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Effect of Technology on the Government Revolving Funds Sustainability in Murang'a County, Kenya

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Abstract:
Most governments of the day in developing economies have tried to make the public values a reality through the introduction of resources for the public service due to persisting poverty in the countries. In this connection the strategic task of providing start-up funds to various organizations and groups, and ensuring their sustainability is crucial. The main focus of this study was to analyse the loan repayment and sustainability issues of government revolving funds in Murang'a County. Use of technology on the government revolving funds in order to bring about the sustainability of the fundsis very essential. The study adopted a positivism philosophy of research, where the researcher was independent on what was being observed and studied. Descriptive survey design was used to determine the level of government revolving fund repayment and its effect on sustainability for other borrowers. The target population was 1520 social and economic groups in Murang'a County. Clustering and Simple Random Sampling techniques were applied to select a sample size of 307 groups, and in addition a census of 16 constituency credit officers, who were also interviewed. This, in total accounted to 19.5% of the total population. A questionnaire and an interview schedule were used to collect data. Descriptive data were analysed using tables and charts. Quantitative data were analysed using Chi-square, Analysis of Variance and Logit Regression Model. The results indicated that,the influence on technology to government revolving fund was statistically non-significant to repayment and sustainability in Murang'a County. The study concluded that though technology did not have a statistical relationship to loan repayment and sustainability in Murang'a County, the government should strengthen this facility to enable loanee follow-up and enhance early detection of defauters in order to take early action.

Keywords: *Sustainability, Revolving Fund, Credit Policy, Credit Assessment*

1. Background to the Study

Revolving fund is the extension of small loans (micro-loans) to deprived borrowers who typically lack security, stable employment and a demonstrable credit history. It is intended not only to sustain entrepreneurship and ease poverty, but also to give power to the neglected groups of the society in order to strengthen entire communities by extension. The concern of the central government of Kenya intending to take resources down to the rural village has been there since Kenya's independence in 1963 (Chweya, 2006).

The Women Enterprise Fund (WEF) was established in Kenya in 2007 as a revolving fund and was basically meant to provide accessible and affordable credits and to support women start and/or expand business in order to create wealth and employment (GoK, 2012). On the other hand, the Youth Enterprise Development Fund (YEDF) as a revolving fund was established in the year 2006 by the government of Kenya, with the main aim of reducing unemployment among the youth, who account to more than 61% of the total population in the country (Sagwe *et al.,* 2011).

The YEDF was to target 13 million youths aged between 18 to 35 years in Kenya. Its development came as a result of various complaints of neglecting of the youths' overtime. The complaints have gained a lot of support from the public, since the population of women and the youths has been growing at a very high rate, and employment opportunities have not matched to that growth. This scenario therefore shifted the focus to empowering the two important groups in order to enable them to become entrepreneurs and future employers, (Sagwe *et al.,* 2011).

Kimondo, Kihara and Njogu (2012) suggests that, sustainability of borrowed funds in micro-credit institutions may be well thought-out at several levels of institutional, group and individual, and can link to organizational, managerial, and financial aspects. The study by Kimondo *et al.,* (2012) established that financial regulation, number of clients served, financial coverage and volume of credit transacted were reasons that highly influenced sustainability of public owned Micro-Finance Institutions (MFIs) in Murang'a Municipality which was a small zone. The study deduced that, sustainability of MFIs is a functional relationship of related and interconnection of factors. This study required to evaluate the relationship between technology on repayment and sustainability of borrowed government revolving funds in Murang'a County in a wider perspective, where the issue of financial sustainability of youth and women groups has drawn more attention in conventional analysis at the expense of the sustainability of the individual borrower.

1.1. Statement of the Problem

Several Social-economic Women and Youth groups have borrowed the already existing government revolving funds in Murang'a County, but according to Opiyo (2013), groups have started defaulting on the loans given as start-upfor businesses. The default rate according to the study hasnow reached 40% rate in most groups and the fund managers fear that the revolving funds could dry out very soon and deny opportunities to new borrowers. The study reported most borrowers as having stopped servicing their loans completely. For example, the Youth Fund Status Report (GoK, 2009) noted the loan repayment rate in two constituencies in Murang'a County, namely; Kandara and Maragua was 37.5%. Out of the Ksh.4 million lent out since inception of the youth enterprise development fund, only Ksh.1.5million has been recovered. Medium term Enterprise loan recovery in 14 constituencies in Kenya distributed in Nairobi, Nyeri, Nakuru and Kakamega respectively showed an average loan repayment rate of 72% which was a remarkable repayment rate, but a common phenomenon to only a few constituencies all over the country, (Kiraka, Koboa and Katuolo, 2013 It's on this basis that this research was conducted to establish the effects of technology on loan repayment and sustainability of government revolving fund in Murang'a County, Kenya.

1.2. Objective of the Study

The study objective was,to determine the effect of technology on repayment and sustainability the government revolving funds in Murang'a County, Kenya.

1.3. Research Hypothesis of the Study

- H0: There is no relationship of technology on repayment and sustainability of government revolving fundsin Murang'a County, Kenya.

2. Theoretical Literature

The study was guided by the following theory

2.1. Unified Theory of Acceptance and Use of Technology

Unified theory of acceptance and use of technology advanced by Venkatesh *et al.,* (2003) holds that, there are four key constructs in technology, namely; performance expectancy, effort expectancy, social influence and facilitating conditions. According to the theory, the first three are direct determinants of usage intention and behaviour. In this theory, technology has a key role in determining performance and efforts applied in production units. The social construct argues that technology does not determine human actions but human actions shape technology. The fourth construct that deals with facilitating conditions is a direct determinant of direct behaviour and for actions to be realized, the facilitation conditions must be adequate and relevant. These constructs presence and execution makes technology used to be acceptable.

2.2. Empirical Literature

The empirical literature for this study was as indicated below

2.2.1. Use of Technology and Revolving fund on Loan Sustainability

2.2.1.1. Data Mining for Loan Repayment

Wakuloba (2006) note a strong relationship between major source of income and cause of default in government revolving funds in Uasin-Gishu Sub-county. The study used descriptive survey design and observed that from year 2000 to 2005 out of 90,217,577.00 of loan disbursed to groups, only about 59,346,107.35 accounting to 66% has been recovered (appendix 5).To the study, borrowers were not repaying for their loans and defaulting rate was very high. The study recommended the need for strengthening the organisation's management information systems to facilitate provision of up-to-date loan repayment statements to borrowers and enable early detection of potential slow repayment, and defaulters who were on multiple loans in the sub-county. The study did not specify how much debt the borrower can comfortably handle and did not specify the income streams, and other obligations that could interfere with repayment.

Mathison and Manger (2006) observe that banks over the last three decades have transformed their business from paper to fully integrated ICT- enabled systems. In time, as stipulated by study, many micro-finance practitioners see ICT innovation as a key strategy in efforts to take revolving fund to the next level in terms of outreach and sustainability. With ICT innovation, it's now

possible to explore opportunities, to apply it closer to client interface, to create significant new efficiencies and allow micro-finance providers to save the hard-to-reach client in more remote areas.

On the other hand, credit-card services as noted by Mathison & Manger (2006) on the above study were introduced to reduce the high costs associated with small transaction lending. It's particularly important for unsecured credit for unspecified purpose, small transactions and pre-defined credit limits. Smart-cards technologies were introduced as part of revolving fund solution. The cards have embedded computer clip that could store client and transaction data, as well as process information. Smart-cards functioned as electronic pass-book, thereby reducing reliance on printed receipts and as noted by the study were used in conjunction with biometric technologies (for finger print of client identification) thereby enhancing privacy and data security. Internet banking provided clients with real true information about account, and the ability to transfer funds between accounts. It also gave bank clients the flexibility to manage their financial resources deliberately at their own leisure.

2.2.1.2. Use of Credit Bureau for Loan Repayment

Mishikin and Eakins (2007) postulate that, the financial industry just like other industries are in business to earn profits by selling its products. To maximize profits, financial institutions develop new products to satisfy their own needs as well as those of their customers. Most micro-finance institutions as noted by the study have not done enough to lending to the retail customers. The lending to productive sectors of the economy has been negligible due to lack of viable projects for individual borrowing. This was the major reason why the institutions have not been active in lending to some enterprises and the so called absence of loan repayment culture, which is costly when clients treats loans as grants or gifts.

The review notes that the newly established credit rating bureau agent through the Central Bank of Kenya (2012) is to provide vital information about potential borrowers and has to make financial institutions more comfortable to lend to small and medium enterprising funds (SMES) and agriculture. They noted Commercial Banks as the only users of the credit rating bureau as per the time of the study. They accuse those mandated to make sure the credit bureau works to have embraced the pursuit of profit at the expense of ethics. It's the high time that all bottle-necks of credit reference bureau were dealt with, to extend services to all revolving fund finance institutions.

2.2.1.3. Use of Smart Cards for Loan Repayment

(Srivastava, 2004; Ghada, 2010) observe the efforts taken by banks in Uganda in trying to identify their customers using biometrics for final use by credit reference bureau. The studies indicated that banks and MFIs should not sit around and wait until the ideal policy; legal and regulatory environment has been created by government. They should continuously innovate to reduce costs, improve financial sustainability, and expand outreach.

Gine (2010) observe that the introduction of biometrics into the revolving fund sector improved the loan repayment rate in Malawi. Borrowers' fingerprints were taken and according to the study, 40% of those whose fingerprints were taken, paid their loans more than those whose finger prints were not taken at all. Those whose finger prints were taken took smaller loans perhaps to be sure of their ability to pay. The study noted a considerable increase loan repayment which was much higher than the cost of outsourcing the biometric instruments. The study also noted that, the use of biometrics helped to reduce multiple loans borrowing as well as the clients' transaction costs.

Gine, Goldberg, Sankaranarayanan, Sheerin, and Yang (2011) assert the importance of biometrics in monitoring and surveillance applications. The study notes that the mechanism of likely extension of time and attendance processes to prevent hourly employees from punching time cards for their absent friends, which costs employers hundreds of millions of dollars annually. They are used in eliminating the need for multiple identification mechanisms. Biometrics according to the study helped to determine whether applicants were already enrolled under a different identity and thus prevented individuals from cheating the public sector benefits programmes by collecting benefits under multiple identities.

2.3. Summary of Literature Review and Research Gaps

From the literature review, some research has been conducted on default on government revolving funds and its effect to group disintegration in Kenya. Wakuloba (2005) noted that, the default rate was extremely high on the trade and development joint loans. The environment under study would be different from the area of study of the researcher which would provide different results. The researcher recommends the use of ICT and innovations (Smart cards/Biometrics or otherwise) to detect default in time, which the researcher intended to investigate and the extent of its use after the recommendations.

Study by	Title	Findings	Knowledge gap	Focus on proposed study
Karlan & Morduch (2009)	Development of finance in USA	Customers have become much more sophisticated regarding financial matters	Technological change needs to be phenomenal	Use of innovations in revolving fund institutions
Wakuloba (2006)	Causes of default in government micro credit programmes. A case study of Uasin- Gishu sub-county trade development joint loan board.	-Lack of appropriate Management Information Systems (MIS) to be able to detect slow borrowers and potential defaulters. -Non-prosecution of defaulters is contributing to the rising trends in default	Determine how much debt the borrower can comfortably handle, income streams and any other obligations that could interfere with repayment.	How to intensify borrower follow-up to, improve recovery of outstanding loan balances accruing to slow borrowers and prosecute defaulters
Giné (2010)	Use of biometric in the micro- credit institution in Malawi	Increased loan repayment was far much higher than the cost of outsourcing the biometric instruments.	Improve loan recovery methods	Ensure innovations are applied to increase loan recovery
Lapenu & Zeller (2001)	Distribution growth and performance of revolving fund institutions in Africa	Social cohesive groups pool risks by diversifying the members asset portfolio	Need to broaden micro institutions clientele and to innovate in cost-efficient service delivery systems	Development of lending technology systems that are cost effective to loan creation and repayment

Table 1: Summary of Literature Review and Gaps
Source; Researcher (2013)

2.3. Conceptual Framework

Based on the preceding literature review and discussion, the systematic Diagram figure 1 was developed to show the relationship between the independent, moderating and dependent variables. A discussion on how each of the variables was operationalized is given below:

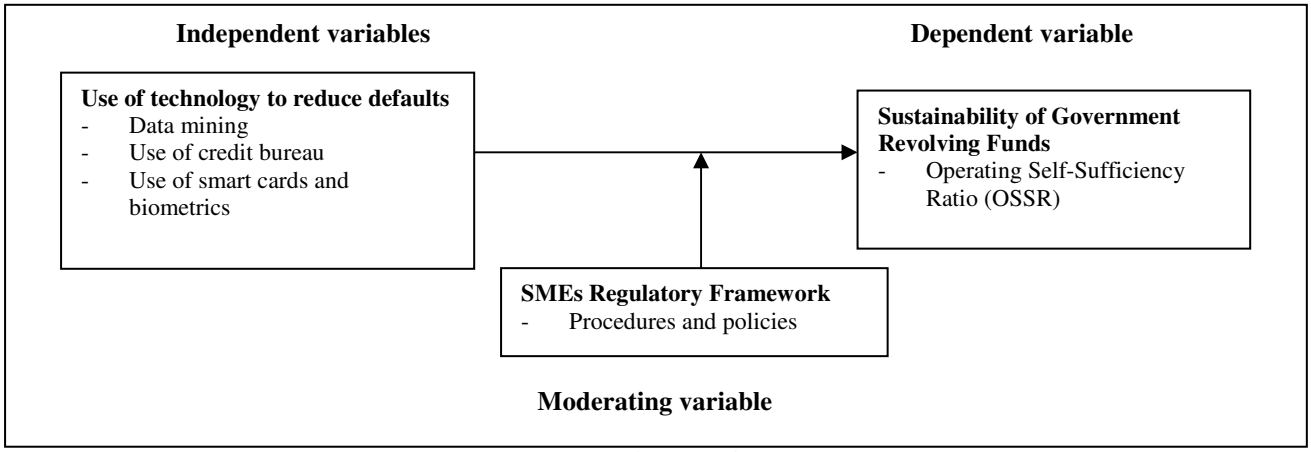

Figure 1: Schematic diagram
Source: Researcher (2013)

3. Research Methodology

3.1. Research Design

The study adopted a positivism research philosophy which is an epistemological position that advocates an observable social reality that allows replication and end product that can be generalised elsewhere (Saunders, Lewis & Thornhill, 2009).

3.2. The Empirical Model

Discrete regression models like the probit, discriminant and logit models as indicated by Gemma (2014) are ideal to use when the dependent variable is of a binary choice. Generally, any of the three models can be used as they tend to generate more or less similar

results. The choice of any of the model is a matter of convenience. This study employed the logit model to examine the sustainability or (non-sustainability) of government revolving funds as a matter of personal preference. The following logit model was adopted as suggested by Gemma (2014)

$$Pr(Yi = 1|Xi) = f(\beta 0 + \beta i\ Xi + \varepsilon i) \quad \text{---------- (3.1)}$$

Where the function (f) takes on a linear function, it is known as a linear probability model (LPM)

This outcome has more than one independent variable. The outcome of the logistic regression will be 0 or 1, where 1 indicates that the outcome of interest is present, and 0 indicates the outcome is absent. Logistic regression generates the coefficients and standard errors and significant levels of a formula to predict a logit transformation of the probability of presence of the characteristic of interest. The logit model estimates the probability of dependent variable to be 1(Y=1). This is the probability that some events have happened. Both logit and probit models are preferred because they help in overcoming weaknesses inherent in linear probability models such as heteroskedasticity and linearity problems (Muathe, 2010)

Quantitative data were analysed using descriptive statistics and inferential Statistics (Logit Regression) using SPSS data analysis software program. The models helped to establish whether there was a zero-order relationship among the variables. If one or more of these relationships, are non-significant, the study concluded that the moderating factor was not likely to influence the results. If there is a significant relationship, the regression coefficient for indirect effect represents the change in Y for every unit change in X_i, and hence influences the results. Qualitative data were analysed through content analysis by capturing common themes and group. Final result of data analysis was presented through tables and figures for easy understanding and interpretation.

3.3. Measurement and Operationalization of Variables

The explanatory variables included in the model were described and categorized into extent of use of technology and regulatory framework. They were operationalized and hypothesized to influence government revolving fund repayment and sustainability in a certain direction greater than or less than 1 as shown in Table 2

use of technology to reduce defaults	Data mining (X10)	Frequency of data mining	Sum of management judgement on 1-5 scale	Positive
	Use of credit bureau (X11)	Application of credit bureau by revolving fund institutions	Sum of management judgement on 1-5 scale	Uncertain
	Use of smartcards and biometrics (X12)	Degree of use of smart cards or biometrics	Sum of management judgement on 1-5 scale	Uncertain
Regulatory frame work	Procedures and policies (X13)	Legal framework to regulate revolving fund institutions	Sum of management judgement on 1-5 scale	Uncertain

Table 2: Operationalization and Measurement of Variables
Source: Researcher (2013)

3.4. Target Population

The target population was 1,520 respondents which include 1504 groups and 16 constituency credit officers or fund managers from the socio-economic women and youth groups, dealing with government funded revolving fund found in the county as per the youth enterprise board (2013) and the Women Enterprise Board (2013).

STRATA Sub-counties in Murang'a County	**WEF groups Year 2013**	**YEDF groups Year 2013**	**Total (N)**	**Percentage of the total**
Gatanga	253	100	353	23%
Kandara	151	100	251	16.5%
Murang'a South	62	77	139	9.14%
Kigumo	42	67	109	7.17%
Mathioya	137	91	228	15%
Kiharu	79	40	119	7.8%
Kahuro	78	40	118	7.76%
Kangema	116	71	187	12.3%
Constituency credit officers	8	8	16	1.05
Total	**926**	**594**	**1520**	**100**

Table 3: Distribution of the Population
Source: Researcher (2013)

Table 3 shows the WEF and YEDF groups that are registered with the ministry of culture and youth services in Murang'a County. The county has been sub-divided into 8 sub-counties out of which 7 constituencies have been curved. Kiharu Constituency serves both

Kiharu and Kahuro sub-counties. Results from the table 3 indicate that most groups for both WEF and YEDF were found in Gatanga Sub-county with 23% of the groups respectively. Kigumo and Kahuro Sub-counties had the lowest number of groups with 7.17% and 7.76% respectively.

3.5. Sampling Design and Procedure

Clustering of the entire county into eight sub-counties and then applying a Simple Random Sampling technique to select a sample size of 307 respondents, which included 291 groups and 16 constituency loan officers was done. From every group sampled, one executive official was sampled using simple random sampling. In addition, a census of 16 constituency loan officers which entitled 8 constituency loan officers or the YEDF and 8 constituency loan officers for WEF were interviewed. This, in total accounted for 19.5% of the total population.

STRATA Sub-counties in the County	**Total WEF and YEDF groups in Murang'a county (N)**	**Weighting from the total number of groups**	**Sampling rate**	**Sampled WEF and YEDF per sub-county**
Gatanga	353	23%	**19.5%**	69
Kandara	251	16.5%	**19.5%**	50
Murang'a South	139	9.14%	**19.5%**	27
Kigumo	109	7.17%	**19.5%**	21
Mathioya	228	15%	**19.5%**	44
Kiharu	119	7.8%	**19.5%**	23
Kahuro	118	7.76%	**19.5%**	23
Kangema	187	12.3%	**19.5%**	36
Constituency loan officers	16	1.05	**100%**	16
Total	**1520**	**100**		**307**

Table 4: Sample Determination
Source; Researcher (2013)

Table 4 shows the sampling procedure to arrive at the number of respondents. Probability sampling technique where the chance or probability is known and is usually equal to all cases was applied, Sauders *et al.,* (2007). After adding the WEF and YEDF together, a common rate of 19.5% per constituency was applied. To arrive at 307 respondents, 100% of the constituency loan officers were also included in the sample.

3.6. Data Analysis

Several methods were adopted in this study in order to describe, illustrate and analyse data statistically. Descriptive survey data were summarized in tables and figures. Descriptive statistics allowed the researcher to digest and understand large quantities of data and effectively communicate to users the research study purpose (Cooper & Schindler, 2006). Content analysis by finding themes, patterns and relationships derived from structured interviews and observations was applied to analyse qualitative data. All the independent variables had an accompaniment of a number of factors which were combined and averaged to find the composite index (Appendix 3). For empirical analysis of the study and for drawing inferences from population sample, bivariate analysis, that is the test of differences or measure of association between two variables at a time was applied. It employs the Pearson Correlation Coefficient which is a measure of the magnitude and direction of the linear relationship between two variables. The value of the correlation ranges from -1 to 1, where the sign of correlation coefficient indicates the direction of the relationship, (Mugenda and Mugenda, 2003). The absolute values of the correlation coefficient indicated the strength, with larger absolute values indicating stronger relationships. Significance of the variables was tested at (sig level of 0.05). The significance of each correlation is also displayed in the correlation tables. If the significance level is very small (less than 0.05) then, the correlation is significant and the two variables are linearly related. If the correlation is (more than 0.05) then, the correlation is not significant and the two variables are not linearly related. Logit regression model was also applied to test the extent to which the independent variables predicted the sustainability of government revolving funds.

Before testing the fit of the model, multicollinearity analysis was performed to establish the possibility of a collinearity problem of the predictor variables having some explanatory power over each other. According Sosa-Escudero (2009), multicollinearity is a situation where correlations among the independent variables are strong. When this happens, it makes the estimated regression to fluctuate widely, making interpretation difficult. To measure the level of multicollinearity, the collinearity test was conducted using correlation analysis. The results were inferred by Variance Inflation Factors (VIF) analysis whereby, if (VIFs =1, there is no correlation), if (5>VIFs >1 as per Sosa-Escudero (2009), there is moderate correlation) and if (VIFs>10, there is high correlation, which is a problem) and also using the Tolerance Level that measures the extent of correlation, which is the degree to which one predictor can itself be predicted by the other predictors in the model. The higher the Tolerance level, derived as (Tolerance = $1/VIF_i$), the less the overlap between variables. The lower the tolerance value, the higher the degree of collinearity which is a problem. Tolerance value of 0.5 is generally considered acceptable (Sosa-Escudero, 2009). The study suggested that, a tolerance value of less than 0.1 almost certainly indicates a serious collinearity problem.

The overall fit of the model was tested using the log-likelihood and associated chi-square statistics. The contribution of each predictor variable was tested using Wald statistics. Similarly, the open-ended questions were analysed through content analysis (ANOVA) where the researcher grouped common themes and drew inferences from the findings. Cooper and Schinder (2003) note that content analysis helps to bring issues into the forefront that would not have otherwise been captured through the use of structured questions in the questionnaire.

To arrive at the correct conclusion, it was also necessary to reduce the possibility of committing Type I and type II errors. Sosa-Escudero (2009) argues that in hypothesis testing, a Type I error occurs when the null hypothesis is rejected when it is true. Furthermore, type II error occurs when null hypothesis is not rejected. For any set data given, Type I and Type II errors are inversely related. The smaller the risk of one, the higher the risk of the other, hence reducing the possibility of committing a Type I error increases the probability of committing a Type II error and vice-versa. In addition, based on the real-life application of errors, a type I error is considered to be more serious and therefore, more important to avoid than a Type II error. In this study, care was focused on minimising the occurrence of both types of errors. Increasing the sample size helps to reduce the risk of committing both types of errors. The sample was fairly high, about 307. In addition, the P-values, which are important in estimating the probability of committing type I error when the null hypothesis is rejected when in fact it is true, were compared at 0.05 significant levels (Commins & Hazinski, 2000). Power test which is equal to (1-β) is probability of a test rejecting the null hypothesis when null hypothesis is false as reported by Black (2008) was computed. Table 5 provides summary of the analysis undertaken:

Use of technology to reduce defaults	Data mining	Interval	Mean and standard deviation	Multicollinearity analysis, logit analysis, Type 1 and II test, ANOVA tests
	use of credit bureau	Interval	Frequency	

Table 5: Summary of Data Analysis Techniques
Source: Survey data (2013)

4. Research Finding and Discussions

4.1. The Response Rate and Descriptive Statistics

From the study, the sample population under examine was 307 respondents who were sampled from the target population of 1502. A total of 261 respondents filled and returned the questionnaires; in addition, 10 constituency loan officers were available for interview. This response rate was 85.60% of the total population. Mugenda & Mugenda (2003) and Saunders, *et al.,* (2007) have argued that a response rate of 50% and above is sufficient for a study and therefore response rate of 85.60% for this study was very good.

4.2. Technology and Loans Repayment

The study intended to determine the effect of technology to the revolving fund institutions for loan sustainability in Murang'a County, Kenya. First, the study sought the extent to which the use of technology and innovations affects loan repayment. Table 6 below shows the effect of technology to loan repayment.

Category		Frequency	Percent
Finger prints taking technology for all members of revolving fund groups that has been lacking should be taken and kept in a data base	Strongly disagree	3	1.1
	Disagree	6	2.3
	Neutral	29	11.1
	Agree	106	40.6
	Strongly agree	116	44.4
	Not applicable	1	.4
	Total	261	100.0
Signing against our names in the group records which has been going on is not enough, something more should be done	Strongly disagree	3	1.1
	Disagree	5	1.9
	Neutral	20	7.7
	Agree	122	46.7
	Strongly agree	110	42.1
	Not applicable	1	.4
	Total	261	100.0

Table 6 continue….

Finger prints taking technology have been exposed us compared to use to face recognition technology	Strongly disagree	78	29.9
	Disagree	24	9.2
	Neutral	33	12.6
	Agree	86	33.0
	Strongly agree	39	14.9
	Not applicable	1	.4
	Total	261	100.0
Credit Reference bureau technology that is meant to commercial banks should be extended to revolving fund institutions	Strongly disagree	30	11.5
	Disagree	3	1.1
	Neutral	28	10.7
	Agree	103	39.5
	Strongly agree	96	36.8
	Not applicable	1	.4
	Total	261	100.0

Table 6: Effect of Technology to Loan Repayment
Source: Survey data (2014)

Results from Table 6 show that a large number of respondents (44.4%) strongly agree that finger print taking technology for all members of revolving fund groups should be taken and kept in a data base, a good number respondent (46.7%) agreed that signing against their names that had going for long is not enough and something more should be done to improve it. A high number of respondents (29.9%) disagreed that finger print technology at disposal had exposed them to face recognition technology. According to the respondents, both finger print and face recognition technologies has not been exposed to most of the groups, and on the credit referencing bureau technology, most respondents (39.5%) agreed that the referencing bureau should be extended to all revolving fund institutions. The results support the study by Wakuloba (2006) on causes of defaults in government revolving fund institutions who suggested the need strengthening organisational management information systems for data mining to enable early detection of slow repayment borrowers.

4.3. Analysis of the Interview Schedule

About (40%) of the constituency loan officers recommended for rewarding of borrowers who repay their obligation in good time and making available information systems that can be used to reduce multiple borrowing that was found to be too high amongst the groups. About 30% of the constituency loan officers' have come across irresponsible lending by some of the officers as they try to meet the set out targets. About (40%) of loan officers were facing challenges of groups' members running away with borrowed funds among other challenges.

4.4. Hypothesis Testing

The previous results had presented descriptive statistics on government revolving fund repayment and sustainability however, to draw inferences about the population on the basis of the sample, there was need to empirically analyse data using the Pearson correlation coefficient. The correlation of the five variables was as provided in table 7.

		Level of Sustainability	**Use of Technology**
Level of loan sustainability	Pearson Correlation	1	-.039
	Sig. (2-tailed)		.0630
	N	261	261
Use of technology	Pearson Correlation	-.039	1
	Sig. (2-tailed)	.0630	
	N	261	261

Table 7: Correlation Analysis of the Variables Under Study
Source: Survey data (2014)

From the table 7, on the use of technology and level of sustainability, the significance level was (0.0630>0.05) and the Pearson correlation coefficient was (-0.039) showing a negative relationship between use of technology and level of sustainability.

4.5. Measuring of the Multiple Logit Regression Models

The four hypotheses that the study sought to test are addressed in this section. The first to the fourth hypotheses were: determine the effect of operation procedures to revolving fund (H_1), examine the implication socio-economic functions (H_2), and establish the effect borrower' characteristics (H_3) and determine the effect of technology (H_4) to sustainability of government revolving funds. Before the variables were analysed, various factors accompanying each variable were combined and averaged. Binary logit regression model was considered appropriate due to the nature of the study because the situation would have to occur or otherwise. The outcome was to be either 0 or 1, where 1 indicates that the outcome of interest is present, and 0 indicates the outcome is absent.

Loan sustainability		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1[a]	Loan operation procedure(H_1)	-.018	.292	.004	1	.048	.982	.554	1.741
	Socio-economic functions(H_2)	-.838	.264	10.064	1	.002	.432	.258	.726
	Borrower characteristic(H_3)	-.965	.341	8.005	1	.005	.381	.195	.743
	Use of technology (H_4)	**-.519**	**.285**	**3.317**	**1**	**.069**	**.595**	**.340**	**1.040**
	Constant	1.618	.230	49.475	1	.000	5.04		
	Chi-square Predicted overall performance -2log likelihood Negelkerke R^2	22.761 73.4* 344.29 0.402				0.000			

Table 8: Parameter Estimate of Logit Model
Source: Survey data (2014)

The regression results of the logit model in Table 8 are reflected by the regression coefficient standard errors t- values, Wald statistics and p-value. The logit model generates a chi-square value of 22.761 and p-value of 0.000 which was statistically significant because the p= value was less than∞ = (0.05).

Results on the use of technology had non-statistically significant relationship to the loan repayment and sustainability. Most respondents indicated that they had not come across the facilities in their groups. Studies done by (Wakuloba, 2006; Mathism and Manger, 2006; Maskin and Eakins, 2007; Ghada*et al*, 2010 and Gine, 2010) noted a strong relationship between source of income and causes of defaults, and recommended the need for strengthening the organisations management information systems. The studies noted paper-less banking taking shape in Kenya through a fully integrated ICT, enabling credit-cards system that was introduced to reduce high costs associated with small transitions. This initiative could be replicated to the revolving fund institutions. The need to ensure extension of the Credit Reference Bureau to revolving fund institutions and use of biometrics that had high influence in loan repayment in other countries namely; Malawi, South Africa and Mozambique were also floated in the study. Studies from the countries in question indicated that, after the exercise was rolled out, people whose finger prints were taken took fewer amounts of loans, that they were able to repay and reduced the problem of multiple borrowing and public cheating.

Most Kenyans came across to biometrics or biometric authentication as the identification technology during (2013) election accounting to why the respondents found the questions rather strange and produced non-significant report. This technology has been mildly used by a few institutions in Kenya to identify individuals in groups that are under surveillance. It was hoped, it will help curb some of the fraudulent practices of manipulation and vote rigging that were prevalent in the previous manual registration system. On the use of biometric technology in developing countries, the success of government in combating corruption and delivery of public services efficiently depends on accurate identification of citizens and the ability to cross reference database and information across government department and agencies. This can only be possible with a national system to allow individuals to uniquely identify themselves. Government programmes especially in Kenya should avoid working in isolation each with its own data base of beneficiary which cannot be merged with each other. Implementation of an efficient identification system in Kenya could expand financial credit market and insurance.

Through people, biometrics which is a measure of identity based on physiological finger prints, face, hand geometry, iris or retina, speech or written signature characteristics of each person's identity and information cannot be forgotten, lost or stolen like in other conventional methods. It can be used to monitor applications to ensure double enrolment on similar benefits, thus preventing cheating on public sector benefits under multiple indentities. A biometric system was introduced in 2013 in the Kenya's parliament to monitor attendance of parliamentarians in a bid to curb absenteeism. This is an indication of the government willingness to embrace technology in the country and has promised to digitalize most of the services for better service delivery to the citizens. The systems in question needs to be extended and more exposure done to all clients particularly those who rely on revolving fund institutions for financing, to capture relevant information on the borrowers, and be able to detect multiple borrowing and defaults early, which is a concern at the moment. Success stories on the use of biometrics in the revolving fund financial sector have been reported in Malawi which can be replicated in Kenya.

Hypothesis	Construct	Result	Explanation
H0	There is no statistical significance on technology to revolving fund loan sustainability	Fail to reject null hypothesis	Significance level **(0.069 > 0.05);**

Table 9: Summary of Hypothesis Testing
Source: Survey data (2014)

The summary of the hypothesis in Table 9 indicates the significance of the coefficients tested. The results showed that the first three variables were significant and hence the null hypotheses were rejected and the alternative hypotheses taking effect. The fourth hypothesis indicated the non-significant of the hypothesis and hence failed to reject the null hypothesis.

5. Summary, Conclusions and Recommendations

5.1 Summary

The main objective of the study intended the final objective of the study intended was to determine the effect of technology on repayment and sustainability of the government revolving funds in Murang'a County. The study derived descriptive statistics on data mining, use of credited bureau, use of smart card and biometrics as factors influencing loan repayment and sustainability. Composite index was also established to make one variable that was analysed and regressed. The results from the Pearson correlation and the logit regression analysis, reviewed that, there was non-significance of the variable in question. The study failed to reject the null hypothesis which meant that, there was no relationship between technology to repayment and sustainability of the government revolving funds in Murang'a County as at 2013. Triangulation method was used which ensured effective analysis of both primary and secondary data.

5.2. Conclusion

Technology was found to be inversely related to loan repayment and sustainability. Most of the groups had never come across a computer in life, and there is dire need to introduce this devise to all the groups. At the same time group members were encouraged to visit groups regularly to abreast with the new changes. Other countries namely Malawi, South Africa, Mozambique and India have embraced technology where biometrics, smart cards and face recognition technology devices have been introduced, which had improved their micro-credits loan repayments. The presence of irresponsible loan officers, lack of elaborate plans and micro-credit institutions not providing training to all groups were the attributes to multiple borrowing which affected loan repayment. Most of the groups were in their second round of borrowing and preferred group membership of between (11-15) members which was in line with the government requirements for revolving fund groups' formation.

5.3. Recommendations

5.3.1. Policy Recommendations

The study made some policy recommedations to loan repayment and sustainability of government revolving funds. The credit reference beureu which has been a preserve of the commercial banks should be made compulsory to all micro-credit institutions and should be net-worked to share some important information on borrowers. It should assist in making credit accessible to more people, and enabling lenders and businesses to reduce risks and fraud. Micro-credit institutions play great role in extending financial services within an economy especially to the rural areas. In support of this role, credit bureaus will help lenders to make fast and more accurate credit decisions.

The government revolving funds organization management systems should be strengthened to facilitate up-to-date loan repayment statements to lonees follow-up and take action early in case of defaults. Some groups indentified prosecution/blacklisting of defaulters as a solution to some of the problems they are currently facing. Due to problems of high risk and high cost of borrowing, uncertainity of repayment capcity on the rural borrower has been reported high, due to irregular income streams. Systems should be developed to ensure consistent incomes and expenditure to reduce/remove uncertainty.

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APPENDIX 1

Group Executive Member Questionnaire

This questionnaire is aimed at collecting data on loan repayment and sustainability of government revolving funds in Murang'a County. It intends find out your satisfaction on the government revolving fund initiative at your disposal. Kindly respond to the following questions as honest and accurately as possible. The information you give will be useful only for the purpose of this research.

- **Section A: Preliminary Information**

Division _____ Name of Group (optional) _____ Number of members _____

1 Kindly indicate your Gender

Male [ ] Female [ ]

2. Group Position Held (Tick): Chairman ☐ Treasurer ☐ Secretary ☐

Marital status

Single ☐ Married ☐ Widowed ☐

3. What is your highest level of Education of most of your group members? (Tick as applicable)

a) Diploma [ ]
b) Degree [ ]
c) Post graduate [ ]
d) Others (specify) ……

4. Indicate the period in (years), you have been a member of this group.

i. Less than one year [ ]
ii. 1-3 years [ ]
iii. 3-7 years [ ]
iv. 8-10 years [ ]
v. Above 10 years [ ]

5. Number and average age of majority of your group members

Age bracket Total in number

a. Age 15- 25_____ Between 1- 5 _____
b. Age 26- 35 _____ Between 6- 10 _____
c. Age 35- 45 _____ Between 11- 15 _____
d. Above 45 _____ 16 and over _____

6. In your opinion, for better group management, what would you suggest would the ideal number of members?

i. Between (3 – 5) group members ☐
ii. Between (6 – 10) group members ☐
iii. Between (11 – 20) group members ☐
iv. Above 20 group members ☐
v. Not sure ☐

7. To what extent do the following factors influence micro credit loan repayment?

Statement	5	4	3	2	1
Members that are single and not married are able to repay their loans promptly					
Members with young children Between (1 - 3) and at ages between (1 - 10) are more committed to group activities and are committed in repaying loans					
Members with children between (4 -5) at ages between (11- 15) are more committed to group activities and are committed in repaying loans					
Members with children between (6 -10) at ages between (16 - 18) are more committed to group activities and are committed in repaying loans					

1-not at all, 2-low extent, 3-moderate extent, 4-great extent, 5- very great extent

8. From your records, who among the group members repay their loans promptly?
Those earning incomes;

a) Between (Ksh 0 - 3000) ☐
b) Between (Ksh 3001- 5000) ☐
c) Between (Ksh 5001-10000) ☐
d) Between (Ksh 10001-20,000) ☐
e) Above 20,000 ☐

- **Section A: Technology Effects to Defaults of Revolving Fund Loan for Sustainability**

9. To what extent do you agree with each of the following statement on use of innovations for loan repayment?

Statement	5	4	3	2	1
Finger prints for all members of revolving fund should be taken and kept in a data base					
Signing against our names is enough for data mining					
Taking the details of groups is enough					
Smart cards or biometrics should be introduced to every revolving fund institution for data mining of the borrowers					
The Credit Reference Bureau that was meant for commercial banks has been extended to most revolving funds institutions to reduce multiple borrowing and lending.					
Micro- credit Institutions are still in suspicion amongst themselves and Credit Reference Bureau may not work					

(1-means strongly disagree, 2-disagree, 3-neutral, 4-agree and 5- strongly agree)

10. Have you been provided with a smart card?
Yes ☐ No ☐

11. To what extent do you agree with each of the following statement on use of smartcards?

Statement	5	4	3	2	1
Piloting of smartcards recognition system was rolled out to all micro- credit institutions					
Smartcards has helped to determine whether loan applicants are already enrolled under different indemnity reducing rate of defaulting					
Finger prints technology for data have exposed to us more than face recognition.					
Individual after data collection on smart cards have been taking smaller loans that they are able to repay					
Benefits acquired from use of smartcards have been able to cover the cost of acquiring the devices.					
Loan defaulters should be identified early and prosecuted for sustainability to be realized					

(1-means strongly disagree, 2-disagree, 3-neutral, 4-agree and 5- strongly agree).

12. Some researchers have recommended the use of Biometrics to reduce defaulting of loans, what is your general recommendation on the use of Biometrics in the revolving fund institutions?
(*Chose one*)

i. It is a waste of time and the ideal should brushed away ☐
ii. It's a costly affair that revolving fund institutions cannot afford and should not be given any thought ☐
iii. It should be enforced to all revolving fund institutions ☐
iv. Government to sponsor biometrics to all revolving fund institution ☐
v. Use of smart cards is sufficient and status quo should remain ☐
vi. Government should instead demand compulsory use of smart cards to all revolving fund institutions ☐

13. What kind of procedures/policies has been put in place to ensure sustainability of government revolving funds?

a) Have championed for a lower interest rate to ensure defaulting is reduced ☐
b) Have introduced incentive mechanism to encourage borrowers to repay loans ☐
c) Have set stiff rules and conditions of access of future loans ☐
d) Advise borrowers to acquire loans in small sizes at a time instead of large size which will pose a challenge to repay ☐
e) Number of loans/projects that an individual or group is servicing is outlined before the loaning is done ☐
f) Importance of joint liability is voiced out always to ensure participation to many in repayment ☐
g) Outline any non-refinancing threat put forward by your micro- credit agency ☐

_____

Thank You

APPENDIX 2: Constituency Credit Co-ordinators Interview Schedule

Sub-county _____Constituency ---------- Marital status _____

Name (optional) _____ Age (optional) _____Gender: M ☐ F ☐

1. How do you monitor groups/procedure?
2. How do acquire information on borrowers?
3. There is an accusation that multiple borrowing has been on the rise as officers try to meet the target thus provide loan irresponsibly, what are your comments on this? Have you experienced deaths and distress of some of your group members due to multiple borrowing?
4. Do you have records of borrowers indicating their loan repayment history? (Please provide a copy for perusal)
5. Please provide any documented guideline where financial information related to the loans is kept.
6. Are there groups' disintegration that you are aware of; what is the rate of new group formation and rate of disintegration? In your opinion is the amount recovered able to cover administrative cost, loss of loans (default) and enough for reinvestment to other borrowers. Do think this fund is sustainable? (Any Comments on the same)
7. What are the challenges that you face daily? How can the challenges be overcome?
8. In your opinion what should be done to make the revolving fund loan sustainable for other users.

APPENDEX 3: Performance of Joint Loan Board Funds in Kenya (2000-2004)

Financial Year	Loan Disbursed (Kshs)	Amount Recovered (Ksh)
2000/01	23,684,000.00	17,438,003.80
2001/02	5,385,000.0014,	717,455.65
2002/03	11,336,557.00	14,215,918.20
2003/04	18,585,000.00	15,431,083.20
2004/05	21,227,000.00	11,543,646.50
Total	**90,217,577.00**	**59,346,107.35**

Source: Wakoloba (2006)

APPENDEX 4: Composite Index Computation

Data mining(X_{31})						
		finger prints taking vital	signing is not enough	taking group details	credit bureau extension	suspicion of micro credit institutions
N	Valid	261	261	261	261	261
	Missing	0	0	0	0	0
Mean		**4.21**	**4.24**	**4.22**	**3.90**	**4.22**
Std. Error of Mean		.050	.045	.052	.071	.053
Std. Deviation		.857	.767	.882	1.200	.904

Note- if the mean>3, value is equated to 1, otherwise 0 for logit regression bivariate analysis

Credit bureau(X_{32})								
		piloting of smartcards	use of smarts cards	finger prints have been used better than face recognition	credit granting decision	individual taking smaller loans	benefits able to cover the costs	loan defaulters prosecution
N	Valid	261	261	261	261	261	261	261
	Missing	0	0	0	0	0	0	0
Mean		**2.49**	**2.76**	**3.03**	**3.24**	**3.77**	**3.22**	**4.06**
Std. Error of Mean		.083	.085	.087	.078	.068	.084	.071
Std. Deviation		1.402	1.434	1.470	1.326	1.146	1.430	1.205

Note- if the mean>3, value is equated to 1, otherwise 0 for logit regression bivariate analysis

Smart cards and biometrics(X_{33})						
	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
use of biometrics	261	1	6	**3.43**	.084	1.420
Valid N (listwise)	261					

Note- if the mean>3, value is equated to 1, otherwise 0 for logit regression bivariate analysis

Sustainability(Y)						
	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Doing a lot of advertising	261	1	6	**4.43**	.047	.798
regular visitation	261	1	6	**4.45**	.041	.694
Members encouraged to visit	261	1	6	**4.46**	.040	.679
Reducing of rigidity	261	1	6	**4.37**	.043	.718
Calling of seminars	261	2	6	**4.46**	.042	.709
Loan supervision	261	1	6	**4.31**	.055	.935
Saving plan to recommend	261	1	5	**1.88**	.075	1.270
Policies put in place	261	1	8	**3.51**	.089	1.505
Group composition	261	1.00	6.00	**2.1930**	.07878	1.33002
Amount borrowed	261	1.00	5.00	**2.4877**	.08445	1.42563
Amount repaid	261	1.00	6.00	**2.4772**	.10035	1.69413
Rating of government Funded micro credits	261	1	6	**3.88**	.077	1.302
Year of commencement to now	261	1.00	4.00	**2.6000**	.04950	.86450
Amount borrowed overtime	261	1.00	6.00	**3.1213**	.10419	1.81959
Amount un-recovered	261	1.00	6.00	**3.1475**	.13763	2.40364
Cash diverted to other uses	261	1.00	6.00	**3.0590**	.13742	2.39993

Note- if the mean>3, value is equated to 1, otherwise 0 for logit regression bivariate analysis

Moderating variable							
Descriptive Statistics							
	N	Minimum	Maximum	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
regulatory framework put in place	261	1	6	**2.97**	1.317	-1.051	.300
pre-financing code and rules	261	1	6	**4.39**	.808	5.497	.300
post alternative sources of funds	261	1	6	**4.40**	.883	5.162	.300
new lending codes	261	1	6	**4.41**	.747	5.481	.300
improving access to be encouraged	261	1	6	**4.48**	.721	6.860	.300
Valid N (list wise)	261						

Note- if the mean>3, value is equated to 1, otherwise 0 for logit regression bivariate analysis

APPENDEX 5: Performance of Joint Loan Board Funds in Kenya (2000-2004)

Financial Year	**Loan Disbursed (Kshs)**	**Amount Recovered (Ksh)**
2000/01	23,684,000.00	17,438,003.80
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2002/03	11,336,557.00	14,215,918.20
2003/04	18,585,000.00	15,431,083.20
2004/05	21,227,000.00	11,543,646.50
Total	**90,217,577.00**	**59,346,107.35**

Source: Wakoloba (2006)