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Experimental and Theoretical Expansion of Access to Credit among Rural Farmers: Case Studies in Boanedistrict, Mozambique

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Findings: Results indicated that there was a significant positive correlation (r =0.79389) between the credit terms and loan accessibility metrics, while the relationship between credit terms and repayment capacity reveals a strong positive correlation and statistically significant(r =0.51525). Conclusions between loan accessibility and repayment capacity metrics indicate that there is a weak and statistically significant positive correlation (r =0.30795). The multiple regression analysis shows that the credit terms and farmers' socioeconomic characteristics predicted a variance of 61.7% and 60.8%, respectively, in loan access.

Practical implications: The study is relevant because several donors, practitioners, consultants, loan officers, and microfinance institutions can revisit the borrowing decision, determine the efficiency and feasibility of providing useful information on the business's ability to sustain and performance of microcredit institutions.

Originality/value: The research seeks to establish relationships of four determinants of access to credit to extract an indicator with emphasis on repayment capacity, credit terms, loan accessibility, and farmers' socioeconomic characteristics among agribusiness cooperatives and microcredit institutions in Mozambique.

Keywords: loans, credit, accessibility, metrics, indicators, credit terms, repayment.

I. Introduction

Microfinance institutions (MFIs) play a vital role in supporting the agricultural and rural sector in Boane district Maputo province, as well as rural development and its contribution to poverty reduction through lending as it enables farmers to reap economies of scale, and venture into production fields. Microfinance is a product of providing financial services to make loans, deposit, insurance service, cash transfer for customers Conroy, (2002). In Mozambique, these MFIs include not only agricultural credit, rural credit, but also savings, transfer of funds, and credit unions to provide quality self-sufficiency services through the mobilization and management of their financial activities (BdeM)[1]. According to Mosca and Nova (2019) there are at least three agriculture in the agricultural sector: (1) the international agribusiness that relies on extractivism and concentrates accumulation abroad, with dominance of value chains in Mozambique; (2) small and medium-sized national capital agribusiness, mainly focused on the urban internal market; and (3) a large, highly differentiated family sector that produces mainly food, is not well integrated in the market and has multiple (mostly informal) income-earning activities.

In this study, the approach focuses on small and medium scale agribusiness as a source of livelihood for rural households and rapid population growth. In this context, credit is an factor in accelerating sustainable agricultural development and increasing incomes among farmers (Ololade and Olagunju, 2013; Yara et al. 2019), and the inadequate flow of this financing becomes critical against incremental food production. However, the dynamic nature of agricultural credit financing poses several challenges caused by the high-interest rate, amount granted, repayment period, default, distance from loan, and critical constraints on access to loans by farmers from formal sources Abiodun et al. (2009).

Faced with these challenges, to support agricultural credit financing, the research seeks to establish relationships of determinants of access to credit considering loan accessibility, repayment capacity, credit terms, and socioeconomic characteristics of farmers to find out if they these are relevant indicators in targeting financing to rural households.

This analysis must quantitatively be supported by metrics. For this reason, this article seeks to answer the following questions.

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[1] Bank of Mozambique. Annual report. Volume 24. Annualreport No. 26

1. What are the determinants of access to agricultural loans from formal and informal sources among farmers?
2. How does repayment capacity affect farmers' loan accessibility in the Boane district?
3. What is the distance from the farmers' place (arable land) to the sources of loan?
4. How do the credit terms influence the loan and repayment capacity of farmers?

a) Objective of the Studies

Based on the gaps identified in Euclides Matusse (2019) systematic review work, the overall objective of this study is to propose a model to extract an indicator, and to support credit managers in assertive decision-making through metrics. In this context, the research attempts to achieve the following main objectives:

i. Investigate the socioeconomic characteristics and restrictions faced by rural farmers in acquiring credit;
ii. Analyze the correlation between credit terms and loan accessibility by rural farmers;
iii. Analyze the correlation between credit terms and repayment capacity of rural farmers; and
iv. Establishing (co) relationships to demonstrate how repayment capacity affects loan affordability to rural farmers.

The paper organized as follows: Section 2 presents the concept of access to agricultural credit financing for rural households; section 3 describes the methodology and its use in the present study. Section 4,analyzes the material and method: the metrics identified from the current literature; section 5 presents the results and discussion to evaluate the approach, comparing their characteristics. Section 6, the conclusions, contributions, recommendations, and finally, the bibliographic references.

II. Theoretical Expansion Framework

a) Concept of Access to the Financing of Agricultural Credit

Access to credit is one of the main components of rural development and catalyst that activates other production factors and underutilizes functional capacities for the rapid, sustainable growth of agriculture (Ijere 1998). To boost productivity, and production, farmers have to use improved agricultural technologies, buying inputs such as fertilizers, pesticides, insecticides, tools, implements, and herbicides.

It is a remarkable interest shown by agribusiness managers, agricultural economists, and policy makers on the need to pay more attention to the financing of credit to farmers in Mozambique. This well-deserved attention calls for the conviction that agriculture and production provide greater food security, poverty reduction, and guaranteed supply of raw materials for the development of industry, employment, and higher incomes (Mosca and Nova, 2019).

Agricultural credit remains a challenge categorized into four determinants; credit terms or negotiated terms (offered by a microfinance institution to a borrower) that control the total or monthly credit value Amitava Basu(2017), characteristic of borrowers are attributes that borrowers must have if they are to benefit or access services of microcredit institutions Fred Nimohet al. (2012), loan access Dzadze, et al. (2012) and repaying ability to get back the borrowed investment Adu, et al. (2019).

Figure 1 illustrates the model of the credit application process through formal determinants and the relationship between demand and lending decision, considering the spatial distance between farmers' location and loan sources (Abiodun et al. 2009;Njoku, 2016).

The spiral approach implements the concept of greatest need; it analyzes the terms of lending, credit access, repayment capacity, and the borrower's socioeconomic characteristics in the credit department subcommittee. Each committee prepares an assessment of all steps in the process except the credit demand that must be adopted by some loan and portfolio agents.

Figure 1: Determinants of access to credit. Source: Author's summary

In this context, the evaluation committee follows a period of three to four days, within which credit analysts must complete and deliver each loan decision process. An alternative to the given delivery period involves the planning and borrower data that should be reassessed as much as possible at the beginning of the process.

This divides the analysis into smaller sub deliveries and providing a detailed decision of prompt

delivery. At the end of each review, the remaining processes must reset, considering the borrower's feedback.

III. Methodology

The goal question metric GQM paradigm was created by researcher Basili and Rombach (1988) which bases on the conviction that for an organization to measure efficiently is necessary, first, to specify the objectives that must achieved, to relate these objectives with data the obtained through measurements, and finally, interpretation of these data according to the proposed.

The GQM approach must be characterized by goal setting: sets objectives relevant to the organization; questions: generates a set of questions that defines objectives through qualitative aspects so that they must measure; and metrics: specifies a set of actions that need to be collected to answer the questions generated (Ribu 2001). Following the approach, the objectives to be achieved in experimental validation must be initially established considering the metrics of the terms of credit Bob Sekiziyivu et.al, (2018), socioeconomic characteristics of farmers Fred Nimoh et.al, (2012), accessibility of the Loan (Abiodun, et al. 2009;EuclidesMatusse, 2019) and capacity in the repayment (Adu, et al. 2019; Nawaiet al. 2010;Mohd Noor Mohd Shariff, 2010; Euclides Matusse, 2019).

The methodology described in this section aims to support the understanding of the preparation of the research to be applied and defines the guideline for the use of the strategy that allows evaluation of each process, such as described in figure 2, steps of the design process meta activity of the experiment.

The description of the elements that make up the research methodology described as follows: definition of objectives (OE) represent the objectives of the experiment should achieve, based on the determining factors of access to credit; determinants in access to credit (DAC) is a set of credit factors that describe quantitative data and need to be obtained and analyzed. These factors must be divided according to the problem (or problems) that you select and generally use some parameters to determine the priority and relevance in access to credit. Selection of metrics (MS) is the set of metrics selected from the current literature according to elements that compose it; therefore, management questions (QGM) are assumptions that must be answered according to the management perspectives of credit, to support the definition for quantitative analysis.

Metrics (DM) is an estimate of data to intended and support credit targeting among rural farmers. The experimental validation mechanism (MVE) must be considered an integral part of the activities in directing credit to rural families and has three distinct phases: planning, data collection, analysis, and documentation. In data collection and data analysis/documentation (CDA) illustrated in figure 2, the actions (rectangles) represent the phases of metrics analysis to evaluate the correlation to extract indicators that serve as elements for strategy while decisions (lozenge), represent the pre and after condition of each phase.

Initially, the credit manager should initiate the evaluation aspects of the experiment, as well as instrumentation and define the artifacts needed for empirical study. Then, experimental data must be collected to analyze and validated in the analysis and interpretation phase. Finally, the results must be presented and packaged during the documentation phase. The negligence of any of these phases leads to erroneous and needs changes in the strategy already made, which is sometimes impossible to accomplish.

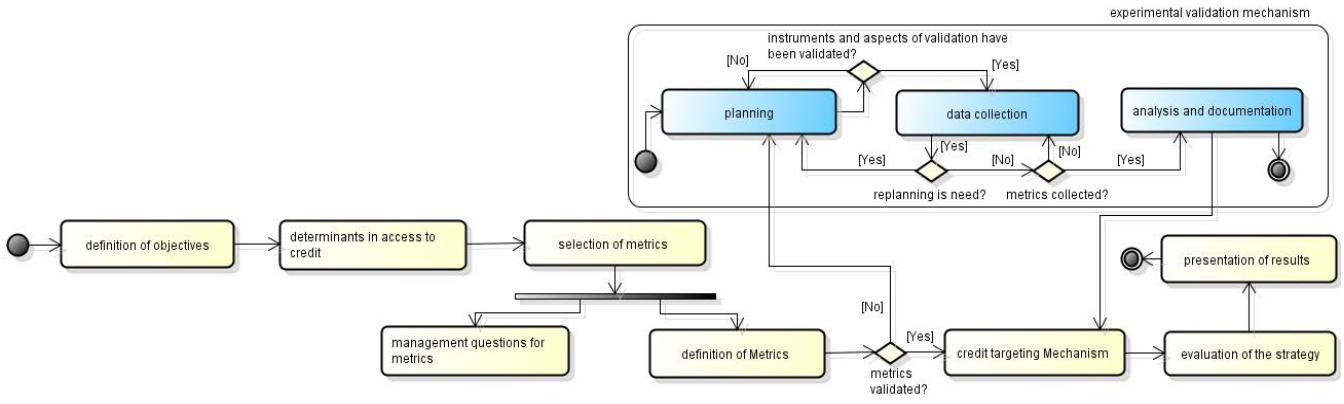

Figure 2: MPAE-Design process meta activity. Source: Author's summary

The Credit targeting Mechanism (MDC) represent the elements for strategy elaboration; these elements aim to integrate metrics with the implementation of the GQM method as an initiative of best practices to support credit managers in the decision-making conform with indicators. Evaluation of the strategy (ES) must be carried out through the elements that compose them derived from the experimental study, and the presentation of results (AR) allows presentation of the results of the strategy to the credit manager and portfolio for making more assertive decision-making in financing credit to rural farmers.

IV. Material and Method

The study was conducted in the Boane District. The district is located southwest of Maputo province, being bordered to the north by Moamba district, to the south and east by Namaacha district, and west by the city of Matola and Mautuine district, located 30 km from Maputo city and lies between longitude 32° 23' 20" East and latitudes 26° 1' 44" South. With an area[2] of 815 km2 and population density of 101 in habitants/km2, the population is young 42% down 15 years of age, mostly female (masculinity rate of 47%) and urban and semi-urban matrix (urbanization rate 68%).

The waterways of Boane district belong to the watersheds of the Umbeluzi, Tembe, and Matola rivers. The Umbeluzi valley has soils with good agricultural and livestock potential, which must be exploited by a vast fabric of private and family farming. Agriculture is the basis of the incomes rural families, with cultures like vegetables, corn, cassava, beans, bananas, and citrus as main crops. The primary data was collected directly from 30 farmers to compose different configurations by the use of structured questionnaires, interviews, and standard analytical testing methods were used to determine the properties of the data applied in the selected metrics from the current literature.

Secondary data were also collected from published data from DPIC[3], Boane, these included the use of descriptive statistics to examine the level of socioeconomic characteristics associated with loans, linear model is adopted for the hypothesis test to analyze factors that influence access to formal and informal agricultural credit.

The R correlation model analysis is performed to establish relationships between the study variables. This method generates a measure of the magnitude and direction of credit financing to the rural family. The multiple regression model illustrated the Pearson correlation formulain equation 1 presents explicitly specified as follows:

$$r = \frac{\sum (x - m_x)(y - m_y)}{\sqrt{\sum (x - m_x)^2 \sum (y - m_y)^2}} \quad (1)$$

Where m_x and m_y are the means of x and y variables.

The corresponding p-value is determined using t distribution table for $df = n - 2$.

According to Abiodun et al. (2009), the calibration for access to the loan for each farmer must be obtained from the historical basis of the determining factors of the loan of microfinance institutions. Thus, calculation model to analyze factors that influence access to credit, can receive notes ranging from 1 to 4, value 1 indicating that this item is low complexity; the value 2 moderate, medium influence; the value 3 complex; and the item 4 n-complex. The determinant factor of the loan (DEF) must be obtained through the Equation Eq. 2.

$$DEF = NxTFator \quad (2)$$

Where: DEF –The factor of determining loans, TFator - is the sum between the weight and the rating awarded of each loan determinant, N - is the total number of farmers; and the technical estimate to capture the agricultural loan accessibility metric per farmer must calculate in the Equation Eq.3.

$$TAEA(agric) = \text{LOS} + \text{LR} + \text{RPP} + \text{LOG} \quad (3)$$

Where: - $TAEA_{(agric)}$ - is the estimate of the technique for capturing the metric accessibility of agricultural lending per farmer, LOS - refers to the amount granted of the loan (amount-MTN), LR is loan rate (percentage-%), RPP is the reimbursement period (months), LOG - represents the loan guarantee (Amount-MTN).

The statistical formula adapted from the work of Euclides Matusse(2019) to calculate the estimate accessibility of agricultural lending by farmer must describe below for extracting the Equation Eq.4.

$$AEmp_{(agric)} = \frac{\left(TAEA_{(agric)xDEF}\right)}{\left(N^2 - N\right)} \quad (4)$$

Where: $AEmp_{(agric)}$ - accessibility of agricultural lending by the farmer from formal and informal sources, $TAEA(agric)$ - is the estimation of the technique to capture the metric of agricultural lending by a farmer, DEF –the factor of determining loans, and N - is the total number of farmers.

The terms of credit must be understood as terms negotiated involving collateral, payment periods and interest rate (Atieno, 2001). Thus, the technical estimate for capturing the terms credit for the agricultural loan must be calculated in the Equation Eq.5.

[2] Direcção Nacional de Terras (http://www.dnageca.gov.mz/dnt)

[3] Direcção Provincial da Industria e Comércio (https://www.pmaputo.gov.mz/)

$$TERM_{(cred)} = \text{LR} + \text{RPP} + \text{LOG} \quad (5)$$

Where: - $TERM_{(cred)}$ - is the estimate of the technique for capturing the terms of credit of the agricultural loan, LR is loan rate (percentage-%), RPP is the repayment period (months), LOG - represents the loan guarantee (amount-MTN).

The formula for calculating the terms credit or negotiated terms (offered by a microfinance institution to a farmer) must be described below for extracting the Equation Eq.6.

$$TCRED_{(agric)} = \frac{\left(TERM_{(cred)} xDEF\right)}{\left(N^2 - N\right)} \quad (6)$$

Where: $TCRED_{(agric)}$ - is the credit terms estimate of the agricultural loan by the farmer from formal and informal sources, $TERM_{(cred)}$ - is the estimate of the technique to capture the credit terms, *DEF*- a factor of determinant loans and N - is the total number of agricultures.

The repayment capacity process depends on inherent characteristics of farmers and their businesses that make it unlikely that the loan must be repaid as loan size, repayment period, loan fee, distance between the farmers' site (arable land) in relation to loan sources (Goodluck, Moshi 2012; Adu, Owualah and Babajide 2019; Ndiege et. al, 2016).

Thus, the statistical formula adapted from the work of Onyeagoacha et al. (2012) to calculate reimbursement capacity, and slightly modified to suit this study to capture all measurable variables described in the Equation Eq.7.

$$RPC = \text{LOS} + \text{LR} + \text{RPP} \quad (7)$$

Where: RPC is repayment capacity, LOS - refers to the size of the loan (amount-MTN), LR is loan rate (percentage - %), RPP is the repayment period (months).

The formulation for measuring geographic (spatial) dispersion respecting the relationships of precedence's and resources (O´Leary and Cummings, 2007) described in the Equation Eq.8.

$$SDI = \sum_{i-j}^{k} \frac{(KM_{ij} \times N_i \times N_j)}{(N^2 - N)/2} \quad (8)$$

Where: SDI - is the spatial distance index, KM_{ij} - refers to the deadline is the distance between places *i* and *j* in kilometers, N_i and N_j - represent the number of people on-site, k - is the total number spaces that changes in relation to the farmer's decision, N -is the total number of farmers.

The statistical formula adapted from the work of Euclides Matusse (2019) to calculate the estimate of the repayment capacity defined as an object to answer the research question must be describe below for extracting the Equation Eq.9.

$$RPC_{(agric)} = \frac{\left(RPC\ xSDI\right)}{\left(N^2 - N\right)} \quad (9)$$

Where: $RPC_{(agric)}$ - reimbursement capacity per farmer, RPC - is reimbursement capacity, SDI - refers to the spatial distance index, and N - is the total number of farmers.

V. Results and Discussion

We summed up the demographic data of the study participants collected for the 30 resolutions generated as well as evaluating the classification of such metrics.

As table 1 shows, about 20% of farmers fell in the age group of 30 and 39 years, implying young and active individuals, while 56.67% of farmers fit the age category of 50 years above. This shows that agribusiness cooperatives are predominantly populated by seniors active in the study area. Of the 23.33% who were aged 40 and 49 years, 20% are adult and active individuals.

Table 1: Distribution of the Rural Family (Years)

Age (in years)	Frequency	Percentage(%)
20-29	0	0.00
30-39	6	20.00
40-49	7	23.33
50-59	17	56.67
Total	30	100.00

Data on the educational level in table 2 show that 40% of farmers did not have formal education. Those with primary education represented 35%, while 25% received high school.

Table 2: Distribution of the Rural Family (Education)

EducationLevel (in years)	Frequency	Percentage(%)
0 (no formal education)	10	40.00
1-6 (primary school)	11	35.00
7-12 (secondary school)	9	25.00
13-18 (university)	0	0.00
Total	30	100.00

Data on agricultural experience, as shown in table 3 that about 20% of farmers have experience ranging from 6 to 10 years, while only 56.67% have been in the production business for more than 16 years. Of the 23.33% of the interviewees, 10% had experience of

cultivation of 11-15 years and another 13.33% range from 1-5 years.

Table 3: Distribution of the Rural Family (Experience)

Agricultural Experience (in years)	Frequency	Percentage (%)
1-5	4	13.33
6-10	6	20.00
11-15	3	10.00
16 – forward	17	56.67
Total	30	100.00

As shown in table 4, about 90% of farmers have arable land less than 5 hectares in size, while about 10% have arable land with an average size of 7 hectares. The results imply that agribusiness cooperatives are predominantly small farmers, probably due to the limited availability of agricultural land.

Table 4: Distribution of the rural family (land size)

Land size (hectares)	Frequency	Percentage (%)
0.10-4.99	27	90.00
5.0-8.99	3	10.00
9.00-12.99	0	0.00
13.00 – forward	0	0.00
Total	30	100.00

Data on household size in table 5 showed that most farmers have approximately 56.67% of the household size of between 7 and 9 people. Approximately 23.33% maintained the household size of 4-6 people. Of the 20% of respondents, 10% were household sizes of between 1 and 3 people, and another 10% range from 10-12 people per household.

Table 5: Distribution of the Rural Family (Household)

Household (in years)	Frequency	Percentage (%)
1-3	3	10.00
4-6	7	23.33
7-9	17	56.67
10-12	3	10.00
Total	30	100.00

The distribution of farmers by marital status, as represented by table 6, showed that 43.33% were married, while 56.67% segmented into different categories of individuals, such as singles (divorced, separated, widowed).

Table 6: Distribution of the Rural Family (Marital Status)

Marital status	Frequency	Percentage (%)
Married	13	43.33
Single	17	56.67
Total	20	100.00

The distribution of farmers by the distance between their loans sourcesas shown in table 7. Of the result, 100% cover between 1 and 2 kilometers, since microfinance services have be concentrated around agribusiness cooperatives. This distance carries additional costs such as transportation and cost overhead, which shows less propensity to obtain the loan.

Table 7: Distribution of the Rural Family (Distance)

Distance (in kilometers)	Frequency	Percentage (%)
1-2	30	100.00
3-4	0	0.00
4-5	0	0.00
5-6	0	0.00
Total	30	100.00

Income distribution among rural farmers in the study area, as shown in table 8, that about 30% of farmers have an income ranging from 5.000,00-20.000,00 MTN, with the vast majority gaining between 66.000,00 and 80.000,00 MTN per farm season. Of the 23.33% of the interviewees, 16.66% had, income of 46.000,00 and 60.000,00 MTN, and another 6.67% range from 21.000,00 and 45.000,00 MTN. This demonstrate that rural families in the area are generally low-cost employees and low agricultural incomes.

Table 8: Distribution of the Rural Family (Incomes)

Income (in MTN meticais)	Frequency	Percentage (%)
5.000,00-20.000,00	9	30.00
21.000,00-45.000,00	2	6.67
46.000,00-60.000,00	5	16.66
66.000,00-80.000,00	14	46.67
Total	30	100.00

The distribution of the amount granted to each farmer by the amount is shown in table 9. About 56.67% of them are around 61.000,00 and 90.000,00 MTN, and this represents the majority. Due to the scarcity of the loan amount, it should be deduced that rural households are not concerned with strengthening their production because they consider problematic and flexible credit terms and conditions to suit farmers' reality

Table 9: Distribution of the Rural Family (Granted Amount)

Amount (in MTN meticais)	Frequency	Percentage (%)
10.000,00-30.000,00	4	13.33
31.000,00-60.000,00	2	6.67
61.000,00-90.000,00	17	56.67
91.000,00-100.000,00	7	23.33
Total	30	100.00

The distribution of farmers by sex is shown in table 10 indicates that the population of men (56.67%) is dominant in the agribusiness cooperative in the area of study.

Table 10: Distribution of the Rural Family (Sex)

Sex	Frequency	Percentage (%)
Male	17	56.67
Female	13	43.33
Total	30	100.00

To establish the relationship between the socioeconomic characteristics of farmers, terms of credit, and loan accessibility, the multiple regression model is performed. The regression analysis summarized in table 11 indicates that the terms of credit (TCRED) (beta = 1,158, p <.01) and socioeconomic characteristics (CarSoc) (beta = -.264, p <.01) of farmers have a statistically significant positive on access to a loan. This demonstrated that IMFs lend at an affordable rate depending on farm size, education and loan period. The regression model was well achieved and specified for TCRED (F = 47,732, p <.01) and CarSoc (F = 0.327, p <.01) about loan access, implying that both socioeconomic characteristics and credit terms were appropriate and borrowers have the freedom to negotiate the duration of the loan period. Thus, the expected independent variables range from up to 61.7% TCRED and CarSoc 60.8%, respectively, in access to the loan.

Table 11: Analise De Regressão

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.794[a]	.630	.617	2.38377	.630	47.732	1	28	.000	
2	.797[b]	.635	.608	2.41294	.004	.327	1	27	.572	1.382

a. Predictors: (Constant), TCRED
b. Predictors: (Constant), TCRED, CarSoc
c. Dependent Variable: AEmp

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.859	2.324		1.230	.229		
	TCRED	1.158	.168	.794	6.909	.000	1.000	1.000
2	(Constant)	3.199	2.426		1.318	.198		
	TCRED	1.240	.222	.850	5.575	.000	.582	1.719
	CarSoc	-.264	.461	-.087	-.572	.572	.582	1.719

a. Dependent Variable: AEmp

The figure 3 presents the residual statistical values observed from the variables independent, of the credit terms metric, socioeconomic characteristics of farmers on the dependent variable forecast value loan accessibility for a sample of N (30) with a minimum value 14,140, maximum value 25,657, mean (μ) 18.632 and standard deviation (σ) 3,068.

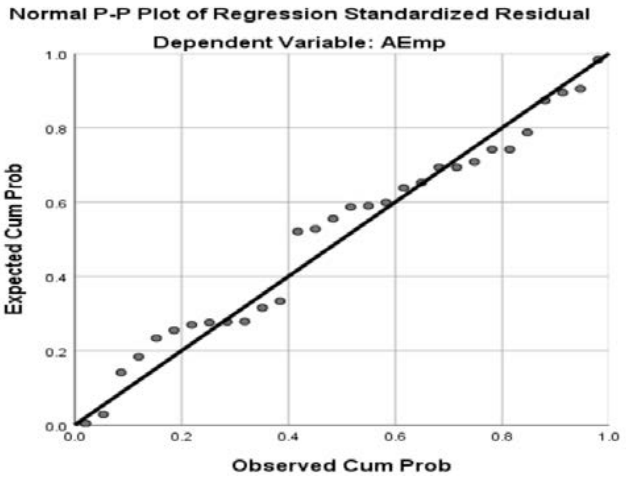

Figure 3: The plot of regression standardized residual

Pearson's Correlation analysis

Correlation analysis in table 12, have to be conducted to establish the relationships between the study variables. This method allows you to determine whether there is a correlation between the two datasets.

Table 12: Correlation Analysis

	Variables	AEmp	TCRED	CarSoc
Pearson's Correlation	AEmp	1.000	.794	.463
	TCRED	.794	1.000	.647
	CarSoc	.463	.647	1.000
Sig. (1-tailed)	AEmp	.		.005
	TCRED	.000	.	.000
	CarSoc	.005	.000	.

a) Experimental validation of metrics

We follow the suggestions provided by Perry et al. (2000) and Wohlin et al. (2000) on how to conduct controlled experiments with small adaptations. Thirty farmers participated in the study, nine of them in secondary education, and eleven primary schools. As a short sample level has be considered, variations with the participants' agricultural experience were reduced. For the study in question, the following hypotheses were proposed:

Hypothesis formulation: hypotheses proposed for the study

Null Hypothesis ($H_{(0)}$)*:* there is no significant correlation between the metric $TCRED_{(agric)}$ and the metric $AEmp_{(agric)}$;

Alternative Hypothesis ($H_{(1)}$)*:* there is a significant correlation between the metric $TCRED_{(agric)}$ and the metric $AEmp_{(agric)}$.

Null Hypothesis ($H_{(0)}$)*:* there is no significant correlation between the metric $TCRED_{(agric)}$ and the metric $RPC_{(agric)}$;

Alternative Hypothesis ($H_{(1)}$)*:* there is a significant correlation between the metric $TCRED_{(agric)}$ and the metric $RPC_{(agric)}$.

Null Hypothesis ($H_{(0)}$)*:* there is no significant correlation between the metric $AEmp_{(agric)}$ and the metric $RPC_{(agric)}$;

Alternative Hypothesis ($H_{(1)}$)*:* there is a significant correlation between the metric $AEmp_{(agric)}$ and the metric $RPC_{(agric)}$.

The study characterized and validated metrics and the feasibility of using them to target credit financing to rural farmers. Thus, the analysis mechanisms used were:

- Descriptive statistical analyses about the metrics collected from the settings generated by each participant, combined with descriptive statistical analyses, scatter charts, as they provide information with observed values on total values of a measure, arithmetic media, standard deviation, minimum value, maximum, amplitude and sample (N) of metrics, and
- trade-off analyses with the objective of prioritizing elements that makeup metrics. The scale to measure the correlation coefficient illustrated according to figure 4.

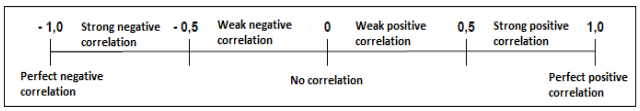

Figure 4: The correlation ranking scale

b) Normality test and the correlation between credit terms and loan accessibility

Figure 5 shows the observed values and the following hypotheses were proposed for tests concerning the metric $TCRED_{(agric)}$:

- Null Hypothesis ($H_{(0)}$): the distribution of observed values is normal;
- Alternative Hypothesis ($H_{(1)}$): the distribution of observed values in question is not normal

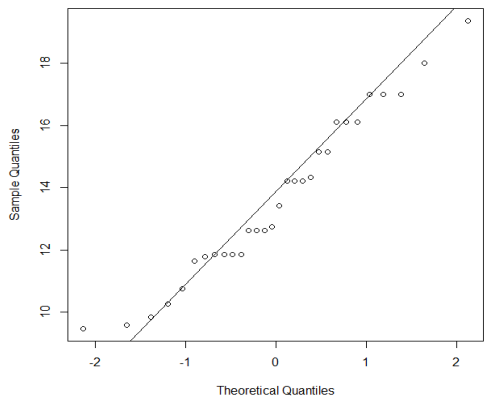

Figure 5: Shapiro and Wilk normality test for metric $TCRED_{(agric)}$

We can observe that the distribution of values is normal. Despite this, normality tests Shapiro and Wilk [21] were performed to make sure of this.

Normality tests for the metric $TCRED_{(agric)}$ as can be seen in Figure 5 for a sample of N (30) with minimum value 9.47, maximum value 19.36, amplitude 9.89, mean (μ) 13.622, and standard deviation (σ) 2,641. Based on the Shapiro and Wilk tests [21], for a sample size of 30 with 95 % safety ($\alpha = 0.05$), the significance value (p) is 0.364 ($p < 0.05$) and the calculated value of $W = 0.9628$ the alternative hypothesis ($H_{(1)}$) should be rejected. Thus, there is evidence to reject the alternative hypothesis ($H_{(1)}$) by metric $TCRED_{(agric)}$, considering the distribution of the observed normal values.

Analysis correlation R model: as metric distribution $TCRED_{(agric)}$ and $AEmp_{(agric)}$ is normal expressed in section (V-D), applied whether the R model correlation, to support the interpretation of the data. This method allows you to determine whether there is a correlation between the two datasets. Equation 10 represents an analysis of the R linear regression model to verify that there is a correlation between the metrics.

$$y = ax + b \tag{10}$$

Where: y is loan accessibility, x - credit terms, a - angular coefficient, b interpolator and r correlation coefficient.

The conclusions reveal that there is a hard and statistically significant positive correlation ($r = 0.79389$) according to the ranking of correlation figure 4. This demonstrate that the terms of credit, interest rates, loan period, and the guarantee requirement are flexible, so farmers tend to pay their parcels regularly in compliance with contractual standards.

c) Normality test and the correlation between credit terms and repayment capacity

The figure 6, shows the observed values, and the following hypotheses where proposed for tests concerning the metric $RPC_{(agric)}$:

- *Null Hypothesis* ($H_{(0)}$)*:* The distribution of observed values is normal;
- *Alternative Hypothesis* ($H_{(1)}$)*:* The distribution of observed values in question is not normal

We can observe that the distribution of values is non-normal. Despite this, normality tests Shapiro and Wilk [21] were performed to make sure this.

Normality tests for the metric $RPC_{(agric)}$*:* as can be seen in figure 6 for a sample of N (30) with minimum value 0.45, maximum value 0.74, amplitude 0.29, mean (μ) 0.657, and standard deviation (σ) 0.063. Based on the Shapiro and Wilk tests [21], for a sample size of 30 with 95 % safety ($\alpha = 0.05$), the significance value (p) is 0.0007 (p

< 0.05) and the calculated value of W = 0.8518 the null hypothesis ($H(0)$) should be rejected

Thus. there is evidence to reject the null hypothesis ($H(0)$) by the metric $RPC_{(agric)}$.

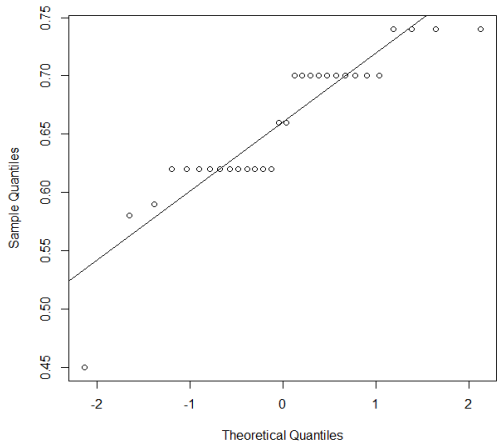

Figure 6: Shapiro and Wilk normality test for metric $RPC_{(agric)}$

Analyze correlation R model: as normal metric distribution $TCRED_{(agric)}$ and $RPC_{(agric)}$ is not normal, applied whether the R model correlation to support the interpretation of the data. This method allows you to determine whether there is a correlation between the two datasets. Equation 11 represents an analysis of the R linear regression model to verify that there is a correlation between the metrics.

$$y = ax + b \tag{11}$$

Where: y is loan accessibility, x - credit terms, a - angular coefficient, b interpolator and r correlation coefficient.

The conclusions reveal that there is a hard and statistically significant positive correlation ($r = 0.51525$) according to the ranking of correlation figure 4. This demonstrate that the more flexible the terms where granting credit, the easier it is for rural families to honor their loans. One of the threats to validity the completion is the sample size (N) that must be increased in future repetitions.

d) Normality test and the correlation between loan accessibility metric and repayment capacity

The figure 7, presents the observed values, and the following hypotheses were proposed for tests concerning the metric $AEmp_{(agric)}$:

- *Null Hypothesis ($H(0)$):* the distribution of observed values is normal;
- *Alternative Hypothesis ($H(1)$):* the distribution of observed values in question is not normal

We can observe that the distribution of values is normal. Despite this, normality tests Shapiro and Wilk [21] were performed to make sure of this.

Normality tests for the metric $AEmp_{(agric)}$: as can be seen in figure 6 for a sample of size N (30) with minimum value 12.16, maximum value 26.53, amplitude 14.37, mean (μ) 18,632, and standard deviation (σ) 3,852.

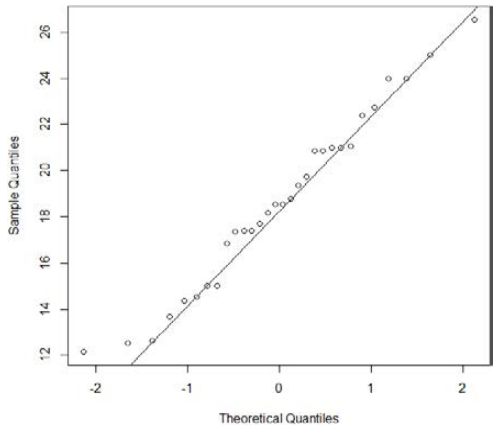

Figure 7: Shapiro and Wilk normality test for metric $AEmp_{(agric)}$

Based on the Shapiro and Wilk tests [21], for a sample size of 30 with 95% safety ($\alpha = 0.05$), the significance value (p) is 0.6637 ($p > 0.05$) and the calculated value of W = 0.9743 the alternative hypothesis ($H(1)$) should be rejected.

Thus. there is evidence to reject the alternative hypothesis ($H(1)$) by metric $AEmp_{(agric)}$.

Analysis correlation R model: as distribution of metric $AEmp_{(agric)}$ is normal and $RPC_{(agric)}$ is not normal; the R model correlation was applied to support the interpretation of the data. This method allows you to determine whether there is a correlation between the two datasets. Equation 12 represents an analysis of the R linear regression model to verify that there is a correlation between the metrics.

$$y = ax + b \tag{12}$$

Where: y is loan accessibility, x - credit terms, a - angular coefficient, b interpolator and r correlation coefficient.

The conclusions reveal that there is a weak and statistically significant positive correlation (r =0.30795) according to figure 4 correlation ranking. This demonstrate that the level of flexibility of loan access was directly associated with the loan repayment level. The point to be highlighted, is a threat to the validity of

the study on the distance from the place of farmers (arable land) about loan sources presented in less than 2 km, since microfinance services were concentrated around the agribusiness cooperatives.

VI. Conclusion

In this research, experimental validation of factors that affect access to formal credit among farmers of agribusiness cooperatives in the Boane district is presented, and reveal emerging realities. The results of the study showed that there is a positive and statistically significant correlation between loan accessibility, repayment capacity, credit terms, and socioeconomic characteristics of farmers through metrics and provides evidence that indicator can be used to target credit financing to rural families.

Contributions

The contributions of this study have be located in two main dimensions: for theory and the market:

- The empirical evaluation of the study showed the importance of credit terms as determinants of repayment of loans between rural families in the Boane district, so credit managers, portfolio, and policymakers need to pay attention guarantees required to farmers before lending.
- The result of statistical model R indicated that there was a significant positive correlation ($r = 0.79389$) between the credit terms and loan accessibility metrics, while the (co) relationship between credit terms and repayment capacity reveal correlation positive and statistically significant ($r = 0.51525$). The conclusions reveal that there is a weak and statistically significant positive correlation ($r = 0.30795$) between the loan accessibility metrics and repayment capacity. Therefore the regression analysis shows that the characteristics farmers predicted a variance of 61.7% TCRED and CarSoc 60.8% respectively in access to the loan.

Recommendations

From the finding of the study, the guarantee requirement weighs heavily on the perspective of borrowers since land, agricultural production is the only guarantor for obtaining loans, so microcredit institutions should relax their conditions of provisions of the terms of credit, especially collateral guarantee, to increase reimbursement capacity.

The Bank of Mozambique (BdeM), in addition to monitoring loan rates, needs to establish structures to avoid undercapitalization, fraudulent practices, and unjustified interference in the consistent injection of funds into agriculture by members of the council of microfinance institutions.

The Government, and regulatory institutions should reorient stable, long-term and effective policies to tailor the reality of the needs of agribusiness cooperatives in Mozambique.

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