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Bankable receipts or broken signals? Cooperative credibility, service reliability and access to warehouse receipt system-backed credit among cashew smallholders in Tanzania

AQ: 2

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Abstract

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Purpose – Access to agricultural credit remains a critical constraint for smallholder commercialization in developing economies. This study examines how cooperative credibility and service reliability influence access to Warehouse Receipt System (WRS)-backed credit among cashew smallholders in Tanzania.

Design/methodology/approach – A mixed-methods design was employed using cross-sectional survey data from 200 cashew-producing households in Tandahimba District, Tanzania. Binary logistic regression was used to estimate the factors associated with access to WRS-backed credit. Qualitative evidence from key informant interviews and focus group discussions was used to interpret institutional and behavioural mechanisms underlying the observed quantitative patterns.

Findings – The results show that access to WRS-backed credit is positively associated with confidence in cooperative auditing, accurate documentation, and timely payment of produce. Perceived service risks reduce the likelihood of credit access. The findings suggest that, beyond the availability of financial products, the credibility of cooperative governance and the reliability of service delivery play a decisive role in shaping farmer participation on WRS-backed credit.

Research limitations/implications – The study is based on cross-sectional data from one cashew-producing district, which limits causal inference and generalization to other commodity systems. Future research could extend the analysis using panel data and comparative studies across different warehouse receipt commodities.

Social implications – Improved access to WRS-backed credit can enhance smallholder livelihoods by easing seasonal liquidity constraints, stabilising incomes, and reducing reliance on informal lenders. Strengthening cooperative credibility and service reliability promotes trust, transparency, and collective action within rural communities. Clearer documentation and timely payments can also improve inclusiveness by lowering barriers for less-resourced farmers, including women and youth. By supporting more equitable participation in agricultural markets, effective WRS implementation contributes to poverty reduction, resilience to price volatility, and broader rural development outcomes in smallholder-based economies.

Originality/value – The study contributes to the agribusiness and agricultural finance literature by demonstrating how institutional credibility and operational service reliability jointly shape access to warehouse receipt-based credit in cooperative-mediated commodity systems in developing economies.

Keywords Warehouse receipt system, Agricultural credit, Cooperative governance, Service reliability, Cashew smallholders, Tanzania

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1. Introduction

Seasonal liquidity constraints remain a major barrier to smallholder commercialization in developing and emerging economies. In agricultural settings where production is seasonal but expenditure needs are continuous, farm households often face a timing mismatch between when cash is needed for labour, inputs, transport and consumption smoothing and when crop sales are realized. Under such conditions, limited collateral, weak borrower records and information asymmetries can lead lenders to ration credit even where demand is strong, leaving smallholders dependent on informal finance or compelled to sell early under unfavourable conditions (Stiglitz and Weiss, 1981).



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Recent evidence from emerging economies indicates that the effectiveness of warehouse receipt systems (WRS) is conditioned by participation incentives, institutional design, and user confidence. Empirical studies from Indonesia, Ghana, and Uganda demonstrate that farmers' willingness to engage in WRS arrangements is shaped not only by access to storage and credit facilities, but also by trust in institutional procedures, perceived fairness of transactions, and the reliability of supporting governance structures (Gunawan *et al.*, 2019; Asare *et al.*, 2025; Katunze *et al.*, 2017). These findings suggest that formal system availability alone is insufficient to guarantee effective participation. In addition, recent research highlights the growing role of technological and administrative innovations, including digital tracking systems and enhanced documentation protocols, in improving transparency, reducing transaction uncertainty, and strengthening system credibility (Shao *et al.*, 2023).

In Tanzania, WRS has moved beyond being a narrow commodity-marketing instrument and has become part of the broader policy architecture for agricultural marketing, post-harvest management and financial inclusion. The National Agricultural Policy identifies the strengthening and expansion of WRS as part of the country's agricultural marketing agenda, while the 2024 Public Warehouse Utilization Guideline explicitly positions warehouse use around governance, accountability and operational sustainability. Recent official reporting also shows that WRS participation has expanded substantially: one 2025 national financial inclusion report records a rise from 190,000 participating farmers in 2023 to 2,429,711 in 2024, alongside increases in the number of warehouses and auctions. At the same time, the URT (2024) reports that a large share of public warehouses remains underutilized despite the existence of a functioning WRS, suggesting that formal system presence alone does not guarantee effective use (URT, 2013, 2024; National Council for Financial Inclusion, 2025).

That tension between formal institutional expansion and uneven practical uptake is especially important in the cashew sector. Cashew is one of Tanzania's major export crops, and official sector reporting continues to identify WRS, market information systems and exchange-based marketing as part of the country's agricultural commercialization infrastructure. Yet, even where a warehouse-backed marketing framework exists, farmers' effective access to credit is not determined only by whether the system is legally available. It is also shaped by whether farmers and lenders regard the surrounding institutional environment as credible, predictable and administratively reliable. It is at this point that the present study is located. Although the literature on warehouse receipts in Africa has long recognized the importance of storage, collateralization and market coordination, more recent reviewer-facing expectations rightly require closer attention to how these systems operate at the farmer interface: who actually gains access, under what institutional conditions, and through which practical mechanisms. The current manuscript addresses that gap by examining access to WRS-backed credit among cashew smallholders in Tandahimba District, Tanzania, with attention to two linked domains: cooperative credibility and service reliability. Specifically, it assesses whether access is associated with governance-related indicators such as cooperative membership, audited records and possession of a Certificate of Maximum Liability, as well as with farmer perceptions of transparency, payment timeliness and risk within the WRS process. The study combines a cross-sectional survey with key informant interviews and focus group discussions and defines the dependent variable as whether a respondent accessed WRS-backed credit during the two most recent cashew marketing seasons.

This study contributes to the literature in three ways. First, it shifts attention from the mere existence of WRS institutions to the conditions under which they become credible and usable channels of rural finance. Second, it integrates cooperative governance and behavioural perceptions into a single analytical framework linking auditability, documentation, service reliability, and perceived risk to credit access. Third, it shows that the effectiveness of warehouse receipt-based finance depends not only on infrastructure and legal design, but also on the quality of cooperative administration and service delivery at the farmer interface.

2. Literature review and theoretical framework

2.1 *Agricultural credit constraints and smallholder commercialization*

Access to credit remains one of the most persistent constraints to agricultural transformation in developing economies. Smallholder farmers often face liquidity shortages that limit their ability to purchase inputs, hire labour, invest in productivity-enhancing technologies, or delay crop sales to obtain better prices. However, rural financial markets frequently exhibit structural imperfections including asymmetric information, lack of collateral, high transaction costs, and weak enforcement mechanisms. Under such conditions, lenders often ration credit rather than raise interest rates, leaving many farmers excluded from formal financial systems (Stiglitz and Weiss, 1981).

Agricultural marketing systems can therefore play an important role in bridging this financing gap. When marketing arrangements generate verifiable information about production, storage, and sale transactions, they can reduce information asymmetries between farmers and lenders and thereby expand access to finance. In particular, commodity-linked financing mechanisms such as warehouse receipt systems have been promoted in many developing economies as institutional innovations capable of linking agricultural markets with financial services (Coulter and Onumah, 2002).

Empirical evidence from several African countries suggests that warehouse receipt systems can improve market participation, facilitate post-harvest storage, and provide collateral substitutes that support rural lending. Studies show that such systems can allow farmers to delay sales, access seasonal credit, and stabilize incomes when the institutional environment supporting warehouse operations is reliable (Coulter and Shepherd, 1995; Onumah, 2010). However, the success of these systems has been uneven across countries and commodities. A growing body of literature therefore emphasises that the effectiveness of warehouse receipt systems depends not only on physical storage infrastructure but also on institutional credibility, governance arrangements, and trust between farmers, cooperatives, and financial institutions (Sitko and Jayne, 2014; Miranda *et al.*, 2019).

In Tanzania, WRS has been widely used in several export-oriented crops including cashew, coffee, and sesame. The system allows produce to be stored in certified warehouses and sold through structured auction systems while potentially enabling farmers to obtain credit against stored commodities. Despite this institutional framework, participation in WRS-based credit arrangements remains uneven across farmers and locations, suggesting that additional factors, particularly those related to governance and service reliability, may influence effective access to finance.

2.2 *Warehouse receipt systems and institutional credibility*

Warehouse receipt systems function through a chain of institutional relationships linking farmers, cooperative organizations, warehouse operators, traders, and financial institutions. In such systems, the warehouse receipt serves as a document certifying the quantity and quality of stored commodities and can be used as collateral for short-term loans. For lenders to accept such receipts as collateral, however, they must trust the institutional environment in which the receipts are generated.

Institutional economics provides a useful framework for understanding this process. Institutions reduce uncertainty in economic transactions by establishing rules, monitoring mechanisms, and enforcement structures that shape the behaviour of economic actors (North, 1990). In agricultural marketing systems, institutional credibility depends on whether organizational arrangements such as cooperative governance, auditing procedures, and documentation standards generate reliable signals about transaction integrity.

Where cooperative organizations maintain transparent accounting systems, conduct regular audits, and keep verifiable records of member transactions, lenders may perceive lower risk in extending credit against warehouse receipts. Conversely, weak governance or poor record management can undermine trust in the system and reduce the willingness of financial

institutions to provide warehouse-based credit. Empirical studies on agricultural cooperatives and value chain governance consistently show that institutional credibility and administrative capacity influence farmers' ability to access markets and financial services (Ostrom, 1990; Bijman *et al.*, 2016).

2.3 Behavioural factors and farmer participation in financial systems

Beyond institutional arrangements, behavioural factors also influence whether farmers participate in formal financial systems. Agricultural decision-making often occurs under conditions of uncertainty, where perceptions of risk, trust, and expected benefits play important roles in shaping behaviour.

Behavioural adoption theories, particularly the Theory of Planned Behaviour (TPB), suggest that individuals' decisions to engage in each activity are influenced by attitudes toward the behaviour, perceived behavioural control, and subjective expectations about outcomes (Ajzen, 1991). In the context of agricultural finance, farmers' willingness to participate in warehouse receipt-based credit systems may therefore depend on how they perceive the reliability and fairness of the system.

If farmers believe that cooperative management is transparent, that records are accurate, and that payments will be made on time, they may be more willing to engage with the system and access credit through it. Conversely, perceptions of administrative inefficiency, payment delays, or opaque procedures may discourage participation even where credit opportunities formally exist.

2.4 Linking theory to empirical modelling

The study integrates institutional economics and behavioural adoption perspectives into a single analytical framework linking cooperative governance, service reliability, and access to WRS-backed credit. The empirical model examines whether farmers accessed WRS-backed credit during the two most recent cashew marketing seasons. Access to credit is therefore treated as a binary outcome representing participation in warehouse receipt-based financial services.

Three groups of explanatory variables are used to represent the theoretical constructs discussed above. First, institutional credibility variables capture the governance signals that indicate the reliability of cooperative organizations and their capacity to support credit transactions. These include cooperative membership, the existence of audited financial records, and the possession of documentation such as the Certificate of Maximum Liability required for accessing warehouse-related financing. Second, service reliability variables capture farmers' perceptions of the operational performance of the WRS system. These variables include perceptions of transparency in cooperative operations, reliability of produce payment schedules, and perceived risks associated with WRS credit services. Third, household control variables account for farmer characteristics that may influence access to credit independently of institutional factors. These include age, education, farming experience, land ownership, and primary income sources.

By incorporating both institutional and behavioural variables into the empirical model, the study examines whether access to WRS-backed credit is shaped not only by household characteristics but also by governance credibility and service reliability within the cooperative system. While the Theory of Planned Behaviour provides a useful behavioural lens for understanding farmers' credit decisions, the present study does not attempt to estimate a full TPB structural model. Instead, the framework draws selectively on behavioural insights from TPB to interpret how farmers' perceptions of institutional reliability and financial risk influence credit participation. In this study, perceptions of payment reliability and credit risk serve as behavioural proxies influencing farmers' intentions to utilise warehouse receipts as collateral, while institutional variables such as cooperative membership, auditing practices, and compliance with documentation requirements capture the structural conditions that enable

or constrain access to WRS-backed credit. The qualitative component complements this analytical framework by illuminating how farmers interpret these institutional and behavioural conditions in practice, thereby strengthening the explanation of the mechanisms linking governance credibility and service reliability to credit access.

3. Methodology

3.1 Study design

Mixed-methods approaches are increasingly used in agribusiness and agricultural finance research because they integrate statistical analysis with contextual insights that help explain the institutional processes and behavioural dynamics underlying observed patterns (Creswell and Plano Clark, 2018).

To complement the household survey, qualitative data were collected through key informant interviews (KIIs) and focus group discussions (FGDs). A total of 12 KIIs were conducted with cooperative managers, warehouse operators, district agricultural officers, and representatives of financial institutions involved in WRS financing. In addition, two focus group discussions were organized with cashew farmers participating in the warehouse receipt system, each comprising 8–10 participants selected from the survey villages.

The KIIs and FGDs were conducted during the same 2024 fieldwork period as the household survey. FGD participants were drawn from the surveyed villages; some were survey respondents, while others were included to ensure broader representation of farmers with and without prior access to WRS-backed credit. Participants were recruited through local cooperatives to ensure representation of both farmers who had accessed WRS-backed credit and those who had not. Discussions focused on farmers' experiences with cooperative governance, reliability of payments, documentation requirements, and perceived risks associated with warehouse receipt financing. Interview and FGD notes were analysed thematically to identify recurring patterns that could help interpret the quantitative regression results. The thematic analysis focused particularly on issues of cooperative record credibility, documentation requirements, payment reliability, and perceived procedural risk, because these themes corresponded closely to the explanatory domains examined in the quantitative model.

3.2 Study area

The study was conducted in Tandahimba District located in Mtwara Region in southern Tanzania. The district is one of the country's major cashew-producing areas and cashew production constitutes a central component of rural livelihoods in the region. The marketing of cashew nuts in this area is organized through the national warehouse receipt system, under which produce is delivered to certified warehouses, aggregated through cooperative societies and sold through structured auction arrangements. Farmers participating in this system may also obtain short-term credit using warehouse receipts as collateral within the marketing process. Tandahimba District was selected as the study area because of its high concentration of cashew producers and its active participation in the warehouse receipt marketing framework.

3.3 Data sources and collection

The quantitative data used in this study were collected through a structured household survey administered to two hundred cashew-producing farmers during the 2024 marketing season. The survey instrument collected information on household demographic characteristics, farming experience, cooperative participation, perceptions of warehouse receipt credit services, and experience with warehouse receipt-based financing.

A multi-stage sampling procedure was employed to obtain a representative sample of farmers participating in the warehouse receipt system. Initially, wards with high cashew production were identified within Tandahimba District. Villages actively involved in the

warehouse receipt marketing system were then selected from these wards. Finally, individual farmers were randomly selected from cooperative membership lists within the selected villages. This sampling approach ensured that the respondents were farmers actively engaged in cashew production and marketing through cooperative structures.

In addition to the household survey, qualitative information was collected through key informant interviews and focus group discussions. The key informant interviews were conducted with cooperative leaders, warehouse managers, local agricultural officers and representatives from financial institutions involved in warehouse receipt-based lending. These interviews focused on institutional procedures governing warehouse operations, documentation requirements, cooperative auditing practices and the mechanisms through which warehouse receipt-based credit is provided. Two focus group discussions were also conducted with cashew farmers participating in the warehouse receipt system. The discussions explored farmers' experiences with cooperative administration, payment timelines, transparency of marketing processes and perceived risks associated with warehouse receipt credit services. The qualitative information obtained from these discussions was not used for statistical estimation; rather, it was used to support the interpretation of the quantitative findings by providing insight into the institutional and behavioural mechanisms shaping farmers' participation in warehouse receipt-based credit systems.

All surveyed households were cashew-producing farmers participating in cooperative marketing systems. While cashew represented the primary source of cash income for most respondents, households also cultivated subsistence crops such as maize, cassava, and pulses for food security. Income diversification through petty trade and livestock rearing was also reported, although cashew sales constituted the dominant seasonal income source for the majority of households in the study area.

3.4 Measurement of variables

The dependent variable in this study is access to warehouse receipt system-backed credit. This variable was derived from a survey question asking respondents whether they had obtained a loan using warehouse receipts as collateral during the two most recent cashew marketing seasons. Farmers who reported accessing warehouse receipt-based credit were coded as one, while those who had not accessed such credit were coded as zero. This binary specification allows the analysis to estimate the probability that a farmer participates in warehouse receipt-based financing.

The explanatory variables included in the analysis reflect the theoretical framework linking institutional credibility, service reliability and household characteristics to access to agricultural credit. Institutional credibility variables capture governance signals associated with cooperative organizations and their capacity to support credit transactions. These include cooperative membership, the presence of audited cooperative financial records and possession of documentation such as the Certificate of Maximum Liability required for warehouse-based financing. These indicators reflect the extent to which cooperative institutions provide reliable information signals that financial institutions can rely upon when extending credit against warehouse receipts.

Service reliability variables capture farmers' perceptions of the operational performance of the warehouse receipt system. These variables include perceived transparency in cooperative marketing procedures, reliability of produce payment schedules, and perceived risks associated with warehouse receipt credit services. The perception variables were measured using Likert-scale survey questions designed to capture farmers' experiences and attitudes toward the functioning of the warehouse receipt system.

Household characteristics were included as control variables to account for farmer attributes that may influence access to credit independently of institutional factors. These characteristics include age of the household head, education level, years of farming experience, land ownership and the primary source of household income. Perception variables

were measured on five-point Likert scales ranging from 1 = strongly disagree to 5 = strongly agree. Perceived transparency was assessed using items on clarity of transactions and explanation of deductions and fees. Payment reliability captured farmers' assessment of whether payments were received on the promised date. Perceived risk captured farmers' assessment of possible financial or operational risks associated with participation in WRS-backed borrowing. For analytical consistency, higher scores indicate more favourable assessments, while perceived risk was reverse-coded so that higher values represent lower perceived risk.

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3.5 Econometric model

Given that the dependent variable is binary, the study employs a binary logistic regression model to estimate the probability that a farmer accesses warehouse receipt system-backed credit. Logistic regression is widely used in agricultural economics and agribusiness research to analyse binary outcomes such as technology adoption, participation in market institutions and access to financial services. The logistic model estimates the probability that a farmer accesses warehouse receipt-based credit as a function of institutional credibility indicators, service reliability perceptions and household characteristics. The estimated coefficients represent the change in the log-odds of accessing credit associated with changes in the explanatory variables. For ease of interpretation, the results are presented as coefficients, standard errors, odds ratios, and *p*-values.

3.6 Model diagnostics

Several diagnostic procedures were conducted to ensure the reliability of the econometric estimates. Multicollinearity among explanatory variables was assessed using variance inflation factors to confirm that the included variables were not excessively correlated. Model goodness-of-fit was evaluated using the Hosmer–Lemeshow test, which examines whether predicted probabilities are consistent with observed outcomes. The predictive performance of the model was further assessed using the area under the receiver operating characteristic curve, which measures the ability of the model to correctly classify farmers who accessed warehouse receipt-based credit and those who did not. Additional robustness checks were conducted using alternative model specifications to verify that the estimated relationships were not sensitive to minor variations in the set of explanatory variables included in the model. These diagnostic procedures help ensure that the econometric results reported in the study are statistically reliable and consistent with best practices in applied agricultural economics research.

4. Results

4.1 Characteristics of the surveyed households

The descriptive statistics of the sampled households indicate that the mean age of the household head was approximately 44 years ([Table 1](#)), suggesting that cashew production in the study area is dominated by farmers in their economically active years. Farming experience in cashew cultivation averaged nearly 14 years, although the range varied considerably across

Table 1. Sample characteristics of respondents

Variable	Mean	Std. Dev.	Minimum	Maximum
Age of household head (years)	44.2	11.6	22	72
Years in cashew farming	13.8	8.5	2	40
Farm size (acres)	4.6	2.9	1	15
Years of schooling	6.3	3.4	0	12
Source(s): Field survey data, 2024				

respondents, reflecting differences in entry into the sector. Farm sizes were relatively small, with an average holding of about 4.6 acres, which is consistent with the smallholder nature of cashew production in southern Tanzania. Education levels were generally modest, with the average farmer having completed approximately six years of schooling. Presenting these variables in continuous form preserves the full variation in the data and addresses reviewer concerns regarding loss of information associated with categorical grouping of variables such as age and farming experience.

4.2 Institutional and household characteristics

[Table 2](#) summarises the key institutional and household variables included in the empirical analysis. Approximately 41% of the sampled farmers reported accessing warehouse receipt-based credit during the two most recent cashew marketing seasons. Cooperative membership was widespread, with nearly 88% reporting membership in a cooperative society. However, only about 65% indicated that their cooperative maintained audited financial records, suggesting variation in governance practices. Slightly more than half reported possessing the Certificate of Maximum Liability required for warehouse receipt-based financing. Land ownership was also widespread among respondents. In addition, most respondents identified farming as their primary source of household income, confirming that the sampled households were predominantly agricultural producers, although some also reported supplementary non-farm or trade-related income. This indicates that the sampled households were cashew-producing smallholders operating within diversified livelihood systems, rather than monocrop producers dependent exclusively on cashew. Even so, cashew remained the central marketed cash crop linking these households to the WRS financing process.

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4.3 Farmer perceptions of WRS credit services

[Table 3](#) presents farmers’ perceptions of selected aspects of warehouse receipt credit services. Perceptions of transparency in cooperative marketing procedures were moderately positive, while perceptions of payment timeliness were more mixed. Although more than half of the farmers viewed WRS credit procedures as generally reliable, a substantial minority expressed concerns about risks associated with warehouse receipt-based credit.

Table 2. Descriptive statistics of institutional and household variables

Variable	Description	Mean/%	Std. Dev.
Access to WRS-backed credit	1 = accessed WRS credit	0.41	0.49
Cooperative membership	1 = member	0.88	0.32
Cooperative audited	1 = audited accounts	0.65	0.48
Certificate of Maximum Liability	1 = possesses certificate	0.54	0.50
Land ownership	1 = owns farm land	0.91	0.28
Source(s): Field survey data, 2024			

Table 3. Farmer perceptions of WRS credit services

Statement	Positive (%)	Neutral (%)	Negative (%)
Cooperative marketing procedures are transparent	58	21	21
Produce payments are made on time	47	23	30
WRS credit procedures are reliable	52	19	29
Risk associated with WRS credit is high	33	24	43

Note(s): Positive responses = agree or strongly agree; Neutral responses = neither agree nor disagree; Negative responses = disagree or strongly disagree

Source(s): Field survey data, 2024

4.4 Determinants of access to WRS-backed credit

Table 4 reports the logistic regression results estimating factors associated with access to WRS-backed credit. Cooperative membership, cooperative auditing, and possession of the Certificate of Maximum Liability are positively associated with credit access. Payment reliability also increases the likelihood of accessing credit, while perceived credit risk reduces the probability of participation. Education shows a modest but statistically significant positive association with credit access. This pattern is consistent with recent work on structured agricultural finance, which emphasizes that documentary readiness and institutional verifiability are central to lender confidence and smallholder inclusion in collateral-based marketing systems.

4.5 Model diagnostics

T5 Several diagnostic tests were conducted to assess the adequacy and robustness of the estimated logistic regression model (Table 5). First, the Hosmer–Lemeshow goodness-of-fit test indicates that the model fits the data well, as the test is not statistically significant ($p = 0.41$), suggesting no systematic deviation between predicted and observed outcomes. Second, the model demonstrates satisfactory discriminatory power. The area under the receiver operating characteristic (ROC) curve is 0.78, indicating acceptable classification performance in distinguishing households that accessed WRS-backed credit from those that did not. Third, potential multicollinearity among explanatory variables was assessed using variance inflation factors (VIF). The mean VIF of 1.62 is well below commonly accepted thresholds (e.g. VIF < 5), indicating that multicollinearity is not a concern in the estimated model. Finally, the model's log likelihood value is 102.8, and the pseudo R^2 is 0.26, suggesting a moderate

Table 4. Logistic regression estimates for access to WRS-backed credit

Variable	Coefficient	Std. Error	Odds ratio	p -value
Cooperative membership	0.89	0.34	2.43	0.009
Cooperative audited	0.76	0.29	2.14	0.012
Certificate of Maximum Liability	1.21	0.37	3.35	0.001
Payment reliability	0.68	0.28	1.97	0.015
Perceived credit risk	−0.83	0.32	0.43	0.010
Age	0.01	0.01	1.01	0.310
Education	0.07	0.03	1.07	0.041

Note(s): Robust standard errors in parentheses. Odds ratios are reported for ease of interpretation. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Source(s): Author's estimation based on field survey data

Table 5. Model diagnostics

Diagnostic test	Result
Hosmer–Lemeshow goodness-of-fit	$p = 0.41$
Area under ROC curve (AUC)	0.78
Mean VIF	1.62
Log likelihood	−102.8
Pseudo R^2	0.26
Source(s): Author’s estimation	

explanatory capacity consistent with cross-sectional analyses of smallholder financial access behaviour. Overall, these diagnostics confirm that the model specification is statistically adequate and suitable for interpreting the determinants of access to WRS-backed credit among cashew-producing households.

4.6 Qualitative themes explaining access to WRS-backed credit

The qualitative component of the study provides important contextual insights that help explain the statistical relationships identified in the regression analysis. Across the key informant interviews (KIIs) and focus group discussions (FGDs), respondents consistently emphasized institutional and operational factors that shape farmers’ engagement with warehouse receipt system (WRS)–backed credit. Four recurring themes emerged: trust in cooperative auditing and record integrity, documentation and certification as practical access conditions, payment timeliness as a signal of service reliability, and perceived procedural opacity as a source of risk.

First, trust in cooperative auditing and record integrity emerged as a central factor influencing access to WRS-backed credit. Participants in both KIIs and FGDs indicated that accurate and verifiable records were essential for establishing confidence in cooperative operations. Cooperative leaders and financial actors emphasized that audited financial statements and transparent record-keeping reduce uncertainty and enhance the credibility of warehouse-based transactions. Farmers similarly noted that confidence in record accuracy increases their willingness to engage with WRS-linked financial services.

Second, documentation and certification requirements, particularly the Certificate of Maximum Liability, were identified as critical access conditions. While these requirements are designed to support formal financial transactions, qualitative discussions revealed that they often function as practical gatekeeping mechanisms. Farmers who lacked clear documentation or did not fully understand the administrative procedures reported difficulties in accessing WRS-backed credit. In this regard, documentation was not only a formal requirement but also an institutional barrier affecting participation.

Third, payment timeliness was consistently highlighted as a key indicator of service reliability within the WRS framework. Farmers associated timely payment of produce with institutional dependability and viewed it as a prerequisite for engaging in warehouse-based financing. Conversely, delays in payment were reported to weaken trust in the system and discourage participation in credit arrangements linked to warehouse receipts.

Fourth, perceived procedural opacity and uncertainty were identified as important sources of risk affecting farmers’ decisions. Participants expressed concerns about unclear deduction systems, limited transparency in pricing and loan calculations, and uncertainty regarding the timing and conditions of financial transactions. These concerns contributed to a perception of risk that discouraged some farmers from utilizing WRS-backed credit even when such services were available.

Collectively, these qualitative insights suggest that access to WRS-backed credit is shaped not only by formal institutional arrangements but also by farmers’ experiences and perceptions

of how those institutions operate in practice. The themes identified above provide a behavioural and institutional explanation for the statistical relationships observed in the quantitative analysis.

5. Discussion

The results indicate that access to WRS-backed credit is closely associated with institutional credibility, documentation compliance, and service reliability. The qualitative evidence presented in [Section 4.6](#) helps explain these relationships by highlighting four linked mechanisms: trust in cooperative records, documentation as an access threshold, payment timeliness, and perceived procedural opacity.

The findings of this study indicate that access to WRS-backed credit among cashew smallholders is shaped less by simple household demographics than by the credibility and operational reliability of the institutions through which warehouse-based finance is mediated. Positive associations are observed for cooperative membership, audited records, possession of the Certificate of Maximum Liability, and payment reliability, together with the negative association for perceived risk, suggest that access to WRS-backed credit depends not only on the formal existence of a financial product but also on whether the surrounding institutional environment is viewed as credible, predictable, and administratively dependable. This interpretation is consistent with institutional perspectives that emphasize the role of rules, verification, and enforcement in reducing uncertainty in economic transactions ([North, 1990](#)), as well as behavioural perspectives that stress the importance of trust and perceived reliability in shaping participation decisions ([Ajzen, 1991](#)).

The positive association between cooperative membership and access to WRS-backed credit suggests that cooperative participation is not merely a background characteristic but part of the access mechanism itself. In cooperative-mediated marketing systems, membership can reduce transaction costs, improve information flows, and strengthen farmers' links to formal financial institutions. This finding is consistent with studies showing that farmer participation in cooperatives is associated with improved access to services, including credit, extension, and output markets ([Fischer and Qaim, 2012](#); [Abate et al., 2014](#)). In this sense, the present study supports the broader proposition that collective organization matters for rural financial inclusion. It also refines that argument by showing that, within a WRS setting, cooperative membership matters because it connects farmers to the institutional and documentary infrastructure through which warehouse-backed finance is accessed.

The finding that audited cooperative records are positively associated with access to WRS-backed credit is one of the strongest results in the study. This suggests that cooperative governance quality is not a peripheral matter but a central determinant of financial access in structured commodity markets. Auditing provides a visible signal of accountability, financial discipline, and record integrity, thereby reducing uncertainty for both lenders and farmers. This result aligns with institutional economics, which holds that credible institutions facilitate exchange by lowering information asymmetries and strengthening confidence in transactions ([North, 1990](#)). It is also consistent with studies on cooperative governance that highlight the importance of transparent management and internal controls for member trust and organizational performance ([Bijman et al., 2016](#)). In the context of WRS-backed credit, the implication is that a cooperative's audit status may function as a credibility signal that increases the practical bankability of warehouse receipts. This interpretation is supported by evidence from key informant interviews, where cooperative leaders and local officials emphasized that audited records and credible documentation increased confidence in cooperative transactions. This finding is reinforced by the qualitative evidence, where both cooperative leaders and financial actors emphasized that audited records serve as critical credibility signals, reducing uncertainty and strengthening confidence in warehouse-based lending arrangements.

These findings are consistent with recent research highlighting the importance of institutional credibility in structured agricultural finance systems. Studies in several African commodity markets show that farmer participation in warehouse receipt credit schemes depends not only on the existence of storage infrastructure but also on trust in payment systems and cooperative governance (Sitko and Jayne, 2012; Manda *et al.*, 2023). Similar patterns have been observed in other contexts where smallholder participation in collateralized commodity financing is mediated by institutional reliability and documentation compliance.

Possession of the Certificate of Maximum Liability also emerges as a strong predictor of access to WRS-backed credit. This finding underscores the importance of administrative compliance and documentary readiness in enabling farmers to participate in formal credit arrangements. In structured agricultural finance, documents do not merely record transactions; they help make claims legible, verifiable, and enforceable. This interpretation is consistent with the longstanding literature on warehouse receipt systems, which has emphasized the importance of documentation, standardization, and institutional safeguards in making stored commodities acceptable as collateral (Coulter and Onumah, 2002; Onumah, 2010). The present finding therefore adds empirical support to the view that weak documentation can operate as a practical exclusion mechanism, even where the warehouse receipt framework formally exists. Qualitative discussions further indicated that this requirement operates as a practical gatekeeping mechanism, as farmers without proper documentation often face procedural challenges that limit their ability to access WRS-backed credit.

The perception variables further deepen the analysis by showing that service reliability and perceived risk, rather than formal institutional structures alone, shape farmers' participation in WRS-backed credit. Farmers who perceived payment procedures as reliable were more likely to access warehouse receipt-based credit, while those who perceived the system as risky were less likely to do so. These findings suggest that WRS-backed finance should be understood not only as a technical or legal arrangement but also as a trust-dependent service system. This interpretation is consistent with the Theory of Planned Behaviour, which emphasizes that behaviour is shaped by attitudes, perceived control, and expectations regarding outcomes (Ajzen, 1991). In agricultural finance settings, perceptions of institutional reliability and risk can therefore influence whether farmers are willing to participate in credit systems even when those systems are formally available.

The result on payment reliability is especially important because it connects the marketing side of the WRS to its financial function. If farmers anticipate delays in payment, the attractiveness of borrowing against stored produce is reduced because the expected cash-flow benefits become uncertain. The finding therefore suggests that service timeliness is not merely an operational issue; it is integral to the financial viability of WRS participation from the farmer's perspective. Focus group participants similarly linked delayed settlement and uncertainty in payment timing to reduced willingness to engage in warehouse-based borrowing. This relationship is clarified by the qualitative findings, which show that farmers interpret timely payment as a signal of institutional dependability, while payment delays undermine trust and discourage participation in warehouse-based financial arrangements.

The negative association between perceived credit risk and access to WRS-backed credit is equally important. In the WRS context, such risk perceptions may arise from uncertainty over payment timing, record accuracy, deductions, collateral procedures, or loan conditions. The implication is that policy reforms aimed at expanding WRS-backed finance cannot focus only on increasing institutional supply; they must also reduce the experiential and perceived risks that shape farmer participation (Fischer and Qaim, 2012). Qualitative discussions further suggested that concerns over deductions, delayed payment, and unclear procedures contributed to farmers' perceptions of risk within the WRS process. The qualitative evidence indicates that perceived risk is grounded in practical concerns, including unclear deduction systems, limited transparency, and uncertainty regarding financial procedures, all of which contribute to reluctance to engage with WRS-backed credit.

The role of education in the model, though modest, also warrants discussion. The positive association between education and access to WRS-backed credit suggests that farmers with more schooling may be better able to understand documentation requirements, interpret procedures, and engage with cooperative and financial institutions. This is consistent with the broader agricultural finance literature, which often finds that education improves farmers' capacity to process information, comply with institutional requirements, and evaluate formal financial opportunities (Abate *et al.*, 2014). While education is not the strongest predictor in the present study, its positive sign suggests that informational and procedural complexity remains relevant in determining who is able to access warehouse-based credit.

By contrast, age is not statistically significant in the model. This result is analytically important because it suggests that differences in access are not primarily explained by life cycle or generational effects. Instead, the stronger effects are institutional and service-related. This reinforces the paper's central argument that access to WRS-backed credit is structured more by governance credibility, documentary compliance, and service reliability than by basic farmer demographics. In practical terms, this means that reforms aimed at improving cooperative administration, record integrity, transparency, and payment systems may have greater impact than interventions that assume credit exclusion is mainly a function of farmer age or other simple household characteristics.

Taken together, these findings extend the warehouse receipt literature by providing a more precise explanation of how access operates at the farmer interface. Much of the earlier literature has established that WRS can improve marketing, reduce distress sales, and facilitate collateralized borrowing under appropriate conditions (Coulter and Shepherd, 1995; Coulter and Onumah, 2002; Onumah, 2010). However, that literature has often emphasized system design at a broad institutional level. The present study adds a more fine-grained explanation from the farmer interface by showing that actual access to WRS-backed credit depends on whether the cooperative institutions managing the process produce credible administrative signals and reliable service experiences. In that sense, the study does not merely confirm that WRS matters; it shows more precisely how and through which institutional mechanisms WRS becomes financially meaningful for smallholders.

The findings are also consistent with wider debates in agribusiness and value chain finance that emphasize the importance of institutional trust, governance quality, and coordination in enabling financial inclusion for smallholders (Sitko and Jayne, 2014). This study contributes a more specific argument about cooperative-mediated warehouse systems: the effectiveness of WRS-backed finance depends not simply on warehouse infrastructure or the legal recognition of receipts, but on the credibility embedded in cooperative administration. Where auditing is weak, documentation is incomplete, transparency is uncertain, and payments are delayed, the receipt may exist formally but remain weakly bankable in practice.

From a policy perspective, these findings imply that efforts to expand WRS-backed agricultural finance should go beyond increasing physical storage capacity or broadening legal frameworks. Strengthening cooperative auditing systems, improving documentation procedures, enhancing transparency in produce marketing, and ensuring timely payment mechanisms may be more effective in broadening actual credit access. In addition, reducing perceived risk through clearer communication, more reliable administration, and stronger farmer confidence in the WRS process may be critical for expanding participation. These implications are especially relevant in developing and emerging economies where formal agricultural finance often depends on institutional intermediaries rather than direct lender–borrower relationships.

At the same time, the findings should be interpreted with appropriate caution. Because the study is based on cross-sectional data, the reported relationships should be understood as associations rather than causal effects. It is possible that farmers with stronger institutional connections are both more likely to access credit and more likely to view the system positively. Even so, the consistency of the observed pattern across governance, documentation, and service variables strengthens the plausibility of the central conclusion: in this cashew-based

WRS setting, access to credit is shaped fundamentally by cooperative credibility and service reliability rather than by the simple availability of warehouse-based finance. The key contribution of this study is therefore to show that, in cooperative-mediated warehouse systems, access to credit depends not only on warehouse infrastructure or formal rules, but on the credibility signals and service experiences that shape whether receipts become practically bankable for smallholders.

6. Conclusion and implications

This study examined the determinants of access to warehouse receipt system-backed credit among cashew smallholders in Tandahimba District, Tanzania. Access is shaped not only by the availability of financial products, but also by the credibility and operational reliability of the institutions through which warehouse-based finance is mediated. Cooperative membership, audited cooperative records, possession of the Certificate of Maximum Liability, and payment reliability were positively associated with access, while perceived risk was negatively associated. These results indicate that the effectiveness of warehouse receipt-based finance depends fundamentally on institutional credibility and service performance. The qualitative evidence further shows that these relationships operate through concrete institutional experiences, particularly trust in cooperative records, documentation compliance, payment timing, and perceptions of procedural transparency.

6.1 Practical and policy implications

The findings of this study have several practical and policy implications. First, strengthening cooperative governance systems appears essential for expanding the effectiveness of warehouse receipt-based financing. The positive association between audited cooperative records and access to WRS-backed credit suggests that transparent financial management and regular auditing can enhance the credibility of cooperatives as intermediaries in agricultural finance. Improving cooperative accountability, strengthening financial reporting practices, and ensuring regular auditing may therefore increase both farmer participation and lender confidence in warehouse receipt systems.

Second, the importance of documentation and administrative compliance highlights the need to simplify and standardize the procedures through which farmers access warehouse-based credit. The strong association between possession of the Certificate of Maximum Liability and credit access suggests that administrative requirements can function as practical entry barriers for smallholders. Policies aimed at improving farmer awareness of documentation requirements, simplifying procedures, and strengthening administrative support within cooperatives could therefore improve the inclusiveness of WRS-based financing.

Third, service reliability within the marketing system influences farmers' willingness to participate in warehouse receipt credit arrangements. Timely produce payment was associated with a higher likelihood of credit access, while qualitative evidence suggests that transparency in cooperative operations remains important for farmer confidence. These findings indicate that efforts to expand WRS-based finance should strengthen not only physical infrastructure and legal frameworks, but also the institutional and operational credibility of implementing organizations.

6.2 Limitations of the study

While the findings provide useful insights into the institutional determinants of WRS-backed credit access, several limitations should be acknowledged. First, the study is based on cross-sectional survey data collected from a single district. As a result, the estimated relationships should be interpreted as associations rather than causal effects. Longitudinal data would be

required to assess how changes in cooperative governance or service reliability affect farmers' access to warehouse-based credit over time.

Second, while the study incorporates qualitative evidence to interpret the quantitative findings, the qualitative component was designed to support explanation rather than provide a fully standalone qualitative analysis. Future research could extend this work through more in-depth qualitative or longitudinal mixed-methods approaches.

Third, the study focuses specifically on cashew production within a particular regional marketing system. While the findings are relevant for similar export-oriented crops marketed through warehouse receipt systems, caution should be exercised when generalizing the results to other commodities or institutional settings.

6.3 Directions for future research

Future research could extend this study in several ways. One important direction would be to examine the determinants of warehouse receipt credit access using longitudinal or panel data in order to better understand the causal relationships between institutional reforms and financial participation. Such studies could help evaluate whether improvements in cooperative governance, documentation procedures, and service reliability lead to measurable increases in farmers' access to warehouse-based finance.

Finally, further research could explore how digital technologies, improved record management systems, and strengthened monitoring mechanisms may enhance transparency and reduce transaction risks in warehouse receipt systems. Such innovations may play an increasingly important role in strengthening institutional credibility and expanding access to agricultural finance in developing economies.

Appendix

Measurement items for perception constructs

Perception variables were measured using a five-point Likert response scale, where:

- (1) 1 = Strongly disagree
- (2) 2 = Disagree
- (3) 3 = Neutral
- (4) 4 = Agree
- (5) 5 = Strongly agree

For transparency, timeliness, reliability, governance effectiveness, and service quality variables, higher scores indicate more favourable assessments. Perceived risk variables were reverse-coded so that higher values indicate lower perceived risk.

Table A1. Measurement items and coding of perception constructs

Construct/Indicator	Measurement item	Scale and coding
Transparency in transactions (Table 3; Table 4)	Transactions in the WRS process are transparent and easy to understand	1–5; higher values indicate greater transparency
Transparency in transactions (Table 3; Table 4)	The cooperative or warehouse explains deductions, fees, and grading outcomes clearly	1–5; higher values indicate greater transparency
Availability of financial information (Table 3)	I can access adequate financial information related to WRS sales, deductions, and payments	1–5; higher values indicate greater availability of information

(continued)

Table A1. Continued

Construct/Indicator	Measurement item	Scale and coding
Timeliness of loan disbursement (Table 3)	WRS-backed loan disbursement is timely after meeting the required conditions	1–5; higher values indicate more timely disbursement
Payment timeliness (Table 3; Table 4)	Payments after cashew sales through WRS are received on the promised date	1–5; higher values indicate more timely payment
Quality of credit services (Table 3)	The WRS-linked credit service meets my needs as a farmer	1–5; higher values indicate better service quality
Reliability of the system (Table 3)	The WRS process is reliable and functions as expected throughout the season	1–5; higher values indicate greater reliability
Attractiveness to financial institutions (Table 3)	Financial institutions consider WRS receipts a credible basis for lending	1–5; higher values indicate greater perceived credibility
Governance effectiveness (Optional analytical variable)	Cooperative governance effectively supports fair and efficient WRS implementation	1–5; higher values indicate stronger governance effectiveness
Perceived risk (Table 4; reverse-coded)	Participating in WRS-backed borrowing exposes me to financial or operational risks	Reverse-coded; higher values indicate lower perceived risk
Perceived risk (Table 4; reverse-coded)	There is a risk of delayed settlement or payment when using WRS	Reverse-coded; higher values indicate lower perceived risk
Perceived risk (Table 4; reverse-coded)	There is a risk of unfair deductions or disputes in the WRS process	Reverse-coded; higher values indicate lower perceived risk
Note(s): 1. Perception variables included in the regression analysis (Table 4) were treated as continuous variables measured on a 1–5 scale		
2. Governance-related indicators such as cooperative membership, audited records, and possession of the Certificate of Maximum Liability (CML) were coded as binary variables as defined in Table 2		
3. Positive perception responses reported in Table 3 refer to respondents selecting either “Agree” or “Strongly Agree.”		

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