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Effect of Financial Innovation on Credit Risk (Non- Performing Loan Ratios) of Commercial Banks in Kenya

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Abstract:- Financial institutions seek investment opportunities with limited risks and opportunities with a higher probability of profitable returns. Kenyan institutions of finance face a lot of risks in providing their services. A company's possible loss if counterparties fail to fulfill their financial commitments is known as credit risk. Banks frequently shift credit risk to free up capital for additional loan intermediation, which results in cash outflow. The study investigated the effect of financial innovation on credit risk of commercial banks in Kenya, focusing mainly on the effect of mobile financial feature innovation, internet financial access innovation, plastic cards innovation and cheque truncation on credit risk.The theories adopted for the study include; Technology acceptance model, Resource based theory, Diffusion Innovation theory and Theory of Constrains. The target group that formed the unit of analysis, was the forty-twoKenyan commercial banks. The annual financial reports of commercial banks that are listed were the source of secondary data for the given time2013 to 2022 analyzed through EVIEWS. The study adopted an experimental research in determining the influence the independent have on dependent variables, while using ARDL approach to examine cointegration. Based on the findings mobile financial feature, internet financial access, plastic card innovation and cheque truncation system had a positive significant influence on Credit risk quantified by Kenyan commercial banks' under non-performing loan ratio.

I. INTRODUCTION

Financial innovation is considered as creating advanced financial instruments, technologies, organizations and trade area. The innovation is mainly in two forms product or process innovation, under product simplified in the form of new chip and pin plastic cards, advanced systems that enable both the reading chip and plastic cards, while process is all about the new ways of processing or pricing transactions. Policy generators contend the implementation of financial innovations must be mitigated and are concerned that financial innovations, may be fruitful provided a better environment, they may also give rise to or be part during a problem. Justification of this concern is based onhow innovations are implemented (Dunk, 2011). Mobile finance features can spread a business's revenue more than other features. When companies need to focus on value, they can often achieve this by using low-cost tools that can be implemented faster and scale without friction. Mobile phone usage has increased by more than 73.9% in the last six years, with more than 6.5 billion smartphone owners. Today, more than 80% of the world's population (about 7.9 billion) uses a mobile phone and spends several hours a day on it; In this way, it is easier than ever to perform banking transactions from mobile devices. Explosive growth of mobile wallets: With the increase in mobile usage, mobile wallets are also on the rise. The global wallet market is expected to grow exponentially from $6.6 billion in 2016 to $64 billion in 2022. Between 2010 and 2020, the cash market will decline by 50% due to the rise of mobile payments. Dependence on consumers: More and more consumers are becoming dependent on innovations in mobile finance, especially in Latin America, Africa and Asian regions, where corporate services are not easy (Mbai, 2022). Mobile financial services can provide budgeting and planning functionality to help users improve their finances, save more, and plan payments. User-friendliness, especially chatbots and virtual assistants, are important features for customers because they can access them at any time of the day and guide the customer through new or simple actions. Mobile money services offer airtime and data to consumers, but often allow consumers to purchase them only for themselves or others, with lower limits.

Internet financial access innovation, also known as banks and other financial institutions offer internet banking, often known as electronic banking, which enables users to access and utilize their bank accounts via the internet.. Most services have no time limits; you can check your account balance and send money at any time without waiting for the bank to open. It is very easy to benefit from the services offered by Internet Banking. You can complete the transaction wherever you are. Pay utility bills, fixed deposits and other bills in minutes using internet banking. The transactions you make on the Bank's Internet Banking Innovation Portal will be recorded to provide proof of transfer when necessary. One of the most common money transfer methods is Electronic Funds Transfer (EFT). This process is time limited at the bank but is available 24 hours a day, 7 days a week on the Online Financial Connections Innovation Portal. Usually, funds are transferred securely via NEFT in around 30 minutes. However, the duration may exceed 2-3 hours. Password protected banks reduce the possibility of online fraud. Banks provide complete protection and security for online transactions. This is beneficial for customer's trust in online business. Keep track of mortgage payments, loans, savings and other automatic payments. Customers don't have to worry about online

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fraud; the website provides security against cybercrime(Mutegi, 2017).

Cheque truncation is the process of converting physical cheques coming from real or legal persons of the bank into electronic form, sending the image to the bank for processing and finalizing the payment to the bank. The current practice of using the wire service to ACH transfer cheques from all bank accounts nationwide has been discontinued. Instead, banks use communication links between their branches to send identification information for payment purposes. The process benefits banks and the public in the following ways: streamlining and improving the process of collecting payments, reducing collection days, reducing transaction-related costs, controlling the body, shortening the cycle, facilitating access to income, payments and disbursements for beneficiaries. Performance of companies. The clearing system, which reduces the risks associated with manual and long-term cheques and quickly detects fraud, will netting in a clear area across the country for three days when released, which should be gradually reduced to one elimination day. The new order will apply to Kenyan shilling cheques and cheques drawn on Kenyan banks in local and foreign currencies, including British pounds, US dollars and euros.(Central Bank of Kenya, 2010).

Plastic cards innovation is an inevitable alternative for cheques and cash, the first ever form of plastic money was the debit card, which are similar in appearance to credit cards, they enabled users to make purchases through the transfer of funds from their personal accounts to the merchants account. Debt mainly focused on traditional form of loans which are not like credit card loans. Where traditional debts are based on predetermined loan amounts and set repayments plan, credit card debts are at the user's discretion upon issuing of a credit card. Credit card debt repayment is flexible, with installments fixed on the total debt(Lie, 2010). Credit card debt is not offered on collateral which is a risk on the issuer. The introduction of plastic cards in Kenya has led to the emergence of new products; Visa Payments is an easy, affordable and secure way to carry out domestic and international transactions using Visa cards. Equity Bank is the first bank in Africa to accept Visa payments. Users can make person-to-person Visa payments, send or transfer money to friends or family. Recipients only need to provide the recipient's 16-digit Visa card number and the transaction is sent securely to eligible Visa cardholders on the Visa network. The use of plastic cards has increased immensely over the years in Kenya with gradual transition to plastic card based payments however, purchases are low, even among the plastic card holders and are mostly not linked to low value transactions, and the average transaction is recorded between Kenya shillings three thousand to four thousand, where the largest value reported is over a million shillings(Akin, 2010).A large number of plastic cards remain dormant even after issuance. On the contrary, the introduction and use of electronic devices can bring negative benefits to consumers in many aspects such as cost reduction, convenience, security and reliability. Considering that electronic payments account for only one-third to one-half of paper payments, it is clear that payment costs can be reduced if implemented.

II. SIGNIFICANCE OF THE STUDY

It is expected that the study's findings will significantly impact Kenya's commercial banks' credit risk. where information on the degree of compatibility between innovation and credit risk detection, measurement, monitoring, and control is anticipated to be provided by the findings. This study will be significant to add value to financial innovation on credit risk of commercial banks as a whole, while being informed on the challenges of implementing innovation to any organization and the benefits.This study hopes to add value to governments in policy generation and implementation, where litigation is highly influenced with the available data that aids in the decision making of the best way to achieve a set goal and policies that guide all the organization in that sector to adhere to the principles ensuring a free and fair participation in that industry that is beneficial to its performance and the country as a whole. This study aims to be of benefit to the already existing empirical literature, where other interested researchers will note the gaps in the research and conduct further studies on the matter creating room for more studies on the topic.

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III. CONCEPTUAL FRAMEWORK

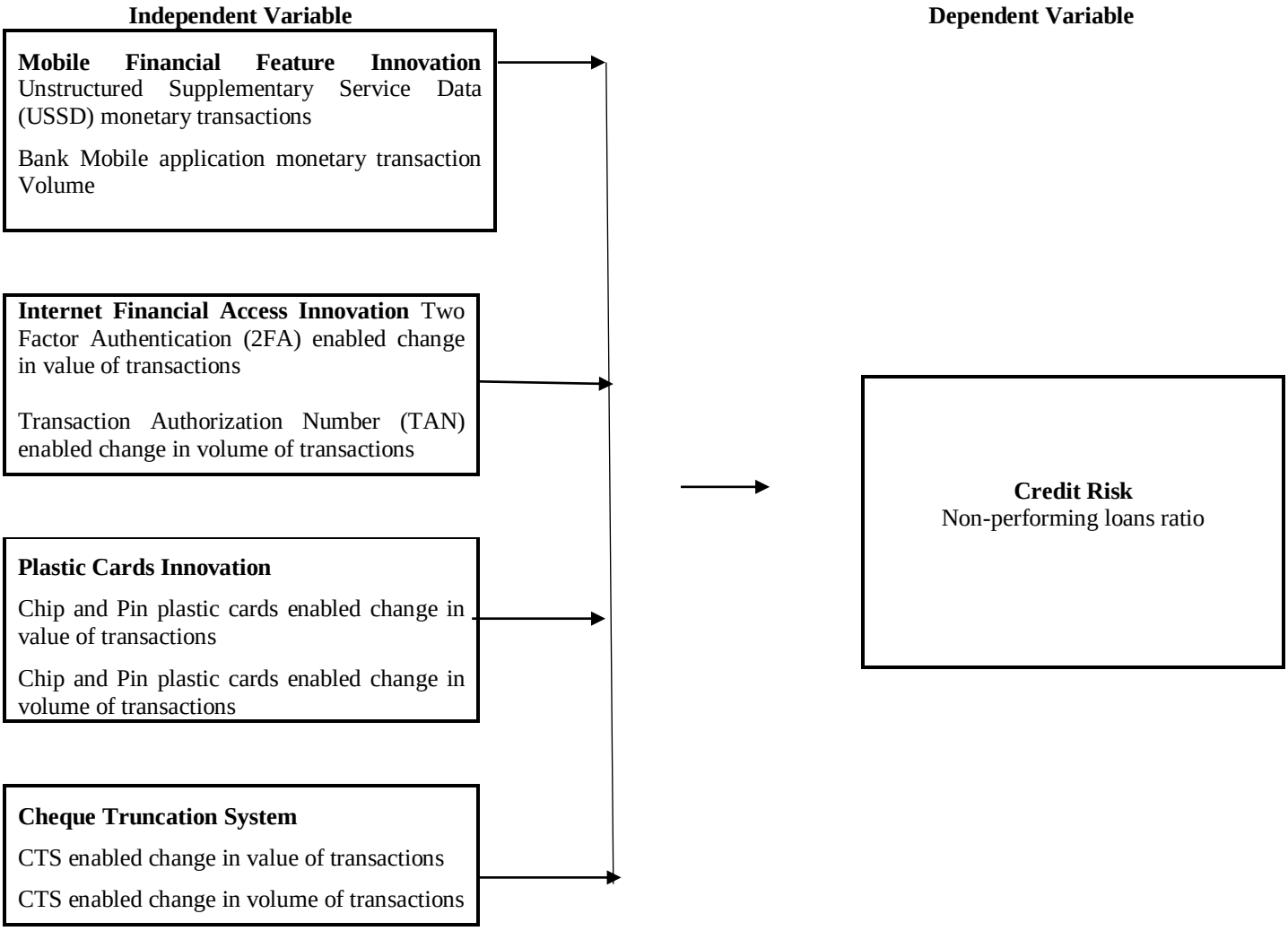

Fig. 1: Conceptual Framework

IV. LITERATURE REVIEW

(Timona, 2014)Did a study on credit card usage in the banking industry Kenya he looked forward to look at the affiliations between credit card possession and utilization and statistic characteristics of cardholders within the setting of Kenya. Centered on Kenyan Commercial Banks, guided by the targets: to set up the degree credit card usage, to decide challenges of utilizing credit cards; to set up the benefits of utilizing the credit card and to analyze the variables driving the utilization of the credit card and concluded that pay levels, business status and credit card charges do directly affect the relationship between comfort of exchange, financing office, statistic characteristics and credit card utilization.

(Githakwa, 2011) Carried out a study on financial innovation and its importance. This leads to a competitive advantage, predominant and made strides in financial performance. Monetary development and budgetary execution of companies, as uncovered in numerous studies have a noteworthy positive relationship. Advancement is experienced within the handle and it is a great thing for the banks. Expansion to this the cheque truncation framework is useful in terms of sparing costs and time for banks since there's no physical transportation of cheques. For standardization purposes the banks symbol, quality of paper, void pantograph and watermarks among others are the benchmarks that have been endorsed over the nation.

V. METHODOLOGY

The data collection method used for the study is through secondary data. This research aim is to use data available from the yearly financial reports which was used to provide a view of the change in time from the year 2013 to 2022.Statistical tests depend on specific assumptions of the available variables in consideration if the presumptions are not catered for, an unworthy outcome may arise, resulting in a Type I or Type II error of effects. As per (Fox, 2015) notes, realizing the cause when presumptions guide to biases of small outcome, are necessary for data analysis. Creating a scenario where we have information, but we cannot rely on the outcome, as there is no indication if the assumptions were observed. Whilewe are keen on the assumptions of multiple -regression, reliability of measurement, homoscedasticity, normality, granger causality, cointegration, multicollinearity, auto correlationand unit root test.

$$\Delta NPLr_t = a_0 + \sum_{i=1}^{n} \alpha_{1i}\Delta NPLr_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\Delta M_{t-i} + \sum_{i=0}^{n} \alpha_{3i}\Delta I_{t-i} + \sum_{i=0}^{n} \alpha_{4i}\Delta P_{t-i} + \sum_{i=0}^{n} \alpha_{5i}\Delta CTS_{t-i} + \alpha_6\Delta NPLr_{t-i} + \alpha_7\Delta M_{t-i} + \alpha_8\Delta I_{t-i} + \alpha_9\Delta P_{t-i} + \alpha_{10}\Delta CTS_{t-i} + \mu_{1t}$$

VI. DIAGNOSTIC TESTS

Diagnostic test done to ensure that the observable data did not violate specific assumptions of the available variables in consideration, if the presumptions are not catered for, an unworthy outcome may arise, realizing the cause when presumptions guide to biases of outcome are necessary.

Table 1: Jarque-BeraTest

Series: Residuals	
Sample 2013M01 2022M12	
Observations 120	
Mean	0.00015
Median	0.01011
Maximum	0.04938
Minimum	-0.06386
Std. Dev.	**0.03691**
Skewness	**-0.40426**
Kurtosis	**1.58967**
Jarque-Bera	**13.21380**
Probability	**0.00135**

Table 2: Linearity Test

Dependent Variable: NPLR
Method: Least Squares
Sample: 2013M01 2022M12
Included observations: 120

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Constant	0.083611	0.139401	0.599787	**0.5498**
Cheque Truncation System	0.221811	1.252188	0.177139	**0.8597**
Internet Financial Access Innovation	-0.178933	1.249492	-0.143204	**0.8864**
Plastic Cards Innovation	-0.043530	0.276376	-0.157501	**0.8751**
Mobile Financial Feature Innovation	0.186571	0.962741	0.193791	**0.8467**

R-squared	**0.000924**
Adjusted R-squared	**-0.033827**
Probability (F-statistic)	**0.998614**

Table 3: Breusch-Pagan-Godfrey test

Heteroscedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoscedasticity			
F-statistic	**0.1341**	**Prob. F(4,155)**	**0.9695**
Observation*R-squared	**0.5572**	**Prob. Chi-Square(4)**	**0.9677**
Scaled explained SS	**0.1509**	**Prob. Chi-Square(4)**	**0.9973**

Table 4: Variance Inflation Factor Test

Variance Inflation Factor		
Variable	**Coefficient Variance**	**VIF**
Internet Financial Access Innovation	1.561231	**1.187897**
Cheque Truncation System	1.567975	**1.109897**
Mobile Financial Feature Innovation	0.926807	**1.092252**
Plastic Cards Innovation	1.567975	**1.032293**

Table 5: Johansen Cointegration Test (Trace test)

Series: NPLR CHQ EFT PC MM				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.330513	128.5796	69.81889	**0.0000**
At most 1 *	0.246494	82.43651	47.85613	**0.0000**
At most 2 *	0.207584	49.88936	29.79707	**0.0001**
At most 3 *	0.156511	23.13239	15.49471	**0.0029**
At most 4	0.030469	3.55847	3.841465	**0.0592**
Trace test indicates 4 cointegrating equation(s) at the 0.05 level				
*** denotes rejection of the hypothesis at the 0.05 level**				

Table 6: Johansen Cointegration Test (Max-eigenvalue test)

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		**Max-Eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.330513	46.14309	33.87687	**0.0011**
At most 1 *	0.246494	32.54714	27.58434	**0.0106**
At most 2 *	0.207584	26.75697	21.13162	**0.0072**
At most 3 *	0.156511	19.57392	14.26460	**0.0066**
At most 4	0.030469	3.55847	3.841465	**0.0592**
Max-eigenvalue test indicates 4 cointegrating equation(s) at the 0.05 level				
*** denotes rejection of the hypothesis at the 0.05 level**				

Table 7: Granger Causality Test

Granger Causality test			
Null Hypothesis		**Null Hypothesis**	
IFAI does not Granger cause NPLR	**0.4003**	NPLR does not Granger cause IFAI	**0.4557**
CTS does not Granger cause NPLR	**0.0318**	NPLR does not Granger cause CTS	**0.9675**
MFFI does not Granger cause NPLR	**0.6100**	NPLR does not Granger cause MFFI	**0.6999**
PC does not Granger cause NPLR	**0.5794**	NPLR does not Granger cause PC	**0.4294**

Table 8: Durbin-Watson Test

The Durbin-Watson Test		
Model	D W	**Conclusion**
Financial Innovation on Credit Risk	**0.0118**	**Autocorrelation**

Table 9: Augmented Dickey Fuller Test

Unit root tests	**Level**			**1st difference**		
Variable	**C**	**C&T**		**C**	**C&T**	
Credit Risk	0.4707	0.9473	**Non-Stationary**	0.0000	0.0000	**Stationary**
Internet Financial Access	0.0000	0.0000	**Stationary**	0.0000	0.0000	**Stationary**
Cheque Truncation	0.0027	0.0168	**Stationary**	0.0003	0.0023	**Stationary**
Mobile Financial Feature	0.0000	0.0002	**Stationary**	0.0002	0.0016	**Stationary**
Plastic Cards Innovation	0.0000	0.0000	**Stationary**	0.0000	0.0000	**Stationary**

Table 1: Auto Regressive Distributed Lag

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Credit Risk (-1)	0.71365	0.09323	7.65447	0.00000
Credit Risk (-2)	**0.27263**	0.09275	2.93954	**0.00400**
Mobile Financial Feature	**0.01159**	0.08571	0.13520	**0.89270**
Internet Financial Access	**0.02830**	0.11271	0.25106	**0.80230**
Plastic Cards Innovation	**0.04167**	0.02492	1.67176	**0.09750**
Cheque Truncation System	-0.16893	0.12281	-1.37553	0.17190
Cheque Truncation System (-1)	0.06360	0.12366	0.51430	0.60810
Cheque Truncation System (-2)	0.28068	0.12219	2.29716	0.02360
Cheque Truncation System (-3)	0.11851	0.12168	0.97396	0.33230
Cheque Truncation System (-4)	**0.34509**	0.12278	2.81072	**0.00590**
Constant	-0.05756	0.02104	-2.73537	0.00730
R-squared	**0.992440**			
Adjusted R-squared	**0.991720**			
Probability (F-statistic)	**0.000000**			

Table 11: Long Run ARDL results

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Mobile Financial Feature	0.84412	6.24685	0.13513	**0.8928**
Internet Financial Access	2.06125	8.32080	0.24772	**0.8048**
Plastic Cards	3.03510	2.56179	1.18476	**0.2388**
Cheque Truncation System	46.54493	34.81095	1.33708	**0.1841**
Constant	-4.19307	3.07037	-1.36566	**0.1750**
EC = NPLR - (0.8441*M + 2.0612*IF + 3.0351*PC + 46.5449*CTS - 4.1931)				

Table 12: F-Bound Test

F-Bounds Test		**Null Hypothesis:**	**No levels relationship**	
Test Statistic	**Value**	**Significance**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	**3.863366**	10%	2.2	**3.09**
k	4	5%	2.56	**3.49**
		2.50%	2.88	**3.87**
		1%	3.29	**4.37**

Table 13: Error Correction Regression

ARDL Error Correction Regression				
Dependent Variable: D(NPLR)				
Selected Model: ARDL(2, 0, 0, 0, 4)				
Case 2: Restricted Constant and No Trend				
Sample: 2013M01 2022M12				
Included observations: 116				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob**
D(NPLR(-1))	-0.272626	0.088027	-3.097074	0.0025
D(CTS)	-0.168926	0.108956	-1.550409	0.1241
D(CTS(-1))	-0.744281	0.140296	-5.305068	0.0000
D(CTS(-2))	-0.463604	0.124459	-3.724958	0.0003
D(CTS(-3))	-0.345094	0.111642	-3.091078	0.0026
CointEq(-1)*	**-0.013728**	**0.002786**	**-4.927881**	**0.0000**

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VII. RESULTS

This section presents the summary of findings, the general objective being to determine the effect of financial innovation on credit risk of commercial banks in Kenya. Guided through four main independent variables; mobile financial feature innovation, internet financial access innovation, plastic cards innovation and cheque truncation system, where also four hypotheses were also formulated from the specific objectives and tested in their null form. The use of census survey was key as the population of the study was small and having the access to secondary data readily availed by the Central Bank of Kenya on their monthly economic indicator reports.

This study adopted an experimental research design which is interested in determining the influence the independent have on the dependent variable. Descriptive statistics such as the mean, standard deviation and skewness were used to summarize and display the data collected. The model specification was tested through diagnostic tests; normality, linearity, autocorrelation, cointegration, multicollinearity, homoscedasticity, granger casualty and unit root test.

VIII. CONCLUSIONS

The main objective of the study was to determine the effect of financial innovation on credit risk of commercial banks in Kenya. Examined through four main independent variables; mobile financial feature innovation (MF), internet financial access innovation (IF), plastic cards innovation (PC) and cheque truncation system (CTS) some conclusions were realized.

Based on the first objective that aimed to establish the effect of mobile financial feature innovation on credit risk, the results clearly indicate that mobile financial feature innovation had a positive statistical significance. On the basis of the second objective that sought to explore the effect of internet financial access innovation on credit risk the results clearly indicate that internet financial access innovation had a positive statistical significance on credit risk of commercial banks in Kenya. Regarding the third objective of the study that sought to evaluate the effect of plastic cards innovation on credit risk indicate that plastic cards innovation had a positive statistical significance on credit risk. Concerning the fourth objective of the study aimed at determining the effect of cheque truncation system on credit risk the results clearly show that cheque truncation system had a positive statistical significance.Future research on the same area of study should consider other forms of risks that hinder the operations of other businesses not limited to commercial banks as the effect may be different. Similar studies should also focus on other forms of performance rather than solely on financial performance. There is need for an extensive further studies to determine the extent to which the effect of innovation has from the period before the introduction of the innovation to present implantation.

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