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Queue Modeling and Cooperative Credit Access in Benin City: A Study of Rural Husbandmen Cooperative Credit and Relief Programme

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Abstract- ***Credit access remains a critical constraint for smallholder farmers in Nigeria despite policy interventions. This study applied queueing theory to analyze the efficiency of loan processing at the Rural Husbandmen Cooperative Credit and Relief Programme (RH-CRRP) in Benin City, Edo State, between 2011 and 2015. Using cooperative records and survey data from 60 respondents, the study found an 88.2% loan approval rate with a traffic intensity of 1.132, indicating system overload. Key constraints included inadequate finance (M=2.66), loan repayment issues (M=2.64), and embezzlement (M=2.52). Findings suggest that cooperative credit systems require improved financial management, digital processing, and financial literacy training to reduce queuing delays and enhance farmer productivity.***

Keywords: ***Queueing Theory, Cooperative Credit, Agricultural Finance, RH-CRRP, Benin City, Nigeria***

I. INTRODUCTION

Agriculture employs over 70% of Nigeria's rural population and contributes 23.5% to GDP, yet productivity remains low due to limited access to formal credit. Smallholder farmers face collateral requirements, high interest rates, and bureaucratic delays that restrict investment in inputs and technology.

Cooperatives have emerged as alternative financial institutions that pool resources and reduce transaction costs.

The Rural Husbandmen Cooperative Credit and Relief Programme (RH-CRRP) was established in Benin City to provide affordable credit to rural farmers. Despite its role, loan processing delays and repayment challenges persist. Queueing theory offers a framework to analyze service systems where arrivals and service rates determine waiting times.

Objective: To evaluate the efficiency of loan processing at RH-CRRP using queueing theory and identify constraints affecting credit access.

II. CONCEPTUAL FRAMEWORK

Credit is defined as the ability to obtain goods or services before payment. In agriculture, credit enables farmers to purchase inputs, adopt technology, and manage seasonal cash flow gaps. Cooperatives function as member-owned financial intermediaries that reduce information asymmetry and moral hazard.

Queueing systems consist of arrivals, service channels, queue discipline, and service time distributions. High traffic intensity ($\rho>1$) leads to excessive waiting and loan rationing.

III. LITERATURE REVIEW

Recent studies confirm that credit access significantly improves agricultural productivity in Nigeria. Osabohien et al. found that commercial bank credit to agriculture increased agricultural output by 17.05% between 1981-2018. However, credit rationing remains prevalent, with only 18% of smallholders accessing formal loans.

Cooperative credit systems have shown mixed results.

Kehinde and Ogundeji reported that simultaneous access to credit and cooperative services significantly increased cocoa productivity in South-western Nigeria. Komolafe et al. found that 67% of cooperative members in Oyo State faced credit constraints due to inadequate cooperative capital and poor governance. Similar constraints were reported in Kwara and Bayelsa states.

Institutional governance also matters. Mba Fokwa found that the effectiveness of agricultural credits in Sub-Saharan Africa depends on institutional governance and microfinance sustainability. Weak governance increases default risk and reduces credit outreach.

Queueing applications in agriculture are limited but growing. Olayemi and Onyenwaku applied queue models to rice processing in Nigeria, reporting traffic intensities above 1.0, indicating overloaded systems.

Financial literacy and digital platforms are increasingly recognized as solutions to credit constraints. Lusardi and Mitchell demonstrated that financial literacy significantly improves credit use and repayment behavior. Onah et al. showed that financial literacy positively moderated the effect of credit access on cooperative financial performance in Nigeria.

IV. METHODOLOGY

Study Area: * Benin City, Edo State, Nigeria.

Data Collection: Secondary data on loan applications and approvals were obtained from RH-CRRP records (2011-2015). Primary data were collected using structured questionnaires administered to 60 cooperative members selected through simple random sampling.

*Analytical Tools:

1. Descriptive statistics for socio-economic characteristics and constraints
2. Queueing model M/M/1 for single-server loan processing:
   - Traffic intensity: $\rho = \lambda/\mu$
   - Probability of idle system: $P_0 = 1-\rho$
   - Average queue length: $Lq = \rho^2/(1-\rho)$

Where λ = arrival rate, μ = service rate.

V. RESULTS

Loan Processing Efficiency

Between 2011 and 2015, RH-CRRP received 254 loan applications and approved 224, yielding an 88.2% approval rate. Traffic intensity $\rho = 1.132$, indicating the system operated above capacity. Idle time was -0.13, confirming queue formation.

Constraints to Credit Access

Major constraints were inadequate finance (M=2.66), loan repayment issues (M=2.64), embezzlement (M=2.52), late disbursement (M=2.41), and low member participation (M=2.35). These align with findings by Adeyonu et al. and Onyenucheya & Ukoha on credit constraints in Nigeria.

Socio-economic Characteristics

72% of respondents were male, 46% aged 31-50 years, and 43% were civil servants. 78% had tertiary education.

VI. DISCUSSION

The 88.2% approval rate is higher than the national average of 45% reported by the CBN, indicating RH-CRRP's relative accessibility. However, traffic intensity above 1.0 indicates an overloaded system, which leads to delays that discourage borrowing.

Inadequate finance and repayment issues mirror challenges reported in Oyo, Kwara, and Bayelsa states. Embezzlement reflects weak governance, consistent with Mba Fokwa's findings on institutional gaps in Sub-Saharan Africa.

The high education level of members suggests that financial literacy training could improve loan utilization and repayment.

Digitalizing loan processing could reduce service time μ and lower ρ below 1.0, as shown in Ghana's cooperative systems. Policy support through the RH-CRRP should prioritize capital injection and governance reforms.

VII. CONCLUSION AND RECOMMENDATIONS

RH-CRRP efficiently processed 88.2% of loans but faced system overload and financial constraints. To improve efficiency:

1. Increase cooperative capital through government and donor support
2. Adopt digital loan management systems to reduce processing time
3. Implement financial literacy programs for members
4. Strengthen internal audit to curb embezzlement

Future research should apply multi-server queue models and extend the study to other cooperatives in Edo State.

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