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The impact of digital banking on the profitability of deposit money banks: Evidence from Ghana

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Abstract

Digital banking refers to the act of performing banking and financial transaction without the use of physical cash, coins or bills. The fundamental objective of the study was to find out the impact of digital banking on the profitability of deposit money banks in Ghana. Secondary data spanning from 2012 to 2018 were collected from the annual payment system reports of the central bank of Ghana. Cheque codeline clearing, Ghana automated clearing house, Ghana interbank settlements, Gh-Link, and mobile money payments in value were the independent variables. Return on assets (ROA) was the dependent variable employed in the study. Partial least square (PLS) regression was the statistical tool used for the analysis with the aid of Origin2018 scientific software.

The results of the study indicated that Gh-Link and E-zwich distinguished themselves from the rest of the variables by explained 95.87% of the variations in the profitability of Ghanaian banks. It was further found that a positive relationship existed between cheque codeline clearing; Ghana automated clearing house, Ghana interbank settlement, GH-Link, and the profitability of Ghanaian Banks. Mobile money and E-zwich, on the other hand, had a negative relationship with the profitability of the banks. It was therefore recommended that the banks should make more efforts in the form of education and marketing to win more customers to patronise the digital banking products for profit maximization. The implication of this study is that policymakers henceforth will have a fair idea when formulating policies concerning Fintech in the future.

Keywords: Digital, Cashless, electronic, bank, Ghana, profitability, Fintech

1. Introduction

Digital or cashless banking refers to the act of performing banking and financial transaction without the use of cash, coin or bills (Kamboh and Leghari 2016) ^[14]. The name, digital banking, cashless banking, electronic banking, internet banking, online banking, virtual banking, web-based banking, remote electronic banking, phone banking etcetera are all terms used interchangeably to refer to electronic banking (Pery-Quatey, 2018) ^[18]. According to Addae-Korankye (2014) ^[7], the Ghanaian banking industry has been undergoing a rapid change in its service delivery due to the advancement of technology and customer demands. Over the past two decades, the banking sector in Ghana has embraced and introduced various channels of electronic banking with the primary objective of enhancing efficiency, convenience and financial inclusiveness. That was envisaged by Hammer and Champy (2001) ^[12], who indicated that the advent of electronic business was going to disrupt the way and manner businesses operate. It was buttressed by De Young (2001) ^[10] who argued that the internet was going to truncate how banks services and products are developed and delivered. Among the e-banking products adopted by Ghanaian banks include cheque codeline clearing (the automation of the cheques clearing system), point of sale devices (POS), Automated teller machine (ATM), Mobile banking, web-based banking, Debit and Credit cards, and many more. The most recent boost in the digital banking space was the introduction of bank and mobile interoperability, which allows money transfer from one mobile operator to another and also from mobile wallet to bank account and vice versa. Before the emergence of information technology, the cash-based transaction was the only channel of conducting banking transactions which were characterised with risk, inefficiency and inconvenience to both the payee and the payer. Both practitioners and researchers have lauded the inception of the cashless banking system and researchers as the antidote to problems of the traditional cash-based banking (Apau *et al.*, 2019) ^[1]. Profit maximization is the ultimate focus of every business establishment, including banks.

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Management of these deposit money banks has no other option than to find efficient channels of products and services delivery in order to be able to maximize their shareholders' wealth. That is where digital banking comes to play a vital role to aid in the achievement of this primary goal. Technology-based products have proven to enhance efficiency, lower cost of operation and increase the profitability of banks (Akhisar *et al.*, 2015)^[6].

1.1. Statement of Problem

There has been an upsurge use of technology for service delivery in the Ghanaian banking space for the past two decades. However, the impact of digital banking on the profitability of these deposit money banks is yet to be established. The question experts and stakeholders always pose, therefore is whether the cost and challenges involved in the implementation of information technology infrastructure are worth the investment. The current study, therefore, is to understand the relationship between the electronic banking payment systems and profitability of deposit money banks in Ghana. The outcome of the study will help stakeholders thus the regulator and the shareholders to take investment decisions on the expansion of information technology infrastructure as the results will point out to them as to whether it is worthy of committing more funds

1.2. Objectives of the Study

The broad objective of the study is to establish the relationship between digital banking and profitability. Specifically, the study seeks:

1. To identify the most patronized electronic banking systems in Ghana
2. To find out the impact electronic banking has on the profitability of deposit money banks
3. To find out the most important variables that affect ROA.

1.3. Literature Review

Empirical evidence found by Omotunde *et al.* (2013)^[19] indicated that the introduction of cashless policy in an economy creates employment, reduce the risk of carrying cash around, reduce corruption and attracts foreign investors. In line with this, Danaa *et al.* (2016)^[2] argue that the deployment of ICT capital by Ghanaian banks has accelerated growth, reduced operational cost, helped in the introduction of variety of bank services, able to coordinate branch activities and can match up with the changes in regulations and policies of the government, which aid in improved profitability. Addae-Korankye (2014)^[7] also found a positive effect of electronic banking on customer service and profitability of Ghanaian banks. Appiahene *et al.* (2019)^[5], in their quest, to ascertain the impact of information technology on the performance of Ghanaian banks using DEA method, found a significant impact of IT on bank performance. Although the introduction of technology and communication infrastructure is capital intensive digital banking has a strong impact on the profitability of deposit money banks in Nigeria (Chukukaelo *et al.*, 2018)^[8]. Simiyu (2018)^[9] noted that electronic banking plays a significant role in the financial performance of commercial banks in Kenya. Electronic banking has been

found to increase profitability, improve bank management quality, increase bank assets, and promotes growth and expansion. Wadhwa (2016)^[20] in trying to assess the impact of mobile banking on the performance of Indian banks indicated that although mobile banking services has not had any significant impact on profitability if the banks correctly follow the path of mobile banking the overall profitability will increase in the long run. Enoruwa *et al.* (2019)^[16] found ATM, POS, Mobile pay and WEBpay all exhibiting a strong relationship with Nigerian bank performance.

Mawutor (2014)^[15] also examined the impact of E-banking on profitability in Ghana by using 150 respondents from the agricultural development bank. The study indicated that electronic banking has a substantial impact on the agricultural development bank's performance and its customer relationship. The researcher however identified network failure, which leads to the breakdown of ATMs and other online payment systems to be the major challenge facing customers using electronic banking product in agricultural development bank. The study further indicated that customers use E-banking products such as ATM more than internet banking due to its time saving, easy access to cash and convenience in the usage of the products. Moreover, the customers believe ATM is safer and much more secure than internet banking. Itah and Ene (2014) in their study to find out the impact of cashless banking on Nigerian banks' profitability indicated that ATM and POS payment systems positively related to profitability whereas WBT (web-based transaction) negatively related to ROE, a finding they attributed to high charges on these services.

Another concern of many people that makes them hesitant to patronize electronic banking is the fear of fraudsters. Muoghalu *et al.* (2018)^[4] decided to investigate the effect electronic banking-related fraud has on Nigerian banks performance. Their study showed that fraud on POS, Mobile Banking, ATMs and Web does not affect banks performance negatively. The researchers recommended transaction authentication by sending OTP to the linked phone numbers for the confirmation by the account holders. Magboul and Abbad (2018)^[13] investigated the antecedents that affect the adoption of electronic banking and how electronic banking adoption affects bank performance in Sudan. Their findings indicated that management support, perceived usefulness, perceived ease of use and training play significant roles in the adoption of electronic banking. They concluded that the adoption of electronic banking affects bank performance positively.

1.4. Research Gap

Most of the available literature focused on specific banking institutions while some too dwelled on selected banks. This study, however, used the census approach by analysing data on all licensed deposit money banks in order to fully understand the impact digital banking has on the profitability of banks in Ghana. Moreover, all the literature reviewed used only the predictive approach in studying the relationship between digital banking and bank performance but this study will use PLS regression, which combines both explanatory and predictive approaches.

2. Methodology

The data for the study was mainly secondary sourced from

the annual payment system reports of the central bank of Ghana. The data was collected on all the deposit money banks operating in Ghana during the study period. The independent variables employed in the study include the major bank based payment systems namely, Cheque Codeline Clearing (CCC), Ghana Automated Clearing House (GACH), Ghana Interbank Settlement, (GIS), GH-Link (national switch), E-zwich, and Mobile money. The dependent Variable is profitability measured by ROA. Data on annual payments in terms of value from 2012 to 2018 was compiled for analysis using Partial Least Square (PLS) regression with the aid of Origin2018 statistical software.

2.1 Model Specification

PLS regression is a technique used to reduce the predictors to a small set of uncorrelated components and performs least squares regression on these components rather than on the original data. The general underlying model of multivariate partial least square is given by:

$$X = TP^T + E$$

$$Y = UQ^T + F$$

Where:

X = an $n \times m$ matrix of predictors

Y = an $n \times p$ matrix of response

T and U are $n \times l$ matrices that are projections of X and projections Y respectively

P and Q = $m \times l$ and $p \times l$ orthogonal loading matrices, respectively.

E and F = the error terms assumed to be independent and identically distributed normal random variables.

The decompositions of X and Y are done in order to maximize the covariance between T and U

The multivariate regression formula below is therefore used in prediction of the dependent variable.

$$\hat{Y} = TBC^T = XB_{PLS}$$

Where $B_{PLS} = (P^T)^+ B C^T$ where P^{T+} is the Moore-pseudo-inverse of P^T

3. Results and Discussion

3.1 Data presentation

Table1 below indicates the data collected from the bank of Ghana annual reports. The data comprise of annual value (in Ghana Cedis) of electronic transactions executed through the Cheque Codeline Clearing (CCC), Ghana Automated Clearing House (GACH-Direct Credit), Mobile Money, Ghana Interbank Settlement (RTGS), GH- Link, E-zwich, and Return on Assets of the deposit money banks from 2012 to 2018. Since the relationship between explanatory variables and the response variable often have a natural logarithm relationship, the data was transformed by finding the natural logarithm of both the regressors and regressand in order to achieve much more predictive target.

Table 1: Cashless payments during the study period in Ghana Cedis

Year	Cheque Codeline Clearing	Ghana Automated Clearing House Direct Credit	Mobile money	Ghana Inter-bank Settlement (RTGS)	GH-Link	E-zwich	ROA
2012	69,222,100,000	3,690,000,000	594,120,000	331,320,900,000	1,100,000	217,800,000	4.8
2013	81,144,300,000	6,332,700,000	2,652,470,000	470,375,100,000	67,500,000	217,200,000	6.2
2014	113,698,400,000	10,815,200,000	12,123,890,000	758,312,160,000	183,320,000	272,670,000	6.5
2015	131,189,700,000	15,075,070,000	35,444,380,000	1,032,544,000,000	305,140,000	922,900,000	4.5
2016	152,390,420,000	19,245,650,000	78,508,900,000	1,670,369,460,000	447,040,000	2,362,960,000	3.8
2017	179,555,470,000	24,327,260,000	155,844,840,000	2,083,846,270,000	603,430,000	3,431,490,000	3.6
2018	203,465,320,000	30,226,940,000	223,207,230,000	1,963,465,270,000	543,740,000	5,651,140,000	3.4

Source: Bank of Ghana annual payment systems report

3.2 Normality Test

For any data set to be parametric, certain assumptions have to be met and one of such is the assumption of normality. That is to test and see whether the data set is normally distributed. One such a test is Shapiro-Wilk's test. According to Yap and Sim (2011) [21], the Shapiro-Wilk test of normality has proven to be the most powerful for both symmetrical and asymmetrical distributions. The Shapiro-Wilk test of normality was, therefore

performed to ascertain the normality of the data, as shown in Table 2 below. If the $p > .05$, it indicates that the distribution of the data is not significantly different from a normal distribution, however, if the test indicates a $p < .05$ then the distribution of the data is significantly different from the normal distribution. The p-values as can be observed in table 2 are all greater than .05, indicating that the data is normally distributed. Moreover, the histogram plot in fig. 1 indicates clearly that the data set is normally distributed.

Table 2: Shapiro-Wilk Test of Normality

Variables	DF	Statistic	p-value	Decision at level (5%)
CCC	7	0.96605	0.86862	Cannot reject normality
GACH -Direct Credit	7	0.96923	0.89285	Cannot reject normality
Mobile money	7	0.84514	0.11089	Cannot reject normality
Ghana Inter-bank Settlement (RTGS)	7	0.90474	0.36063	Cannot reject normality
GH-Link	7	0.9403	0.64143	Cannot reject normality
E-zwich	7	0.83693	0.093	Cannot reject normality
ROA	7	0.88641	0.25647	Cannot reject normality
Cheque Codeline Clearing (CCC): At the 0.05 level, the data was significantly drawn from a normally distributed population.				
Ghana Automated Clearing House (GACH Direct Credit): At the 0.05 level, the data was significantly drawn from a normally distributed population.				
Mobile money: At the 0.05 level, the data was significantly drawn from a normally distributed population.				
Ghana Inter-bank Settlement (RTGS): At the 0.05 level, the data was significantly drawn from a normally distributed population.				
GH-Link: At the 0.05 level, the data was significantly drawn from a normally distributed population.				
E-zwich: At the 0.05 level, the data was significantly drawn from a normally distributed population.				
ROA: At the 0.05 level, the data was significantly drawn from a normally distributed population.				

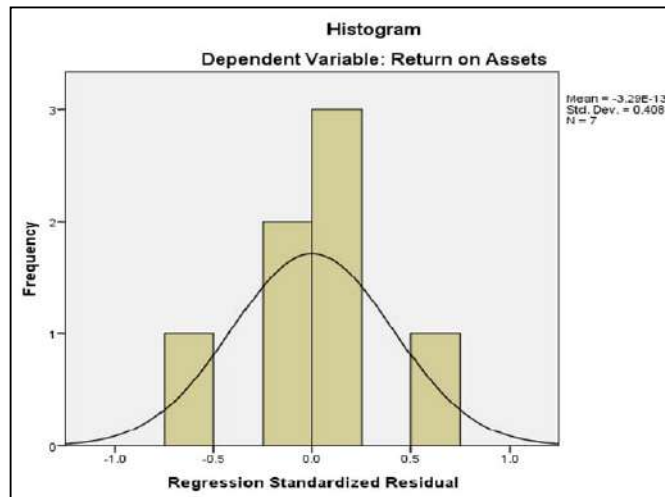


Fig 1: Normality Plot

3.3 Multicollinearity

Multicollinearity is a situation whereby the explanatory variables are nearly linear dependent. Usually, researchers prefer correlation among all variables not exceeding 0.8. For instance, Gujarati (2004) [11] indicated that multicollinearity only becomes an issue when the correlation coefficient between any two regressors of pairwise correlation is higher than 0.9. Table 3 below is the correlation matrix for the model, and as can be seen, all the independent variables are

highly correlated. The collinearity statistics in table 3 shows that the tolerance values are all less than 1, whereas the variance inflation factor (VIF) are all way higher than 10; hence the confirmation of the presence of multicollinearity. The presence of multicollinearity means that we cannot apply ordinary least square (OLS) regression. We therefore applied partial least square (PLS) regression model in our analysis.

Table 3: Correlation Matrix

		Return on Assets	Cheque Codeline Clearing	Ghana Automated Clearing House direct credit	Mobile money	Ghana Interbank Settlement (RTGHS)	GH-Link	E-Zwich
Pearson Correlation	ROA	1.000						
	CCC	-.750	1.000					
	GACH-direct credit	-.708	.994	1.000				
	Mobile money	-.718	.993	.999	1.000			
	GIS (RTGHS)	-.768	.986	.985	.991	1.000		
	GH-Link	-.392	.862	.909	.907	.869	1.000	
	E-Zwich	-.918	.943	.924	.928	.949	.707	1.000

Table 4: Collinearity diagnostic

Collinearity Statistics	
Tolerance	VIF
.004	274.940
.001	939.229
.010	100.888
.017	59.020
.028	35.246

3.4 Partial Least Square Regression Results

Even though some researchers (e.g. Chikwemma and Nwadiolor, 2019) [17] still ignore the violation of the multicollinearity assumption to run ordinary least square regression, the Partial Least Square (PLS) regression is appropriate in a situation where there is the presence of multicollinearity among the predictor variables, and there are relatively few samples. Table 5 below is the cross-validation summary, which depicts the number of factors to extract. The root mean PRESS indicates the predicted residual sum of square of the model where the model with the minimum root mean PRESS has the optimal number of

factors. In this case, the optimal number of factors to extract is 6. The variable importance plot (VIP) as indicate in fig,2 is a measure of the importance of the variables in the modelling of X and Y. According to Eriksson *et al.* (2006), a VIP value of 0.8 is regarded as small, which must serve as a cut-off point. From the VIP plot only two variables; GH-Link, and E-zwich are above the cut-off point of 0.8, which is an indication that much attention should be paid to these two variables and exclude the rest in the model.

Table 5: Cross Validation Summary

Factors	Root Mean PRESS
0	0.2994
1	0.3151
2	0.0871
3	0.3115
4	0.5499
5	0.0714
6	0.0714
Minimum root mean PRESS: 0.07144	
Optimal number of factors: 6.	

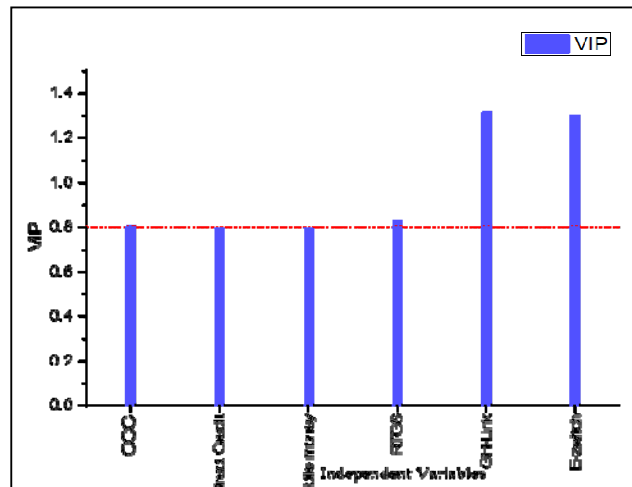


Fig 2: Variable importance plot (VIP)

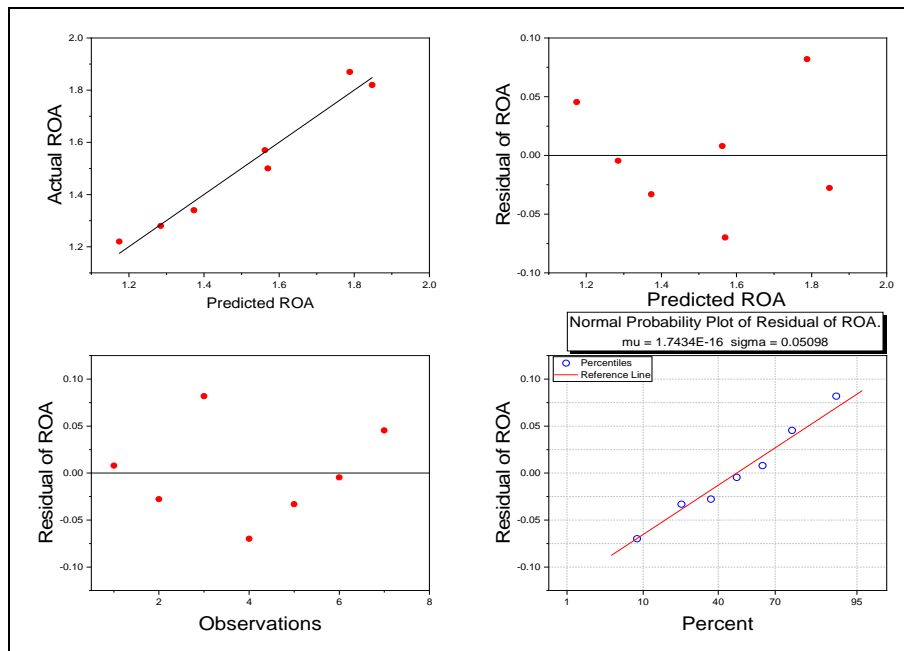


Fig 3: below is the model diagnostic plot, which is used to examine the quality of the model. The predicted against actual values graph indicates a very fit model for the first component, whereas the residual graph shows no drift from the process since the residuals are randomly distributed around zero. The P-P plot shows a very fitted regression line, thereby affirming the normality of the data

3.4.1 Variance Explained

The table 6 below is the variance explained indicating the proportion of variance explained by each factor. It could be observed that factor 1 explains 91.59% for the X effect and 50.71% for the Y effect. Factor 2, on the other hand, explains 8.09% for the X effect and 45.16% for the Y effect.

Factor 3 also explains 0.27% variations in X effect and 2.01% in Y effect. These three factors cumulatively, explain 99.94% and 97.88% for the X and Y effects respectively. Fig.4 below indicates that more attention should be given to the first two factors as these factors explain more than 95% variations in both X and Y effects.

Table 6: Variance Explained

Number of Factors	Variance Explained for X Effects (%)	Cumulative X Variance (%)	Variance Explained for Y Responses (%)	Cumulative Y Variance (%)
1	91.58612	91.58612	50.71093	50.71093
2	8.08579	99.67191	45.15841	95.86935
3	0.26736	99.93927	2.01459	97.88393
4	0.04735	99.98662	0.71962	98.60355
5	0.0133	99.99992	1.38284	99.98639
6	8.14E-05	100	0.01361	100

*Method: SVD *Standardize: No

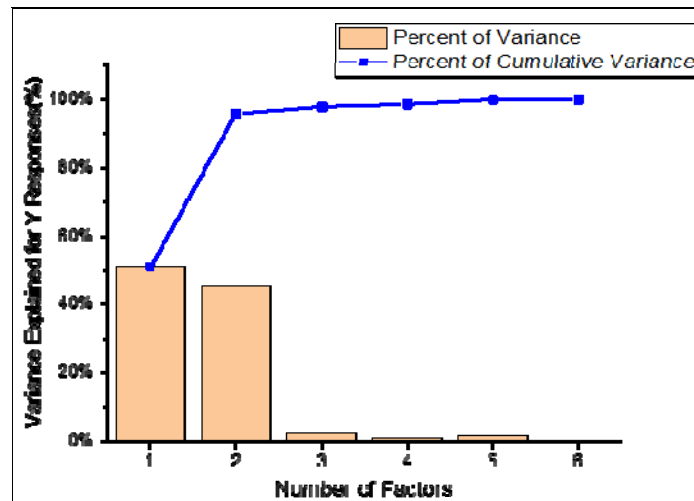


Fig 4: Variance explained plot

3.4.2 The Regression equation

The estimated PLS regression equation deduced from table 7 will be as follows:

$$ROA = -36.44 \text{ CCC} + 1.38 \text{ GACH} - 0.74 \text{ Mobile money} + 0.48 \text{ RTGS} + 0.87 \text{ GH_Link} - 0.26 \text{ E_Zwitch}$$

Table 7: Predicted PLS regression results

Observations	ROA	Independent Variables	ROA
	Predicted Responses for Test Data		Coefficients for Original Data
1	1.57	Intercept	-36.4381
2	1.82	CCC	0.54831
3	1.87	GACH	1.37679
4	1.5	Mobile money	-0.73685
5	1.34	RTGS	0.47833
6	1.28	GH-Link	0.08657
7	1.22	E-zwich	-0.26138

Table 7 above shows the coefficients of the independent variables. The results indicate that when all the variables are held to constant zero the profitability of deposit money banks in Ghana will be reduced by -36.44 units. If all the other independent variables are held constant, a unit increment in E-zwich payments will reduce ROA by -0.26138 (-26.14%). It could also be seen that a unit change in payment through cheque codeline clearing (CCC) will increase the profitability of Ghanaian deposit money banks by (0.5483) 54.83%. A percentage increase in the volume of payment via GIS (Real-time gross settlement) will cause a 47.83% (0.4783) increase in profitability of the deposit money banks. Mobile money payments also negatively affect ROA of Ghanaian banks by a magnitude of -0.7369 (-0.73.69%), whereas GH-link positively affects ROA by 0.0866 (8.66%). Ghana automated clearing house (GACH) on the other hand, positively affects profitability by 1.3768 (137.68%).

4. Conclusion and recommendations

4.1 Conclusion

The study was embarked on with the primary objective of ascertaining the impact of digital banking on the profitability of Ghanaian deposit money banks. The initial intention of the research was to utilize ordinary least square multiple regression to understand the relationship between the digital banking products and the return on assets of these

banks. However, after the preliminary test conducted on the dataset, it was realised that the independent variables were highly correlated, which was going to affect the accuracy of the prediction. Partial least square was opted for because it is a method, which is designed to deal with multiple regression when the dataset has a small sample, missing values, or multicollinearity.

The variance explained output indicated that two among the six factors cumulatively explained 99.67% variations in the X effect, whereas in the Y effect, the two factors explained 95.87%. This is an indication that only two out of the six variables significantly impact the profitability of the deposit money banks in Ghana. The predicted PLS regression results indicated that cheque codeline clearing (CCC), Ghana automated clearing house (GACH), Ghana interbank settlement (Ghana's version of real-time gross settlements), and GH-Link exhibited a positive relationship with the profitability of Ghanaian deposit money banks. Surprisingly, mobile money and E-zwich related negatively with the profitability of the banks. The negative relationship may be due to the scarcity of E-zwich machines at vantage points and the charges on mobile money transactions. The customer is charged when depositing into someone's mobile wallet and that person also gets charged again when withdrawing. This double charges discentive the customers. Management and all other stakeholders who matters in decision making will now have much understand

of the interrelationship between digital banking and profitability, which will go a long way to help them in decisions pertaining to digital banking. The findings of the study has paved way for more studies using the PLS regression method as the new dimension with regard to investigating the relationship between digital banking and profitability.

4.2 Recommendations

1. The more people patronise a particular product or service, the high the income generated through transactional charges. It is therefore recommended that the back-to-back transactional cost on mobile money should be looked into by the Bank of Ghana to lessen the burden of customers in order to attract more patronage.
2. It is further recommended that the point of sale devices (POS) which rides on the E-zwich payment platform should be deploy more in to the market in order to derive its maximum return.
3. Since one of the primary reasons why many customers do not patronise e-banking is the risk of losing their money in the process, bank management should pay particular attention in securing digital transactions in order to win customers' confidence.
4. Again, since it emerged from the variance importance plot that E-zwich and Gh-Link distinguished themselves as the most important variables bank management and the central bank should pay special attention to these variables in order to maximise profit.

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