
The effect of digital delivery channels on the financial performance of banks

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Abstract: Digitisation has penetrated every sphere of life and the adoption of digital technologies in the delivery of banking services has reached substantial heights. This study employs a multiple linear regression model to examine the influences of digital delivery channels on the profit performance and cost efficiency of banks. The study finds that most of the digital applications are introduced and used concurrently. The findings of this study show that both automated teller machines (ATM) and internet banking applications improve the income performance and the cost efficiency of banks. However, mobile banking applications have decreasing effects on banks' cost efficiency and income performance. The results suggest that while digital innovations may exert significant positive influence on bank performance, there may be cost implications for the banks. It is crucial that banks while adopting digital innovations, should also engage in a reduction of the proportion of overdue and underperforming assets.

Keywords: digital delivery channels; commercial banks; digital innovations; financial performance.

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1 Introduction

While it is largely true that the essential functions performed by banks have remained relatively unchanged over the past several decades, the way those functions are discharged, and the structure of the banking industry has seen significant changes. This 'new look' banking industry apparently eventuated from the expansion in information technology, rapid changes in financial instruments, intensified competitive international environment, and liberalised domestic regulations (Tidd and Hull, 2003).

Digitisation has penetrated every sphere of life and the banks as well are banking on the digital. Indeed, researchers (see Bátiz-Lazo and Woldeesenbet, 2006) have professed quite many reasons accounting for the increasing applications of digital innovations in the financial and banking industry. The quest for a superior performance according to Porter (2004), requires continuous innovation and a conscious effort to continuously improve not just the product but also the process. Thus, the banks' innovative eyes are continuously fixed on the digital.

Among others, digital innovation in banking connotes the conversion of analogue banking into digital banking (paperless and technology-enabled services) while providing integrated multichannel offerings that make the customer experience seamless. Noyer (2007) describes the forces spurning digital innovation in the banking industry in terms of new distribution channel systems such as internet and mobile banking. Also, Anbalagan (2011) finds rapid revolutions in computer and telecommunication technology as the driving force behind some of the banking innovations. Anbalagan (2011) explains that the creation of the automated teller machines (ATM) is more of an outcome of financial innovation rather than an output of 'asset backed securitisation'.

The banking sector in developing countries for decades-spanning 1990–2011, has been the subject of several 'regulatory and industry changes', resulting in increased competition among the banks (Anabila and Awunyo-Vitor, 2013). Okoe et al. (2013) document that since the 1990s, substantial changes have occurred in commercial banking particularly in developing economies. Rawani and Gupta (2000) indicate that innovative banking services such as ATM, electronic transfer, smart cards, internet banking which are technology-based, have now assumed regular usage among banking customers in developing countries.

In Ghana, the digitisation of banking services is largely underscored by the increased operations of the Ghana integrated payments and settlement systems (GhIPSS) and its various platforms, systems and products such as the national switch (e-Zwich) and related biometric card (e-Zwich card) and automated clearing house (ACH). The introduction of these platforms and systems has underscored the substantial applications of electronic banking and payment methods in Ghana. ATMs seem commonplace in Ghana while internet banking services have been applied in ways that enable customers to effect transactions online.

Apparently, digital products and their usage are on the rise in the financial sector and it is therefore critical to establish the effect of digital innovations on the performance, particularly the financial performance of banks. While the banks are 'banking on the digital' and investing hugely in digital products including but not limited to debit cards, ATMs, online and mobile banking, it is not certain the direction of influence of digital channels on bank performance and particularly so, banks' financial performance, which is a key indicator of the health of banks.

Arnaboldi and Claeys (2009) while taking cognizant of the fact that investment in 'clicks' instead of 'bricks' is potentially a means to reduce costs of the retail network, and offer lower fees and higher rates while improving customer convenience; contend that the prospects of online banking to outcompete established 'brick and mortar' banks are vastly overstated. Thus, while digitisation in the banking industry has potential positive effects, literature (for example, Malhotra and Singh, 2009) documents certain challenges associated with its introduction.

Lerner and Tufano (2011) posit that while existing empirical evidence can tell more about financial innovation, there are substantial unanswered questions in the areas of the impact of innovations on financial institutions. Indeed, the question has not been answered as to whether the effect of digital innovations on banks' financial performance in most developing countries is significantly positive or otherwise. Also, it has not been established whether the respective digital products (for example debit cards, mobile banking and internet banking) influence banks' financial performance differently. This current research adds to prior research by examining and documenting the influences of digital innovations on the financial performance of banks in a frontier economy and considers these results in the light of those in the advanced economies. The study examines the year 2015 and reports the results using a cross-sectional approach. The study empirically examines the influences of digital delivery channels on the cost efficiency and profit performance of banks and shows mixed influences of the digital innovation variables on the cost efficiency and profitability of banks. The rest of the paper is organised as follows: Section two presents a review of relevant literature on digital and technological innovations and the impact of such innovations on bank performance. Section three describes the data and methods employed; section four entails results presentation and discussion while section five provides some concluding remarks.

2 Related literature

The growth of the internet, phone applications and communication technology has added a different dimension to banking. Digital innovations in banking come with the conversion from analogue banking into digital banking where services are paperless, and technology-enabled, and integrated multichannel offerings are provided to make the customer experience seamless.

Theories concerning the surge in the relevance of technological innovations have typically evolved out of the Schumpeterian argument which assumes that new products and processes developed by a firm are protected from imitation for a certain period. Thus, a successful innovation generates a proprietary competitive position, if even transient, that bestows on the innovative firm a competitive advantage and superior performance (Lyons et al., 2007). But the Schumpeterian process of creative destruction is characterised by imitations of innovative technologies. This then generates the need for enterprises to produce still, more innovations to maintain a competitive advantage (Schumpeter, 1982).

In the banking industry, Lyons et al. (2007) cite ATMs (automated teller machines), telephone banking, internet banking, and e-money as among the significant innovations revolutionising the face of banking and the channels of delivering banking services. They argue that the relevant aspects of technological change include innovations that reduce costs related to the collection, storage, processing, and transmission of information, as well as innovations that transform customers' access to bank services and the banking distribution system. So, the banks have digitised; but are digital innovations impacting on bank performance?

Mansury and Love (2008) posit that digital innovations such as client relationship management systems, bank management technologies, and other technologies are among the major changes in internal banking systems that have exerted a positive influence on bank performance particularly, profitability. In Italy, Hasan et al. (2009) assess the

relative performance of banks using traditional channels vis-à-vis the performance of banks adopting multi-channels in delivering banking solutions. Their results indicate that bank performance is influenced positively by internet facilities. They measure performance in terms of ROA and return on equity (ROE). Their study provides evidence in support of DeYoung's (2005) claim that the internet is not used as a replacement for physical branches but rather as a complementary channel for delivering banking solutions. This explains why a multi-channel banking model seems to be dominant.

There are some studies within the context of emerging banking industries. Mabrouk and Mamoghli (2010) for instance, examine the influence of financial innovations (process and product innovations) on the performance of the banking industry in Tunisia. In their study of Kenya, Nyangosi and Arora (2011) focus specifically on the use of the internet and mobile banking as delivery channels and investigate the influence of information technology on the performance of Kenyan banks. The two studies reveal first and foremost that SMS banking is quite prevalent in the banking sector while the most available electronic banking tool is the ATM technology. They conclude that customers' demands are increasingly met by the adoption of varied electronic platforms in the delivery of banking solutions. Indeed, the application of information technology in the business of banking is necessary to achieve excellent goals.

Sana et al. (2011) compare the eras of traditional banking to the present e-banking eras and present evidence that e-banking has contributed positively and indeed proliferated the profits of banks. They contend that banks are gradually transitioning from manual means to electronic banking rather than jumping *en bloc* to digital banking. With the adoption of electronic and digital banking, efficiency has risen as costs have been reduced and time saved, while accuracy, reliability and quality of services have all improved.

Muhammad et al. (2013) argue that investing in ATMs increases the value of deposit accounts, which are cheaper in terms of costs of funds than other sources such as borrowing money from other institutions; and hence, reducing the overall cost of funds. This suggests that digital and technological investments play pivotal roles in the explanation of bank profitability.

The research of the impact of digitisation of banking services is not without counter evidence. Malhotra and Singh (2009) apply a multiple linear regression model in a survey of 85 commercial banks in India and find that profitability in the banking industry while offering internet banking does not have any significant association with their overall performance. In another study, Lin (2007) examines the number of US banks offering internet banking and analyses the structure and performance characteristics of these banks. The study finds no evidence of major differences in the performance of the group of banks offering internet banking activities and those that do not offer such services. The performance measures considered are in terms of profitability, efficiency or credit quality.

In a study of the US market, DeYoung (2005) compares the performance of 'brick and mortar banks' and 'internet only banks'. He reports that the performance of start-ups is not improved by 'technology based learning'. Indeed, he finds that 'internet-only banks' report lower profits in the US market. In another study of the USA, Ho and Mallick (2010) detail evidence in support of the fact that the application of technology even though might lead to cost reductions, also has the tendency to lower bank profits through the creation of network effects.

Jalal-Karim and Hamdan (2010) investigate the influence of adoption of technology on the financial and operational performance of Jordanian banks. Their test results show that the banks' use of management information systems (MIS) has no impact on their ROE. This according to them, might be due to the depressing effects of increased IT spending on the return on shareholders' property.

Alber (2011) in his investigation of the influence of digital banking on profit efficiencies of commercial banks in Saudi Arabia, finds that the profit efficiency of banks is not improved by mobile banking, the adoption of PC banking and the number of point of sale terminals (POSs). In another vein, Malhotra and Singh (2009) report that the impact of electronic banking services on banks' profitability is only favourable to larger banks. They further find that the application of electronic banking platforms negatively affects the profits of smaller banks.

Hosein (2013) and Gutu (2014) argue that in most developing countries, the high cost of infrastructure involved in ATM and internet banking services, coupled with the insufficient number of customers is the reason for the negative influences of ATM and internet banking on bank profitability. Gutu (2014) contends further that the declining effects of internet banking on bank performance in most developing economies is not reversed even with huge publicity for internet banking. In most of these countries, digital banking applications are quite low as banking solutions are delivered largely through the traditional branch-based banking. The failure of e-banking services to contribute to cost reductions is the sole reason for the seeming inability of digital innovations to affect positively, the profitability of banks in developing countries.

Akhisar et al. (2015) utilise dynamic panel data techniques and examine the responsiveness of bank performance to electronic banking applications for 23 advanced and developing countries. They report that ATM and bank cards (credit cards, debit cards, etc.) impact positively on bank profitability. Internet banking services and POS terminals, however, are found to have negative influences on bank profitability. Akhisar et al. (2015) assert that the influence of ATM on bank profitability is the highest among the electronic banking platforms used in their study.

Empirical studies have produced conflicting results regarding the influences of technology-enabled delivery channels on the performance of banks. The debate appears not to be over, while much of the knowledge on innovation – performance relationship is from the study of developed countries. This study contributes to the literature by using data from a frontier market to investigate the impact of digital innovations on the financial performance of banks. For this sole purpose, the study conceptualises that digital innovations (ATM, internet banking, and mobile banking) effect on the financial performance of banks through return on assets and cost to income ratio (CIR).

3 Data and methods

3.1 Data and sources

In this study, secondary data in the form of cross-sectional data have been used. The data was collected from the banks' annual financial reports and Price Waterhouse Coopers' Ghana banking annual survey reports. Also, officials in the bank that could furnish the

required information by virtue of their ranks, were relied on to provide any other information necessary to achieve the objectives of this study. The study utilises data from 30 banks in the year 2015. The data comprises of net profits, total assets, total equity, ATM machines, usage of mobile banking and internet banking services of the selected commercial banks.

3.2 Model specification

Adusei (2011) argues that a regression model is appropriate in relating a dependent variable to independent variables. The nature of the data is that of cross-sectional, allowing for the use of a linear regression model. Linear regression expresses a dependent variable as a linear function of independent variables and an error term. The general form of the linear cross-sectional regression model can be specified as follows:

$$Y_i = \alpha + \beta X_i + \varepsilon_i \quad i = 1, \dots, N$$

where subscript i represents the cross-section dimension. Y_i is the dependent variable measuring bank performance, α is a scalar, β is the coefficient. X_i is the vector of explanatory variables and ε_i is the error term.

Thus, the regression specifications to test the impact of digital innovations on financial performance are as follows:

$$ROA_i = \beta_0 + \beta_1 ATM_i + \beta_2 IB_i + \beta_3 MB_i + \beta_4 SIZE_i + \beta_5 GROWTH_i + \varepsilon_i \quad (1)$$

$$CIR_i = \beta_0 + \beta_1 ATM_i + \beta_2 IB_i + \beta_3 MB_i + \beta_4 SIZE_i + \beta_5 GROWTH_i + \varepsilon_i \quad (2)$$

The study variables with their labels and definitions are given in Table 1.

Table 1 Description of variables

<i>Variable</i>	<i>Definitions</i>
<i>Dependent variable</i>	
ROA	Return on Assets expressed as a ratio of average net profits to average total assets
CIR	Cost to Income Ratio expressed as a ratio of operating cost to operating income
<i>Independent variables</i>	
ATM	The ratio of ATM to the number of branches
IB	Number of customers who benefit from internet banking
MB	Number of customers who benefit from mobile banking
Size	The natural log of Total Assets
Growth	A proxy for investment opportunities and measured as growth in revenue

Size and growth are used as control variables and according to Kyereboah-Coleman and Biekpe (2006), the essence of the control variables is to take cognizance of the fact that the performance of a firm and for that matter banks may be influenced by several factors.

The coefficients, β_1 , β_2 , and β_3 capture the impact of digital innovations (automated teller machines, internet banking and mobile banking) on the measures of financial performance respectively. Their significance is tested using the reported

probability values. The significance of the overall model in explaining performance via the independent variables is measured through the F-test. The analysed data is then presented using tables.

4 Empirical results

4.1 Descriptive statistics

The findings from the descriptive statistics show that on the average, most of the firms appear not to have done well with regards to return on assets. Table 2 shows that the mean performance in 2015 was 2.3% with the least performing firm recording as low as -3.7%. Overall, the financial industry faced a daunting economic environment in 2015 which generally impacted on profitability. The industry's return on asset plummeted generally in 2015 as non-performing loans ballooned and profitability declined while total assets improved.

Table 2 Summary of descriptive statistics

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
RoA	0.023	0.024	-0.037	0.068
CIR	0.552	0.215	0.14	1.06
ATM	46.615	53.053	11	271
IB	9.511	1.537	5.714	12.219
MB	10.048	1.588	6.125	12.630
Size	3.138	0.416	2.276	3.775
Growth	-0.261	0.800	-2.468	1.270

The average CIR read 55.2% in 2015. The banking sector experienced general economic difficulties in 2015 and the PwC's 2015 banking survey report indicates that the industry recorded 20.0% increase in operating cost from GH¢3 billion in 2014 to GH¢10.64 billion in 2015. The descriptive statistic reveals that the digital innovation variables show significant disparity due to the variations in the structures of the banks. The average bank size is 3.14. Bank size ranges from 2.28 to 3.77.

4.2 Correlation analysis

All the digital innovation variables have a positive relationship with CIR. This may suggest that the initial outlay for the digital delivery channels might have cost implications for the banks. However, both number of ATM and usage of mobile banking services have negative correlations with return on assets. Again, the negative relationship between ATMs and mobile banking and return on assets might imply depressing effects of these applications on the profitability of the banks, particularly, in the short run. The number of ATMs has a significant positive relationship with CIR. It is not surprising

that the digital innovation variables particularly, internet banking and mobile banking show significant positive correlation. This is largely due to the similarity between the applications of these services. For example, most of these applications are introduced concurrently. Again, it may also imply that the banks increase the use of the innovations simultaneously.

Also, the correlation matrix shows that firm size and growth in revenue are positively correlated with ROA. Growth rate, however, is inversely correlated with CIR. Indeed, the growth rate of revenue has a statistically significant relationship with the bank performance measures. The findings from Table 3 depict that there is a significant positive correlation between growth in revenue and return on assets on one hand and on the other hand, a significant and inverse relationship between growth in revenue and CIR. Highly profitable firms are more likely to have a high return on assets and lower CIR. The firm size, however, has relatively weak relationship with ROA and CIR.

Table 3 Correlation analysis of digital innovations and bank performance

	<i>RoA</i>	<i>CIR</i>	<i>ATM</i>	<i>IB</i>	<i>MB</i>	<i>Size</i>	<i>Growth</i>
RoA/CIR	1.0000	1.0000					
ATM	-0.0629	0.4310*	1.0000				
IB	0.0214	0.1584	0.3010	1.0000			
MB	-0.0132	0.2315	0.4391**	0.4842***	1.0000		
Size	0.2348	0.0886	0.0713	0.7331***	0.6890***	1.0000	
Growth	0.5988***	-0.4589**	-0.3786*	-0.2139	-0.2305	-0.0673	1.0000

*, **, *** represents significance at 10%, 5% and 1% respectively.

4.3 Regression analysis

The study engages a regression model to investigate the influence of digital innovations on the financial performance of banks. The regression is done using the Stata software. The study follows the linear regression options which are mostly used in the literature. The study reports results of the linear regression in Table 4.

The R-squared in Table 4 indicates that about 79% (93%) of the variation in return on assets (the CIR) is explained by the digital innovations and control variables. Thus, the regression models have a considerable strong explanatory power as only 21% (7%) of the variation in return on asset (the CIR) is not explained by the specified regression model. The R-squared results show the overall goodness-of-fit of the model used in this study. The F-statistic in the two specifications shows that the overall regression models are statistically significant and are useful for prediction purposes at 1% level of significance. Thus, the independent variables used are statistically significant in predicting the return on assets and CIR of Ghanaian banks.

The results show that both ATM and internet banking have significant positive influences on the return on assets of Ghanaian banks. This may suggest that the introduction of ATM and the application of internet banking improve significantly the performance of banks. This result is consistent with Kagan et al. (2005) and Jalal-Karim and Hamdan (2010). Mobile banking, however, has a significant inverse relationship with return on assets as a measure of bank performance. This result is particularly surprising and is contrary to the findings of Aker and Mbiti (2010). Mobile banking provides a

convenient option for banks to deliver their services and improve their profitability. The result is however consistent with Alber (2011) who reports that the availability of mobile banking does not improve profit efficiency.

Table 4 Regression results

<i>Dependent variable</i>	<i>ROA</i>	<i>CIR</i>
<i>Variable</i>	<i>Coefficient</i>	
ATM	0.0002*** (0.0001)	-0.0004 (0.0008)
IB	0.0300** (0.0122)	-0.4198*** (0.1393)
MB	-0.0298** (0.0117)	0.3899** (0.1372)
Size	0.0106 (0.0064)	0.1899 (0.1430)
Growth	0.0224*** (0.0059)	-0.1473** (0.0583)
R-Squared	0.7936	0.9307
F-Statistic	28.15	164.69
Prob.	0.0000	0.0000

Standard errors are in parentheses.

*, **, *** represents significance at 10%, 5% and 1%, respectively.

Also, the findings of this study show that both ATM and internet banking affect CIR in a negative way while mobile banking has a positive influence on the banks' CIR. The study results indicate that the influence of the digital innovation variables on the bank performance measures is mixed. The findings of this study are consistent with earlier findings by Gutu (2014). What is clear is that the availability of electronic banking infrastructure and customer habits largely moderate the cost-effectiveness and profit efficiency of digital delivery channels. Gutu (2014) explains that in most developing countries, the lack of IT infrastructure dampens the relative influence of ATM networks and internet banking activities on the performance of banks.

Simpson (2002) argues that digitisation of banking services is mostly motivated by the prospects of minimising operating cost and maximising operating revenues. The results of this study indicate that both ATM and internet banking applications have significant influences on the profitability and the cost efficiency of banks. Indeed, Malhotra and Singh (2009) document that internet banking and ATM applications affect bank performance positively and the effect is particularly pronounced for larger banks.

The results also show that mobile banking has significant increasing effects on CIR. This is however counterintuitive. Mobile banking presents a very convenient service delivery platform for banks particularly in this era of increased use of mobile telephony in Sub-Saharan Africa. The banks do not require any substantial investment in infrastructure in order to roll out this application. Indeed, banks with the help of mobile telephony have been able to advertise their new products using short messages. Also, the

banks have been able to allow customers to use mobile phones to perform basic bank account enquiries including checking bank accounts. Thus, the use of mobile telephony applications in banking should substantially help to improve the banks' cost of doing business. Contrary to these expectations, the findings of this study show that mobile banking applications have declining implications for banks income performance and cost efficiency. Essentially, both the habit of customers and the infrastructure availability moderate the influence of digital applications on the performance of banks.

The study results also suggest that the size of the firm has positive effects on return on assets and CIR. These results are however insignificant. Kyereboah-Coleman and Biekpe (2006) explain that the size of a firm measured by its asset base does not necessarily enhance performance if this is not put to efficient use. However, growth in revenue has a positive and significant relationship with return on assets on one hand, and a significant negative relationship with CIR on the other hand. Clearly, the availability of growth opportunities provides a highly probable indication of the viability of the firm and the more growth opportunities there are, the higher the likelihood of profitability. The result also implies that banks with high growth opportunities are largely cost efficient.

5 Conclusion

The essential functions performed by banks have remained relatively unchanged over the past several decades but the way those functions are discharged, and the structure of the banking industry has undergone dramatic changes. This study employs a multiple linear regression technique and uses a sample of 30 Ghanaian banks to investigate the effects of digital delivery channels on the financial performance of banks. Descriptive statistics reveal that the digital innovation variables show significant differences due to the variations in the structures of the banks. The correlation analysis shows that the digital innovation variables particularly, internet banking and mobile banking have a strong positive correlation. This may imply that the banks increase the use of the digital channels simultaneously

The study results also show that ATM and internet banking have significant positive influences on return on assets while mobile banking has a negative association with return on assets. In a sharp contrast to the results for return on assets, both ATM and internet banking have negative influences on the CIR while mobile banking relates positively with CIR. The results of this study show that both ATM and internet banking improve the income performance and the cost efficiency of the banks. However, contrary to expectations, mobile banking applications decrease the income performance and cost efficiency of the banks. The results suggest that while digital innovations may exert significant positive influences on banking performance, particularly profitability; these innovations may also have significant cost implications for the banks. The influence of digital applications on the performance of banks may be moderated largely by the availability of infrastructure and the habit of customers. It is crucial that banks while adopting digital innovations, should also engage in a reduction of the proportion of overdue and underperforming assets. Indeed, Hernando and Nieto (2007) contend that banks would further profit from cost reductions associated with internet banking adoptions, to the extent that the internet delivery channel functions as a substitute for traditional distribution channels.

The findings of this study show that in this era of digitisation and mobile money, a significant portion of the future of banking services rests on electronic banking. The results of this study indicate that the cost-effectiveness and profit efficiency of electronic banking channels are considerably underscored by the availability of electronic infrastructure. Thus, future research should investigate whether the effects of digital banking on bank performance vary according to bank size and whether the impact of digital delivery channels differs significantly across advanced and less advanced regions.

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