affect profitability by limiting revenue production. Consumer protection regulations may lengthen loan processing timelines and documentation requirements, slowing client onboarding (Ofori-Sasu et al., 2021).

The relationship between regulatory compliance and financial sustainability is not straightforward. SACCOs with very low levels of compliance suffer regulatory consequences, reputational damage, and potential shutdown, making sustainability untenable. Compliance improves trust and stability at moderate levels, which contributes to long-term sustainability (Adams & Tewari, 2020). Compliance costs can undermine profitability and reduce sustainability if they are either high or unduly prescriptive. This U-

shaped connection shows that optimal compliance occurs when benefits outweigh costs (Gupta & Tham, 2024).

Rural Ugandan SACCOs face a greater compliance burden because they have less administrative expenditures, fewer skilled staff and digital literacy gaps (Banda et al., 2025). Manual compliance processes need a disproportionate number of resources. Technology implementation, particularly regulatory technology (RegTech), provides a viable pathway for lowering compliance costs while preserving or increasing compliance quality (Bolton & Mintrom, 2023).

2.3 Resource-Based View: The underpinning theory

The resource-based view (RBV) serves as the theoretical underpinning for this investigation. RBV, which derives from Barney's (1991) work, contends that firms obtain competitive advantage not just through external market positioning, but also through internal resources that are valuable, rare, inimitable, and non-substitutable (VRIN). Financial capital, human knowledge, organizational processes, information systems, and technology infrastructure are examples of strategic resources used by SACCOs. Recent developments of RBV have stressed the concept of resource complementarity, implying that resources do not work independently. Instead, the combination of multiple organizational resources leads to better performance results than the sum of their separate effects (Wade & Hulland, 2020; Lin & Wu, 2022). This approach is especially important for understanding how technology interacts with governance systems like risk management and regulatory compliance.

According to the RBV framework, technology can be viewed as a strategic resource that improves the efficiency and effectiveness of other organizational skills (Waryoba & Masele, 2025). When technology is used with risk management systems, it allows for real-time data processing, predictive analytics, and automatic warnings. Similarly, when used in conjunction with compliance frameworks, technology minimizes administrative overhead while increasing regulatory reporting accuracy (Liang et al., 2010). This study uses RBV to argue that technology implementation does not drive financial sustainability on its own, but rather modifies or conditions the effectiveness of risk management and regulatory compliance.

RBV critics have pointed out that defining resources as whatever contributes to success can be a tautology (Priem & Butler, 2001). RBV, according to recent academics, remains very significant for understanding organizational performance in dynamic situations because it specifies the mechanisms via which resources interact (Kraaijenbrink et

al., 2010; Lin & Wu, 2022). This study tackles this issue by specifically measuring moderating effects, rather than assuming that technology alone is sufficient.

2.4 Risk Management and Financial Sustainability

Risk management in SACCOs includes identifying, assessing, prioritizing, and mitigating risks that could jeopardize institutional viability. Credit risk (borrower default), liquidity risk (inability to meet cash needs), operational risk (internal process failures), and strategic risk (bad business decisions) are the four main risk categories (Njuguna & Mwangi, 2019). Because the loan portfolio is their principal asset, credit risk is the most significant risk faced by most SACCOs (churchill, 2016). Several practices are required for effective credit risk management, including thorough borrower screening and due diligence, appropriate loan structuring and collateral requirements, diversification across sectors and geographic areas, regular loan monitoring, and timely loan recovery procedures (Kassim and Rahman, 2020).

SACCOs that employ structured credit risk management systems tend to have lower portfolio risk ratios. These systems include written credit policies, loan approval committees, borrower credit scoring procedures, and periodic portfolio reviews (Moreno-Menéndez et al., 2025). However, in rural areas like Greater Bushenyi District, implementing these procedures is difficult due to insufficient borrower financial records, a lack of institutional credit bureaus, and reliance on group lending approaches that dilute responsibility (Nakato & Ssekakubo, 2022). Liquidity risk occurs when SACCOs fails to meet its cash obligations, which include loan disbursements, deposit withdrawals, and debt repayments (Wanjiru & Jagongo, 2022). Maintaining adequate cash reserves, diversified financing sources, and matching asset and liabilities maturities are all necessary for liquidity management (Marimira & Gumel, 2025). Fraud, data input errors, system breakdowns, and staff misconduct all fall under operational risk. Internal controls, segregation of roles, regular audits, and employee training are required to mitigate operational risk (Chen & Lee, 2021).

Traditional risk management practices at SACCOs are frequently reactive rather than proactive. Risk identification occurs after losses have occurred, rather than using prediction models. Loan monitoring is based on periodic site visits rather than real-time data (Malik et al., 2025). Reporting is laborious and slow, hindering prompt interventions. These constraints are more pronounced in rural SACCOs with limited access to technology and experienced personnel (Wang & He, 2022). It's further urged that the relationship between risk management and financial sustainability is generally positive, but its strength is

determined by the sophistication of risk detection and mitigation techniques (Illangakoon et al., 2021). When risk management is done manually and retrospectively, the benefit to sustainability is minimal. When technology is used to enhance risk management, it becomes more predictive and effective. This interaction is essential to the moderating hypothesis in this study.

2.5 SACCOs in Greater Bushenyi District, Uganda

Greater Bushenyi District, located in Western Uganda, comprises four districts: Bushenyi, Sheema, Mitooma, and Rubirizi. The area is primarily agricultural, focusing on crops such as bananas, coffee, tea, and livestock. Population density is moderate, but dispersed settlement patterns increase the cost-of-service delivery. Banking facilities are limited, with few commercial branches and ATMs located outside major towns (UBRA, 2023). In addition, greater Bushenyi hosts a variety of microfinance institutions (MFIs), such as SACCOs and community groups, primarily small to medium in size, with one to five branches. Staffing is generally low, with five to twenty employees per institution. Their clientele includes smallholder farmers, market vendors, boda-boda drivers, and small retail business owners. Loan amounts typically range from 50,000 to 500,000 Ugandan shillings (approximately $13-$130 USD) (Bank of Uganda, 2025; The EastAfrican, 2026)

Despite their social and economic significance, SACCOs in Greater Bushenyi suffer a slew of obstacles that jeopardize their operational viability and financial stability. A recent study by Linda (2024) at Kyamuhunga Peoples SACCO in Bushenyi District found that while effective risk management practices, including transparent credit terms, stringent credit standards, and well-communicated credit policies, are pivotal to financial performance, significant gaps exist in their consistent application. The study found that adherence to credit criteria has a direct impact on portfolio quality and financial stability, yet many SACCOs struggle with reactive rather than proactive risk management. Other challenges include irregular agricultural income cycles requiring flexible lending, high loan distribution costs due to low population density, difficulties in borrower screening from lack of formal identity and credit history, security risks associated with cash transactions, and competitive pressure from informal lenders and savings clubs (Nakato & Ssekakubo, 2022).

In addition, certain regional institutions have suffered from governance and leadership problems. At the 8th Annual General Meeting of the Igara-Buhweju Tea Farmers SACCO (IGABU) in Bushenyi District, leaders and farmers cited poor leadership, mismanagement, and internal corruption as the primary causes of financial distress, including demands for bribes to secure leadership positions and mismanagement of factory

resources (Kazo fm, 2026). Such governance deficiencies undermine member trust and institutional stability.

The regulatory framework for SACCOs in Uganda has experienced major changes. According to the Microfinance Deposit-Taking Institutions (MDI) Act, Cap 58, and the MDI (Registered Societies) Regulations of 2023, the Bank of Uganda currently requires major SACCOs with voluntary savings over UGX 1.5 billion and institutional capital above UGX 500 million to apply for licenses Anyanzwa, 2026). This regulatory shift has raised concerns. In January 2026, SACCO leaders from across Uganda, including representatives from the Uganda Cooperative Savings and Credit Union (UCSCU), successfully persuaded President Museveni to halt the Bank of Uganda's crackdown on unlicensed SACCOs, arguing that regulating member-owned, non-profit cooperatives using frameworks designed for commercial banks endangers their survival and undermines financial inclusion (Mbogo, 2026). The President directed that a standardized regulatory framework be devised, distinguishing SACCOs from commercial banks.

SACCOs in Greater Bushenyi are adopting technology at a slower pace compared to their urban counterparts. Many uses basic computers without integrated loan management systems, and mobile banking usage remains low, with cash transactions dominating. Biometric identification is rarely used, and internet connectivity is unreliable, particularly in rural areas. As a result, risk management and compliance methods are mostly manual and rely on paper documentation (CRBA, 2025). However, industry experts have identified digital transformation, deeper investment in financial literacy, product diversity, and a strong focus on sustainability as necessary strategic improvements for the future of SACCOs in Uganda.

The Greater Bushenyi District serves as an optimal case study for analysing how technology influences SACCOs' sustainability. With several SACCOs operating under similar regulatory and economic conditions, variations in technology adoption can be compared. The low initial technology use allows for significant statistical analysis, providing insights applicable to analogous situations in Sub-Saharan Africa and other emerging areas.

2.6 Technology Implementation and Financial Sustainability

Technology implementation in SACCOs refers to the adoption and integration of digital technologies and information systems into fundamental operational procedures. This encompasses hardware (computers, mobile devices, biometric scanners), software (loan management systems, accounting platforms, credit scoring algorithms), and connectivity

infrastructure (internet, mobile networks) (Mwangi & Ouma, 2023). Several types of technology are very relevant to SACCO's operations. Mobile banking services enable customers to make loan payments, savings, and check balances using feature phones or smartphones, lowering transaction costs for both customers (Yousif et al., 2013). Automated loan management systems monitor loan disbursements, repayments, and delinquencies and generate real-time portfolio information. Biometric identification (fingerprint or facial recognition) addresses identity verification issues in communities without official identification documents (Annitah et al., 2025; Cooper et al., 2018). Cloud-based accounting enables consolidated financial management across branches. Regulatory technology (RegTech) automates compliance reporting, checks transactions for questionable activity, and keeps audit trails (Gupta & Tham, 2024). When used correctly, technology effectively lowers transaction costs, enhances accuracy, speeds up processes, improves monitoring, and broadens service reach by automating procedures and facilitating remote client access (Wang & He, 2022).

Rural SACCOs confront numerous hurdles when implementing technology, including unstable electricity, limited internet connection, and minimal network coverage. There is a considerable digital literacy gap among employees and clients, necessitating substantial training investments. Additionally, the initial price of hardware and software, lack of technical expertise, and worries about data security and privacy (Nakato & Ssekakubo, 2022). A fundamental conceptual distinction in this study is whether technology improves financial sustainability or just makes other capacities run more efficiently. While early studies revealed technology as a direct driver of profitability and efficiency, more recent research suggests it serves as a moderator, amplifying the influence of other organizational resources (Ofori-Sasu et al., 2021).

When technology is widely adopted, risk management systems can become predictive and real-time, enhancing the risk-sustainability relationship. Similarly, automated compliance processes reduce costs and improve the relationship between compliance and sustainability. Conversely, low technology adoption results in reactive risk management and burdensome compliance, weakening both relationships (Nair & Meenakumari, 2023). This moderating reasoning is fundamental to the current study.

3. Methodology

This study used a quantitative research design. The population comprised all 47 licensed SACCOs operating in Greater Bushenyi District (Bushenyi, Sheema, Mitooma, and Rubirizi districts). Using stratified random sampling, the study chose 30 SACCOs according to district size. 8-12 people were selected from each SACCO who worked in risk management, compliance, operations, or senior management roles. The target population was 320, and 251 valid replies were received. Data were collected through a combination of face-to-face administration and online questionnaires disseminated via Google Forms, providing for more reach and response flexibility. For data analysis, the study used SmartPLS software, which is well-known for its support for Partial Least Squares Structural Equation Modeling (PLS-SEM). The PLS-SEM was used because it's supported by previous studies. PLS-SEM has been the preferred method for investigating moderation effects among comparable studies (Musfiroh et al., 2025; Moreno-Menéndez et al., 2025; Waryoba & Masele, 2025), owing to its robustness with non-normal data and emphasis on prediction.

The study constructs were assessed with 5-point Likert scales adapted from validated instruments. For risk management (9 items) adapted from Njuguna & Mwangi (2019): Kassim & Rahman (2020). Regulatory compliance (7 items) adapted from Adams & Tewari (2020) and Technology implementation (7 items) adapted from Mwangi & Ouma (2023): Wang & He (2022). Finally, Financial sustainability (10 items) based on Mersland & Strøm (2020): Chikalipah (2017).

3.1 Conceptual Framework

Based on RBV's theoretical foundation and the preceding empirical literature, this study proposed a conceptual framework in which risk management and regulatory compliance influence financial sustainability. Further, the study also assumed that technology implementation moderates the relationships between risk management and regulatory compliance, and SACCOs financial sustainability. Figure 1 below presents the conceptual framework.

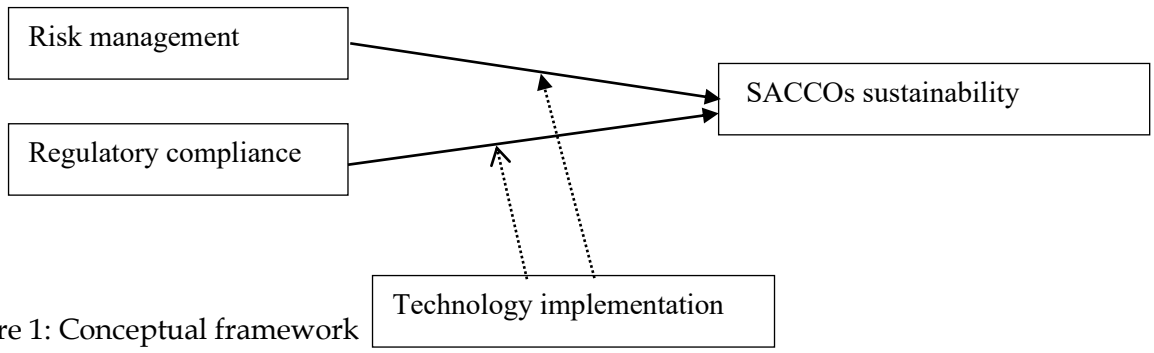


Figure 1: Conceptual framework

From the conceptual framework, this study developed the following hypothesis (H):

H1): Risk management influences the financial sustainability of SACCOs in the greater Bushenyi district, Uganda.

H2: Regulatory compliance influences the financial sustainability of SACCOs in the greater Bushenyi district, Uganda.

H3a: Technology implementation moderates the relationship between risk management and the financial sustainability of SACCOs in the greater Bushenyi district, Uganda.

H3b: Technology implementation moderates the relationship between regulatory compliance and the financial sustainability of SACCOs in the greater Bushenyi district, Uganda.

4. Results and Discussions

4.1 Demographic profile of the study

In Table 1 below, the 251 SACCO respondents' demographics, which include gender, age, educational background, and marital status, are shown. Male responses outnumbered females by 60% to 40%. Respondents aged 31-39 had the highest response rate of 38%, followed by those aged 40-49 at 27%. However, for those aged 20-30 and 50 and above, the response rate was low at 21% and 14%, respectively. Similarly, on the educational level, respondents with a diploma achieved the highest response rate at 31%, followed by those at a degree level at 27% and certificate level at 22%. The smallest number of education level response rates were for A- level and below at 20%. Finally, married respondents achieved a high response rate at 63% followed by single and divorced at 29% and 8% respectively.

Table 1: Demographics of Respondents (N= 251) of the Study

Respondents' profile	Frequency	Percentage (%)
Gender		
Male	153	60%
Female	98	40%
Age		
20-30	53	21%
31-39	96	38%
40-49	67	27%
50 and above	35	14%
Education Level		
Above degree	67	27%
Diploma	78	31%
Certificate	55	22%
Below A level	51	20%
Marital status		
Married	159	63%

Single	74	29%
Divorced	18	8%

Source: Authors' work from SPSS

4.2 Descriptive statistics of the study variables

Table 2 shows the descriptive statistics for the key study variables, based on 251 valid responses. For each variable, we provide the mean, standard deviation (SD), skewness, and kurtosis. Skewness quantifies the asymmetry of a probability distribution around its mean, indicating whether data points are concentrated at higher or lower values. Kurtosis determines the tailedness of a distribution, reflecting the likelihood of extreme deviations from the mean (De Michele & De Bartolo, 2025).

According to established guidelines for social science research, data is regarded as approximating a normal distribution when skewness values fall within the absolute range of ±2 and kurtosis values within ±7 (Isiyaku et al., 2015). Conservative thresholds (skewness ±3, kurtosis ±10) are suitable for large samples (N > 200) in PLS-SEM applications (Hair et al., 2022; Cheung et al., 2024). Table 2 shows that all skewness and kurtosis values are within these acceptable ranges, indicating that maximum likelihood estimation and parametric statistical tests are appropriate.

4.2.1 Risk management

The risk management scores ranged from 6 to 20, with a mean of 15.48 (SD = 3.03). The mean, representing approximately 62% of the maximum possible score, indicated moderate-to-good risk management practices among SACCOs. The standard deviation of 3.03 suggests meaningful variation across SACCOs, with some SACCOs demonstrating substantially stronger risk management capabilities than others.

The skewness value of -1.24 indicated a moderate negative skew, meaning the distribution had a longer tail on the left (lower scores) with most scores clustering toward the higher end of the distribution. The kurtosis value of 2.47 indicated positive kurtosis, suggesting heavier tails and a sharper peak than a normal distribution. This pattern indicated that while the majority of SACCOs report relatively strong risk management practices, a small number of institutions have notably weaker practices.

4.2.2 Regulatory compliance

Regulatory compliance scores varied from 8 to 18, with a mean of 12.41 (SD = 2.38). The mean was around 62% of the highest attainable score, showing adequate but not

outstanding compliance with regulatory standards. The comparatively low standard deviation (2.38) indicated that compliance levels are very constant among institutions, with less fluctuation than seen in risk management.

The skewness value of -1.56 indicated a more extreme negative skew compared to risk management, implying that the distribution is asymmetrically concentrated at higher compliance levels. A kurtosis score of 2.80 shows positive kurtosis, which has a sharper peak and thicker tails. This distributional pattern indicated that the majority of SACCOs in the sample had good compliance, with only a few outliers displaying low compliance. This finding was consistent with the regulatory climate in Uganda, where SACCOs are under increasing pressure to meet Bank of Uganda standards (Bank of Uganda, 2025).

4.2.3 Technology implementation

Technology implementation scores varied from 3 to 12, with a mean of 7.40 (SD = 2.15). The mean score was only 37% of the highest possible score, reflecting poor levels of technology adoption among SACCOs. This finding was consistent with previous studies that found technological adoption challenges in rural Ugandan microfinance institutions, such as unstable electricity, poor internet access, low digital literacy, and expensive initial costs (Nakato & Ssekakubo, 2022; Banda et al., 2025). The standard deviation of 2.15 was the lowest of any variable, showing that most SACCOs have similar (moderately) technology implementation levels with little variation.

The skewness result of -0.61 suggests a small negative skew, implying a slight bias toward higher technology scores, while the asymmetry is less evident than for governance variables. The kurtosis value of -0.48 indicated negative kurtosis, which produces a flatter distribution with lighter tails. This distributional pattern suggests that technology implementation is consistently constrained in most SACCOs, with few extremely high or low scores.

4.2.4 Financial sustainability

Financial sustainability scores ranged from 6 to 21, with an average of 15.10 (SD = 3.44). The mean reflects almost half of the highest potential score, indicating moderate sustainability levels. The standard deviation of 3.44 was the greatest of any variable, demonstrating significant heterogeneity in financial sustainability outcomes across SACCOs. This heterogeneity was to be expected given the region's diverse SACCO sizes, operational histories, and management capacities (Otto & Ukpere, 2021; Zineelabidine et al., 2024).

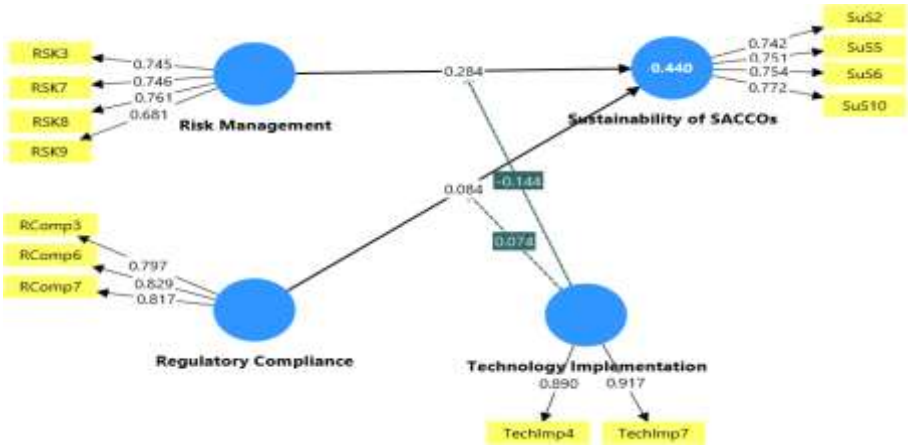
The skewness value of -0.67 indicated a substantial negative skew, implying that the distribution has a longer left tail and most scores cluster toward the higher end. The kurtosis score of 0.35 suggests modest positive kurtosis (slightly heavier tails than a normal distribution), although it is well within permissible limits and not statistically significant. This distributional pattern indicates that, while most SACCOs report moderate-to-good financial sustainability, there is significant heterogeneity, with a fraction of institutions falling behind.

Table 2: Descriptive Statistics of the Study

	N	**Mean**	**Std. Deviation**	**Skewness**		**Kurtosis**	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Risk_Management	251	15.4781	3.02829	-1.240	.154	2.469	.306
Regulatory Compliance	251	12.4104	2.37885	-1.558	.154	2.801	.306
Technology Implementation	251	7.3984	2.15050	-.606	.154	-.478	.306
Sustainability	251	15.0996	3.44123	-.669	.154	.354	.306
Valid N (listwise)	251						

Source: Authors' work from SPSS

Figure 2 below illustrates the structural model of the study



Source: Author work from SmartPLS-SEM

As shown in Table 3, the model identified all constructs with strong correlation coefficients. To achieve this, the study used composite reliability (CR) to investigate a construct's internal consistency and dependability. In contrast, AVE is the average of the squared loadings of items linked with a certain construct. It calculates the sum of the squared loadings divided

by the number of items in the construct (Haji-Othman & Yusuff, 2022). Accordingly, CR and AVE values of 0.7 and 0.5 or higher form the threshold, respectively (Cheung et al., 2024). As a result, the study's constructs were all above the threshold.

Table 3: Average Variance Extracted (AVE) and Composite Reliability

Construct	Cronbach's alpha	Composite reliability (rho_a)	Average variance extracted (AVE)
Regulatory Compliance	0.747	0.748	0.664
Risk Management	0.715	0.721	0.539
Sustainability of SACCOs	0.752	0.755	0.571
Technology Implementation	0.776	0.787	0.817

Source: Author work from SmartPLS-SEM

In Table 4, it is indicated that the coefficient between regulatory compliance and the sustainability of SACCOs is 0.079, with a t-statistic of 1.255 and a p-value of 0.209, signifying that the coefficient is insignificant. This finding verifies that regulatory compliance and sustainability of SACCOs are not significantly related, hence rejecting H1. In the same way, risk management coefficients are 0.286, t-statistics 4.458, and p-values at 0.000, which shows a significant positive relationship with the sustainability of SACCOs, thereby supporting H2. Finally, the findings verify that technology implementation didn't moderate regulatory compliance at a coefficient of 0.076, t-statistic of 1.115, p-value of 0.265, thus partially rejecting H3. And in the same light, technology implementation moderation coefficient of -0.145, t-statistics 2.099, and p-values 0.036 supported H3. As a result, the threshold is set at p = 0.05. P < 0.05 indicates statistical significance, while p > 0.05 indicates non-statistically significant results (Kwak, 2023).

Table 4: Path coefficient of the hypothesized relationship of variables

No.	Relationship of variables	Coefficient	Standard deviation (STDEV)	T statistics	P values	Decision
H1	Regulatory Compliance -> Sustainability of SACCOs	0.079	0.063	1.255	0.209	Rejected
H2	Risk Management -> Sustainability of SACCOs	0.286	0.064	4.458	0.000	Accepted
H3	Technology	0.076	0.068	1.115	0.265	Rejecte

a	Implementation x Regulatory Compliance -> Sustainability of SACCOs					d
H3b	Technology Implementation x Risk Management -> Sustainability of SACCOs	-0.145	0.069	2.099	0.036	Accepted

Source: Author's work from SmartPLS-SEM

Table 5 below shows that the structural model is valid; the coefficient of (R2) is 0.438. R2 is a measure of the extent to which an exogenous variable influences an endogenous variable; values of 0.19, 0.33, and 0.67 are commonly regarded as minimum, medium, and high, respectively (Kamranfar et al., 2023). The model thus explains 43.8% of the variance in (dependent variable) (R^2 = 0.438), which is close to moderate but slightly below 0.50, showing moderate explanatory power. This shows that while the included predictors are meaningful, roughly 56% of the variance is unexplained by the current model.

Table 5: Coefficient of Determination (R^2 Value)

Variable	R-square
Sustainability of SACCOs	0.438

Source: Author's work from SmartPLS-SEM

5. Discussion

The result that regulatory compliance has no significant direct effect on financial sustainability (H2 rejected) is consistent with some previous research while contradicting others. Our findings are congruent with those of Ofori-Sasu et al. (2021), who identified no significant compliance-sustainability correlations in rural Ghanaian microfinance institutions, and Lee and Shin (2019), who discovered that compliance costs outweighed advantages for small-scale organizations. However, the results differ from those of Agyemang et al. (2022); Adams & Tewari (2020), who found favourable effects in larger Sub-Saharan African groups. This discrepancy may be explained by the sample's unique characteristics of the study: all participating SACCOs were already in good regulatory standing (mean compliance score = 12.41 on a 5-20 scale), implying that once a minimum compliance threshold is met, additional compliance efforts may not result in financial gains. This interpretation is congruent with the

study by Kassim & Rahman (2020), the U-shaped compliance-sustainability relationship, which proposes that moderate compliance adds value while extreme compliance incurs disproportionate costs.

6. Conclusion

The study's goal was to examine how technology implementation affected the relationship between risk management, regulatory compliance, and financial sustainability in SACCOs in Uganda's Greater Bushenyi District. The Resource-Based View (RBV) served as the theoretical basis for this study. This is one of the first studies to use the RBV moderating viewpoint in the context of rural Ugandan SACCOs, focusing on technology as a strategic resource that influences the effectiveness of governance-related capacities. The study's data comes from 251 respondents who worked in various SACCOs in the Greater Bushenyi District. Hypotheses H2 and H3b were accepted, whereas H1 and H3a were rejected. In particular, risk management had a considerable beneficial impact on financial sustainability (H2 approved), while technology implementation significantly weakened the relationship between risk management and financial sustainability (H3b accepted). However, regulatory compliance did not have a substantial impact on financial sustainability (H1), and technology adoption did not mitigate the compliance-sustainability relationship (H3a rejected). The study greatly advances our understanding of how technology interacts with traditional governance systems to predict financial sustainability in rural SACCOs.

7. Recommendation

The study suggests the following:

1) SACCO management should prioritize investments in technology that directly improves credit risk management capabilities, such as automated loan tracking systems, biometric identification, and real-time portfolio monitoring tools, because technology significantly strengthens the risk management-sustainability relationship.
2) SACCO boards and management should not rely primarily on regulatory compliance to ensure financial viability. Instead, they should supplement compliance efforts with proactive risk management measures, as compliance alone had no significant direct impact on sustainability in this study.
3) Development partners and microfinance assistance programs can create capacity-building projects that combine technology training with risk management best practices, acknowledging that technology serves as a moderator rather than a solo solution.

4) Even though the moderating effect of technology on compliance was not statistically significant in this study, the Bank of Uganda and other regulators should consider subsidizing or sharing RegTech solutions for rural SACCOs, particularly those that automate compliance reporting and reduce administrative burdens. Further research on this relationship is required.
5) To maximize the moderating benefits shown in this study, SACCOs in Greater Bushenyi and similar rural environments should integrate technology in stages, starting with high-impact risk management technologies and progressing to other areas

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