

Bank performance, governance structures and ICT investment among rural banks in an emerging economy

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Abstract

Purpose – This paper evaluates how bank dynamics, governance structures and financial sector development drive rural banks' information and communications technology (ICT) investment in the Ghanaian economy.

Design/methodology/approach – Data for the empirical inquiry were compiled from relevant sources including World Development Indicators (WDI), World Governance Indicators (WGI) and ARB Apex Bank from 2014 to 2020. Prais–Winsten panel corrected standard errors (PW-PCSE) was employed in estimating and verifying hypothesized relationships for the study.

Findings – The results suggest that return on assets (ROA) and bank size improve rural banks' ICT investment. Moreover, telecommunication development and government effectiveness have significant positive impact on ICT investment among rural banks in the Ghanaian economy. The results further show that telecommunication development has a positive moderating effect on regulatory quality and ICT investment nexus among rural banks in Ghana. Financial development, inflation and liquidity risk were found to negatively affect ICT investment among rural banks in Ghana.

Originality/value – The study is premised on four main motivations; (1) the growing role that ICT plays in development outcomes and firm performance (FP), as well as its potential for comparatively increased penetration among African banks and banking institutions (2) the importance of governance for innovation and investment in ICT, (3) banking regulation and (4) gaps in the literature. Previous studies on ICT investment highlight its impact on profitability but little on determinants of banks' ICT investment in the emerging market context, especially moderating role of governance and ICT diffusion.

Keywords ICT investment, Rural banks, Bank performance, Regulation, Governance structures

Paper type Research paper

1. Introduction

The adoption of new technologies and systems is a topic of substantial controversy in the literature it is however widely accepted that information and communications technology (ICT) is a key factor in improving people's lives as well as the performance of businesses. ICT investment makes customers' lives easier and gives businesses a competitive advantage over rivals (Buchak *et al.*, 2018). Businesses can restructure their organizational structures to reengineer business processes and develop new products as they adopt ICT. Previous studies

JEL Classification — G21, M15, R28

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have opined that technology allows banks to process loans faster (Fuster *et al.*, 2019). An efficient financial sector ensures that capital is available to productive and efficient economic sectors and increases the efficiency of the economy's resource allocation (Adeusi *et al.*, 2018). In Ghana's financial sector architecture, rural and community banks are crucial for enhancing access to banking services for individuals of all social, racial, economic and geographic strata. Finance institutions (especially banks) rely heavily on ICT and stringent risk management practices to achieve their corporate objectives due to the advancement of technologies and the constant need to satisfy customers, meet regulatory requirements and be competitive. The amount of investment made by banks demonstrate the growing importance of ICT (Oladejo and Agbeja, 2012), especially given that most consumers rely on digital infrastructure.

The inconsistent findings on the effect of ICT investments on firms' productivity, profitability and efficiency lead to the phenomenon called the "IT productivity paradox" (Solow, 1956). That is, the perceived discrepancy between a firm's ICT investment and the productivity output it generates. Various studies have established that increased investment in computerization has had little impact on productivity and economic performance (Brynjolfsson and Hitt, 1998). Nonetheless, ICT has influenced the ways banks organize their operations and render innovative products to enhance service quality and efficiency (Agbolade, 2011). According to Computer Economics (2019), banks' IT investments are 3% higher in median than all other industries, and the business value of ICT investment has become a major research issue for researchers (Sabherwal and Jeyaraj, 2015; Schryen, 2013). Poor ICT investment decisions can hurt efficiency, productivity, profitability, overall customer experience and competitiveness. Firms therefore consider intangible benefits as being derived from ICT investments (Oesterreich and Teuteberg, 2018). ICT adoption varies greatly between nations and even between industries within sectors. ICT has rapidly extended throughout industrialized and non-industrialized economies over the years. The key drivers of this success story have been ongoing technological advancements in the ICT industry and the ongoing decline in pricing for networks and computers. This has encouraged an increasing number of businesses to invest in these emerging technologies. It is undeniable that businesses must completely embrace innovation and information technology (IT) in light of the COVID-19 pandemic, which has changed operational strategies and business structures. Over the years, the banking industry has relied on technology to enhance its operational procedures and provide client service. ICT, according to Draca *et al.* (2006), is an aggregated, homogenous capital that has distinct effects on businesses and may have a differential impact on employment and output (Garicano and Rossi-Hansberg, 2006). An assessment of the achievement of millennium development goals' (MDGs) extreme poverty targets by the World Bank indicates that ICT plays a crucial role in inclusive development. All regions of the world have seen a decrease in extreme poverty except Africa, where 45% of the countries in sub-Saharan Africa (SSA) have not achieved the MDG extreme poverty target (Asongu and Kodila-Tedika, 2016).

Technological diffusion in the 21st century has enforced banks' adoption of ICT as a strategy for their business continuous growth in an extended competitive environment. Previous studies have indicated that ICT supports business operations, reduces human errors, minimizes cost and substitutes labor-intensive methods with computerized processes, thereby improving performance. However, performance could be slashed due to service costs, training and other indirect risks associated with business process automation (Okibo and Wario, 2014). The liberalization of financial systems in emerging market economies has increased competition and highlighted the need to improve efficiency. Varied innovative products and services are rolled out by banks to compete, increase market share, survive and grow; thereby making the demand for ICT in the banking sector imminent and unavoidable. In their investigation of the effects of ICT on rural bank management in Ghana, Wiredu *et al.* (2020) concluded that, even though ICT adoption can lower costs and improve customer experience, Atiwa Rural Bank lacks the needed technologies to support its operations. However, previous literature has ignored exploring internal, institutional and structural factors that drive ICT investment among rural banks. This study makes a significant contribution to the literature by

analyzing the internal factors, as well as the governance and regulatory structures that determine the extent of investment in ICT among rural banks in the Ghanaian economy. ICT investment is the quintessential survival element of firm managers' strategy that guarantees business growth. We argue that increased mobile-cellular subscriptions within a populace could signal banks of ICT proliferation and its subsequent usage. Banks may therefore take advantage of increased technology diffusion to increase ICT and related investments, affording customers convenience, security and overall customer satisfaction. We further argue that an effective and efficient regulatory environment may increase investors' confidence and subsequent investment (including ICT investment).

This study makes several contributions to the literature and policy formulation. First, this study elucidates how institutional, governance and performance drive rural banks' ICT investments in an emerging economy compared to previous studies that focused on the development of the entire financial sector (Aluko and Ibrahim, 2021; Aluko, 2020). The study is premier in assessing bank-level performance dynamics, regulatory and governance drivers of ICT investment among rural banks. Additionally, this study argues that investment decisions are influenced by general economic prospects, regulatory regimes and the government's commitment to beef up institutional efficiency. Further, the study explores the interaction effect of regulatory quality and government effectiveness on ICT diffusion and ICT investment nexus, following the theory of the firm. This theory stipulates that firm performance (FP) is a function of several factors and conditions, which includes macroeconomic factors (Jaara, 2021; Baum *et al.*, 2021). ICT drives managers' decisions on products and services to offer to the markets, has changed how banks manage corporate relationships and enhance speed and quality of service delivery.

The study is premised on four main motivations, (1) the growing role that ICT plays in development outcomes and FP, as well as its potential for comparatively increased penetration among African financial institutions (2) the importance of governance for innovation and investment in ICT, (3) banking regulation and (4) gaps in the literature. Previous studies on ICT investment highlight its impact on profitability but little on determinants of banks' ICT investment in the emerging market context, especially moderating role of governance and ICT diffusion. The rest of the paper is structured as follows: literature review, research methodology, results and discussion, and finally, conclusion and policy implications.

1.1 Literature review

1.1.1 Determinants of ICT investment and governance structures. There is considerable evidence that ICT can contribute to a variety of development outcomes, such as improving financial inclusion (Kirui *et al.*, 2013); empowering women. Current banking operations demand investment in ICT which drives the electronic banking system in Ghana today. The entire cash flow of most banks is linked to an information system. ICT is adopted as a strategy for a bank's continuous growth in a competitive environment, changing the manner banks are run in modern times (Binuyo and Aregbeshola, 2014). New delivery technologies and products such as mobile banking (MB), Internet banking (IB), point-of-sale terminals and automatic teller machines (ATMs) are substituting traditional delivery methods (Ozen *et al.*, 2014). Generally, the characteristics of an organization are considered major determinants for ICT adoption. Business-level characteristics include operational complexity, size and competition (Oyewole *et al.*, 2013). Individuals also consider risks, perceived usefulness and security among others in decision-making. ICT investments provide the technological leverage for banks to churn out innovative products and services relevant to customer satisfaction and business growth. Studies have asserted that extent of financial sector efficiency largely depends on institutional structures in an economy (Law and Azman-Saini, 2012). Evidence from developed economies has established a significant positive relationship between strong institutional structures and financial market development (Law and Azman-Saini, 2012). Country-level governance structures ensure the safeguarding of property rights,

enforcement of contracts and adherence to accounting policies which are seen to have a positive effect on financial markets and cannot be overlooked (Jain *et al.*, 2017). Investigated how governance structures influence ICT adoption in SSA, concluding that government effectiveness and corruption control positively influence telephone penetration both short- and long-term. It appears that institutional governance has a significant impact on the adoption of ICTs in SSA. However, previous studies in Ghana have not empirically explored drivers for ICT investment by financial institutions considering the dynamic reflections of bank characteristics (i.e. size, liquidity, financial performance) and other macro factors that potentially push demand for ICT innovations that improve financial inclusion and bank performance including gross domestic product (GDP), ICT diffusion and governance structures in the economy.

1.1.2 ICT investment and performance nexus. The difficulty in evaluating benefits associated with IT decreases the certainty about benefits associated with IT investments. Varied studies have explored the ICT and FP nexus (Vekya, 2017) focusing on developed economies, leaving developing countries (Ogunyomi and Obi, 2016) and especially banks with the mandate to increase financial inclusion or deepening in rural communities, like rural and community banks in Ghana. Quinn and Baily (1994) asserted that IT investment decisions are the beginning of the focus on factors such as growth potential, risk avoidance and strategic evaluation of IT projects. Increasing electronic transactions comprises a gradual attenuation in overhead expenses which translates into improved banks performance. Onay *et al.* (2008) concluded that IB has a positive impact on the performance of Turkish banks. The study used financial data for the period 1996 to 2005. Using bank data for the period 2003 to 2007, with a sample of 15 Jordanian banks, Karim and Hamdan (2010) explored and confirmed the effect of the usage of the management information system (MIS) on return on assets (ROA), net profit margin and earnings per share. However, the study found no effect of MIS on return on equity (ROE). Additionally, Leckey *et al.* (2011) found that banks that keep high levels of investments in IT improve ROE and ROA. The study adopted the balanced scorecard (BSC) framework based on an extensive panel dataset of 15 Ghanaian banks for the period 1998–2007. Fabritz (2015) argued that simply comparing ICT investments in regions or industries where telecommunication infrastructure increases do not necessarily lead to the true effect of ICT. Nonetheless, ICT has a significant effect on banking operational quality, and performance and increases the stock returns of banks (Peace *et al.*, 2018). The study further recommended ICT investment to be part of banks' overall banking performance strategy in Nigeria. Previous studies (Onay *et al.*, 2008; Binuyo and Aregbeshola, 2014; Vekya, 2017) have failed to establish whether banks' performance translates into increased investments, particularly, ICT investment in an emerging economy. We argue that as banks' financial performance improves, there is a likelihood that ICT investments will increase. It, therefore, becomes the connecting factor in integrating a firm's expansionary agenda aimed at increasing performance and maximizing shareholders' wealth. We hypothesize the following hypothesis:

H1. Financial performance increases ICT investment among rural banks

1.1.3 Regulation, performance and ICT investment nexus. Using industry-level data from 14 OECD countries, Jerbashian and Kochanova (2015) found that ICT investments increase with the strength of legal rights, but it decreases with the cost of starting and operating a business. More so, an increase in minimum capital requirement reduces companies' investment in software. According to Barseghyan (2008), regulation of business activities is critical for economic growth. The study indicated that countries with less burdensome regulations grow faster. The context of banking sector liberalization and deregulation affects banks' operational risks and stability and therefore calls for prudential regulation focused on performance. Almag (2020) asserts that the effect of regulations on performance depends on the size and risk level of banks. Considering that there is the need for bank managers to improve performance as well as adhere to regulations, ICT investment serves as a bridge and therefore we propose the following hypotheses:

H2. Improved governance increases banks' ICT investment.

H3. Regulatory structures improve banks' ICT investment.

1.1.4 ICT diffusion, financial sector development and ICT investment. The effective and efficient provision of financial services depends on the use of information and communication technologies. [Asongu and Moor \(2017\)](#) assert that the ICT industry acts as a foundation that enhances bank branch operations by boosting flexibility, convenience, affordability and mitigating risks. Considering the increasing significance of information in all kinds of activities, ICT is considered a sector tool for promoting development initiatives and implementing corporate strategies. ICT is considered a vital part of the growth of commercial activities due to its ability to reduce the price of financial intermediation services ([Dewan and Ramaprasad, 2014](#)). According to [Alimi and Adediran \(2020\)](#), financial development inhibits economic growth in ECOWAS countries, but its interaction with ICT diffusion stimulates it. ICT services are implemented by organizations irrespective of size and ownership (i.e. private or public). To maintain effective internal control over financial reporting, electronic finance is used as an instrument. Studies such as [Sassi and Goaid \(2013\)](#) and [Chowdhury \(2006\)](#) have established a positive relationship between financial development and the use of electronic applications. According to [Waverman et al. \(2005\)](#), ICT development facilitates bank operations by increasing their flexibility and risk disclosures to ensure the banking sector works safely. Commercial banks and microfinance institutions enjoy cost reductions of financial intermediation services as the ICT sector develops, leading to the expansion of business activities ([Dewan and Ramaprasad, 2014](#)). According to [Alshubiri et al. \(2019\)](#), fixed broadband and Internet user variables have a positive effect on financial development in six Gulf Cooperation Council (GCC) countries for the period 2000 to 2016. Considering the relevant literature, we propose the following hypotheses:

H4. ICT diffusion improves banks' ICT investment

H5. Financial development improves banks' ICT investment

2. Data and methodology

This section is dedicated to presentation of the data and its sources, description of the key variables and the methodological approach followed in pursuance of the objectives of the study. We first describe the estimation technique used for the analysis of the data, followed by the sources of the data and description of the variables. The section proceeds with the functional presentation of the models estimated per the objects sought under the study, and concludes with presentation and discussion of results of the descriptive statistics, including variable acceptability checks.

The study uses panel data to carry out the analysis. Panel estimation technique is therefore employed to carry out the various estimations. Specifically, we employ the pooled ordinary least squares (POLS) with panel corrected standard error (PCSE) by [Beck and Katz \(1995\)](#) for the analysis. For the purpose of controlling for autocorrelation within the panels, the models are specified with Prais–Winsten parameters (specified as first order autocorrelation). The study therefore employs Prais–Winsten panel corrected standard errors (PW-PCSE) in carrying out the analysis. According to [Cameron and Trivedi \(2009\)](#), the PCSE estimator is an efficient and robust estimator because it controls for finite sample bias, controls for correlation with panels and heteroscedasticity. Again, the PCSE has been noted as an efficient estimator because it controls for unit-level heteroscedasticity and contemporaneous correlation; this is achieved because the estimator assumes that the disturbances are not independent and identically distributed when calculating the standard errors, covariance and variance ([Sundjo and Aziseh, 2018](#)). Referencing the literature, we summarize the key features of the PCSE,

hence its robustness and efficiency to include controlling for cross-sectional dependence, heterogeneity, autocorrelation, unobserved effects and deviation from spherical errors (see Beck and Katz, 1995; Bailey and Katz, 2011; Sundjo and Aziseh, 2018).

Data for the various variables were compiled from ARB Apex Bank, World Development Indicators (WDI) and World Governance Indicators (WGI) on annual basis for a total of 122 rural banks in Ghana from 2014 to 2020. ICT investment, the dependent variable for the study is represented by the total value of rural bank’s investment in acquiring and operating ICT equipment (it is measured in natural logarithm). Bank size is measured as the natural logarithm of the total value of asset of a rural bank, following the works of Horvey and Ankamah (2020) and Akter et al. (2018). The study also measures liquidity risk by following the work of Bagh et al. (2017) as the value of gross loans to total deposits. Again, following work by Majumder and Li (2017), we denote financial performance by the ROA, measured by the ratio of profit before to total assets. Financial sector dynamics are represented by financial sector development and telecommunication development. We measure financial sector development by the ratio of domestic credit to the private sector to GDP, in reference to Eferakeya and Erhijakpor (2020). Compiled from the WDI, telecommunication development is measured by the number to mobile cellular subscriptions per 100 inhabitants. Inflation (annual change in price of goods and services) and GDP growth (annual growth in total market value of goods and services produced within the country) were also collected from the WDI to denote macroeconomic conditions. Again, to represent governance and regulatory structures, we also compiled government effectiveness and regulatory quality indexes from the WGI. A detailed description of the various variables and their respective sources have been provided by Table 1.

Table 1. Description of variables

| Code | Description | Measurement | Source |
|--------|-------------------------------|---|---------------|
| ICTINV | ICT investment | Natural logarithm of ICT investment | ARB Apex Bank |
| BSize | Firm size | Natural logarithm of total assets | ARB Apex Bank |
| ROA | Financial performance | PBIT/total assets | ARB Apex Bank |
| CAP | Capitalization | Shareholders fund/total assets | ARB Apex Bank |
| LIQ | Liquidity risk | Gross loans/total deposits | ARB Apex Bank |
| TCD | Telecommunication development | Mobile-cellular subscriptions per 100 inhabitants | WDI |
| FSD | Financial sector development | Domestic credit to private sector by banks (% of GDP) | WDI |
| GDP | GDP growth | GDP growth (annual) | WDI |
| INF | Inflation | Inflation rate | WDI |
| TCD | Telecommunication development | Mobile-cellular subscriptions per 100 inhabitants | WDI |
| INF | Inflation | Inflation rate | WDI |
| Rqual | Regulatory quality | <i>Perception of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector</i> | WGI |
| Gffect | Government effectiveness | <i>Perception of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government’s commitment to such policies</i> | WGI |

Source(s): Authors’ Compilation

Conceptually, we hypothesize that the amount or extent of investment in ICT among rural banks could be a function of the internal dynamics of the banks and the financial sector, as well as key macroeconomic indicators and governance/regulatory structures. This is presented functionally as Equation (1) below.

$$ICTINV = f(RBD, FS, Ctls) \tag{1}$$

From Equation (1), ICTINV represents ICT investment, RBD denotes rural bank dynamics (internal dynamics of rural banks), FS is financial sector (dynamics of the financial sector) and Ctls represents control variables (comprising of macroeconomic indicators and governance/regulatory structures).

We proceed to present a detailed function to denote the estimated models for the purpose of realizing the set objects of the study as Equations (2) and (3) below. Equation (2) evaluates the effect of the relevant variables on ICT investment, whilst Equation (3) is purposely presented to verify the moderating impact of governance and regulatory framework on the effect of TCD on ICT investment among rural banks in Ghana.

$$ICTINV_{it} = \lambda_0 + \lambda_1 BSIZE_{it} + \lambda_2 ROA_{it} + \lambda_3 LIQ_{it} + \lambda_4 TCD_{it} + \lambda_5 FSD_{it} + \lambda_6 GDP_{it} + \lambda_7 INF_{it} + \lambda_8 Rqual_{it} + \lambda_9 Gffect_{it} + \omega_{it} \tag{2}$$

$$ICTINV_{it} = \lambda_0 + \lambda_1 BSIZE_{it} + \lambda_2 ROA_{it} + \lambda_3 LIQ_{it} + \lambda_4 TCD_{it} + \lambda_5 FSD_{it} + \lambda_6 GDP_{it} + \lambda_7 INF_{it} + \lambda_8 Rqual_{it} + \lambda_9 Gffect_{it} + \lambda_{10} (TCD * GRS_{q,it}) + \omega_{it} \tag{3}$$

According to both equations, i and t represent the rural bank and year, respectively, and $\lambda_0 \dots \lambda_{10}$ denote the intercept and coefficient of the various explanatory variables, per their order of appearance.

Table 2 presents the descriptive statistics for the various variables used for the study. Results from the table illustrate that, by comparing the mean for ICT investment to the standard deviation, there exist insignificant degree of disparity among the various rural banks in terms of the value of investment in ICT (higher mean as compared to standard deviation). Similar conclusion can be made for the sizes of the various banks and liquidity risk, whilst the ROA on the other hand indicates a significant level of variation in the profitability or performance of the

Table 2. Descriptive statistics

| Variables | Obs | Mean | Std. Dev | Min | Max | p1 | p99 | Skew | Kurt | VIF. |
|-----------|-----|---------|----------|--------|---------|--------|---------|--------|---------|------|
| ICTINV | 854 | 5.218 | 0.804 | 0 | 6.624 | 0 | 6.406 | -3.831 | 25.568 | 1.21 |
| BSIZE | 854 | 7.221 | 0.552 | -0.568 | 8.679 | 5.937 | 8.278 | -3.428 | 48.502 | 1.43 |
| ROA | 854 | -0.005 | 0.127 | -2.01 | 0.159 | -0.502 | 0.091 | -8.898 | 110.661 | 1.21 |
| LIQ | 854 | 0.483 | 0.268 | 0.058 | 3.409 | 0.105 | 1.418 | 3.94 | 34.934 | 1.04 |
| TCD | 854 | 128.567 | 8.07 | 111.52 | 137.517 | 111.52 | 137.517 | -1.054 | 3.15 | 3.72 |
| FSD | 854 | 0.127 | 0.019 | 0.099 | 0.152 | 0.099 | 0.152 | -0.124 | 1.468 | 4.31 |
| GDP | 854 | 0.042 | 0.026 | 0.004 | 0.081 | 0.004 | 0.081 | 0.091 | 1.691 | 2.51 |
| INF | 854 | 0.133 | 0.032 | 0.092 | 0.175 | 0.092 | 0.175 | 0.094 | 1.429 | 7.22 |
| Rqual | 854 | -0.087 | 0.077 | -0.233 | 0 | -0.233 | 0 | -0.561 | 2.279 | 4.91 |
| Gffect | 854 | -0.194 | 0.051 | -0.281 | -0.112 | -0.281 | -0.112 | -0.077 | 2.323 | 2.17 |

Note(s): ICTINV = ICT Investment, BSIZE = Bank Size, ROA = Return on asset, LIQ = Liquidity, TCD = Telecommunication development, FSD = Financial sector development, GDP = Gross domestic product growth, INF = Inflation, Rqual = Regulation Quality, Gffect = Government Effectiveness

Source(s): Authors' Calculations

various rural banks. The results from the table, again show that over the study period, the Ghanaian economy grew on average by 4.2%, whilst inflation recorded an average of 13.3%, suggesting a growing economy that is characterized by some level of instability in general price levels, compared to advanced economies. The governance variables, government effectiveness and regulatory quality also recorded negative average indexes over the study period, indicating that the country is relatively bedeviled with poor governance and regulatory structures. These descriptive statistics in respect of the macroeconomic indicators and governance variables present the Ghanaian economy as an emerging economy that is associated with weak governance and regulatory structures.

Results presented in [Table 2](#) further show the variance inflation factor (VIF) for the various variables under the study. The purpose of this presentation is to test the multicollinearity of the various explanatory factors, to verify the acceptability of these variables for the model estimates. We make an assessment of multicollinearity in reference to [Liao and Valliant \(2012\)](#), in their assessment, they recommend that for a variable to be acceptable for model estimate, the VIF should be less than 10. As evident from the table, all the variables have VIF less than 10, attesting to their acceptability for the estimates sought under the study. [Table 3](#) also presents results of pairwise correlation matrix for all the variables to support the conclusion drawn from analyzing the VIF results. [Suzuki et al. \(2008\)](#) recommend that for a variable to be considered for acceptance in an estimation, correlation coefficient with the other explanatory variables should not exceed 0.85. Analyzing from the table, we can attest to the fact that correlation coefficients between a pair of all the explanatory variables fall below the 0.85 threshold; we can therefore proceed with estimation of the models without problems emanating from multicollinearity.

3. Results and discussion

This section presents and analyses the results of the various estimations in accordance to the objects sought under the study. Results of the various empirical estimations are presented in [Table 4](#). While results shown in columns (1) to (3) examine the impact of internal dynamics of rural banks, and governance and regulatory framework of the Ghanaian economy on rural banks investment in ICT, columns (4) and (5) are presented purposely to verify the moderating impact of telecommunication development on the relationship between governance, regulatory quality and ICT investment among rural banks in Ghana. In respect of the internal factors of rural banks, results indicate that, in columns (1) to (3), bank size and ROA have significant positive impact on ICT investment. These results imply that as rural banks size and profitability increase, they tend to increase their investment in ICT, holding all other factors constant. Increased size and profitability mean that rural banks can have access to more funds to reinvest into their operations, including expansion in their ICT equipment and resources, hence the findings from the estimations. These outcomes conform to hypothesized expectation and empirical works such as [Onay et al. \(2008\)](#), [Karim and Hamdan \(2010\)](#), [Leckey et al. \(2011\)](#), [Peace et al. \(2018\)](#) that have found a positive nexus between various forms of investment in technology and performance of various forms. On the other hand, in column (2), the results indicate that at the 10% alpha level, liquidity risk has significant negative effect on ICT investment among rural banks in the Ghanaian economy. Increased risk, in the form of liquidity problems is therefore found to limit that amount of funds available to rural banks for investment, hence a reduction in investment in ICT, all things being equal. This outcome is consistent to *a priori* expectation, since increased level of liquidity risk signifies weak performance.

In respect of the financial sector dynamics, results displayed in [Table 4](#) for the various columns indicate that telecommunication development has significant positive impact on ICT investment. It implies that, as telecommunication networks improve in the Ghanaian economy, rural banks investment in ICT increases, all things being equal. Improved telecommunication networks provide the enabling environment for the successful implementation of various

Table 3. Pairwise correlations

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| (1) ICTINV | 1.000 | | | | | | | | | |
| (2) BSIZE | 0.398 | 1.000 | | | | | | | | |
| (3) ROA | 0.073 | 0.339 | 1.000 | | | | | | | |
| (4) LIQ | -0.055 | -0.122 | -0.007 | 1.000 | | | | | | |
| (5) TCD | 0.124 | 0.138 | -0.079 | -0.110 | 1.000 | | | | | |
| (6) FSD | -0.164 | -0.184 | 0.149 | 0.128 | -0.485 | 1.000 | | | | |
| (7) GDP | 0.049 | 0.013 | 0.024 | 0.017 | 0.274 | -0.129 | 1.000 | | | |
| (8) INF | -0.015 | -0.004 | 0.069 | 0.012 | 0.450 | 0.245 | 0.613 | 1.000 | | |
| (9) Rqual | -0.003 | -0.004 | -0.034 | 0.000 | -0.537 | -0.211 | -0.502 | -0.838 | 1.000 | |
| (10) Gffect | 0.076 | 0.136 | -0.066 | -0.110 | 0.476 | -0.301 | 0.279 | 0.516 | -0.451 | 1.000 |

Note(s): ICTINV = ICT Investment, BSIZE = Bank Size, ROA = Return on asset, LIQ = Liquidity, TCD = Telecommunication development, FSD = Financial sector development, GDP = Gross domestic product growth, INF = Inflation, Rqual = Regulation Quality, Gffect = Government Effectiveness

Source(s): Authors' Calculations

Table 4. Rural bank dynamics, regulatory and governance structures

| | (1) ICTINV | (2) ICTINV | (3) ICTINV | (4) ICTINV | (5) ICTINV |
|------------------|-----------------------|----------------------|-----------------------|----------------------|----------------------|
| BSIZE | 0.140** (2.24) | 0.148** (2.36) | 0.140** (2.24) | 0.143** (2.26) | 0.141** (2.24) |
| ROA | 0.170** (2.39) | 0.141** (1.96) | 0.166** (2.33) | 0.166** (2.31) | 0.169** (2.36) |
| LIQ | -0.0843 (-1.22) | -0.120* (-1.72) | -0.0846 (-1.22) | -0.0946 (-1.36) | -0.0811 (-1.16) |
| TCD | 0.00866*** (12.74) | 0.00737*** (5.38) | 0.00907*** (11.14) | 0.00934*** (9.91) | 0.0214*** (3.42) |
| FSD | -2.652*** (-9.08) | -2.971*** (-3.95) | -2.421*** (-6.66) | -3.413*** (-7.95) | -1.934*** (-4.16) |
| GDP | 2.013*** (19.14) | 1.846*** (5.39) | 2.055*** (13.43) | 1.428*** (8.00) | 2.449*** (10.32) |
| INF | -2.758*** (-12.55) | -1.978*** (-3.85) | -2.491*** (-9.34) | -2.384*** (-8.96) | -3.079*** (-7.74) |
| Rqual | -0.147*** (-3.43) | -0.107 (-0.66) | | -6.824*** (-2.92) | |
| Gffect | 0.512*** (5.71) | | 0.496*** (4.34) | | -5.247* (-1.88) |
| Rqual*TCD | | | | 0.0491*** (2.90) | |
| Gffect*TCD | | | | | 0.0473** (2.04) |
| Constant | 3.845*** (8.22) | 3.816*** (7.44) | 3.732*** (7.97) | 3.694*** (8.14) | 2.201** (2.36) |
| Obs | 854 | 854 | 854 | 854 | 854 |
| No. of countries | 122 | 122 | 122 | 122 | 122 |
| R-Squared | 0.748 | 0.748 | 0.748 | 0.747 | 0.748 |
| χ^2 | 1504.2 | 108.5 | 506.3 | 795.5 | 1168.5 |
| p-Value | 2.34e-318 | 7.86e-20 | 3.18e-104 | 1.97e-165 | 7.58e-246 |

Note(s): *t* statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. ICTINV = ICT Investment, BSIZE = Bank Size, ROA = Return on asset, LIQ = Liquidity, TCD = Telecommunication development, FSD = Financial sector development, GDP = Gross domestic product growth, INF = Inflation, Rqual = Regulation Quality, Gffect = Government Effectiveness

Source(s): Authors' Calculations

technological systems, including success in ICT projects among rural banks in Ghana. These banks would therefore find it as worthy course of action to increase investment in ICT equipment and software for advancement of their operations. On the other hand, the results indicate that financial sector development, measured as domestic credit to private sector is found to negatively affect ICT investment among rural banks. Significantly comprising of credit offered by commercial banks, increased levels of credit to the private sector signifies an economy with improved financial system, a situation that relegates the role of rural banks and limits their capacity to grow; rural banks could be crowded out when the economy experiences significant development in the financial sector. This situation could lead to underdevelopment of the rural bank sector, hence leading to reduction in ICT investment, holding all other factors constant.

Further results from the table show that government effectiveness has significant positive impact on ICT investment among rural banks in the Ghanaian economy, in conformance to hypothesized outcome and conclusion by [Jerbashian and Kochanova \(2015\)](#). This means that, as governance delivery improves in the Ghanaian economy, its cascading effects are felt by the rural banks; this could result in the development of rural banks and increased level of

investment in ICT, all other factors held constant. For regulatory quality, the results from the estimates indicate a significant negative nexus, a result that goes contrary to the *a priori* expectation. That is, regulatory quality is found to exert adverse impact on the level of investment in ICT among rural banks in Ghana. This could be explained by the kind and focus of regulatory measures pursued in the economy. In Ghana, most of the regulatory policies pursued are geared toward placing impediments on the development path of enterprises, especially for rural banks whose impact could be mostly misconstrued as negligible. Such measures therefore pose significant hindrance to growth and by extension, the extent of investment in ICT among rural banks, all things being equal. For the control variables, results show that GDP growth promotes investment in ICT by rural banks, whilst inflation on the other hand hinders the pace of investment in ICT by rural banks in Ghana, results that are in conformance to expectation.

Moderating influence of telecommunication development on the nexus between governance, regulations and ICT investment are shown in columns (4) and (5). In column (4), the results indicate that telecommunication development has a positive moderating impact on the effect of regulatory quality on ICT investment among rural banks in Ghana. This implies that in times of stringent regulatory measures, enhanced telecommunication network results in improvement of rural banks and increased levels of ICT investment, all things being equal. It also means that telecommunication development helps to lessen the adverse effect that is exerted on rural banks capacity to investment in ICT by stringent regulatory measures in Ghana. Again, in column (5), the results suggest that telecommunication development similarly has a positive moderating effect on the impact of government effectiveness on ICT investment among rural banks in Ghana. It implies that advancement in telecommunication network in Ghana promotes the positive effect of good governance delivery on ICT investment among rural banks.

4. Conclusion and policy implications

The study focused on examining the impact of relevant internal factors of rural banks, financial sector dynamics and other important factors on the extent of investment in ICT among rural banks in the Ghanaian economy. Data for the empirical analysis were compiled from relevant sources from 2014 to 2020. The empirical estimations were carried out with PW-PCSE approach.

Results from the empirical analysis indicate that bank size and ROA positively affect investment in ICT, suggesting that as rural banks increase their size of operations and earn more profit, the amount of they commit to expenditure on ICT equipment and software increases, all other things being equal. On the other hand, findings from the study reveal that liquidity risk pose an impediment to the extent of investment in ICT among rural banks in the Ghanaian economy. Further results from the empirical analysis show that telecommunication development positively affect ICT investment, implying that improvement in telecommunication networks has the potential to increase the amount of investment in ICT among rural banks in Ghana. However, contrary to expectation, as domestic credit to the private sector increases, signifying development of the financial sector, the amount of funds invested in ICT among rural banks decrease, all other factors held constant. Again, the analysis reveals that while government effectiveness improves the extent of investment in ICT, regulatory quality diminishes investment in ICT among rural banks in the Ghanaian economy. We also find that telecommunication development has significant positive moderating influence on the relationship between government effectiveness, regulatory quality and ICT investment among rural banks in Ghana.

The study provides significant policy implication for relevant stakeholders. First, the study adds to the literature on the discourse of rural banking and investment dynamics, specifically, investment in ICT. The study recommends that, for players in the rural banking industry in Ghana, attention should be given to measures that ensure growth in assets and profitability in

order to improve their investment in ICT equipment and software, an important infrastructure in modern global environment. It is also recommended to the government, following conclusion of the study to enhance the delivery of good governance and implement policies that improve the telecommunication infrastructure and growth in GDP for increased level of investment in ICT. Policymakers are also advised to focus on regulatory measures that improve upon operations of rural banks for improved investment in ICT.

References

- Adeusi, S.O., Dada, O. and Adeosun, O.A. (2018), "Effect of financial sector deregulation on economic growth of Nigeria", *International Journal of Academic Research in Business and Social Sciences*, Vol. 8 No. 9, pp. 1119-1132, doi: [10.6007/ijarbs/v8-i9/4685](https://doi.org/10.6007/ijarbs/v8-i9/4685).
- Agbolade, O.K. (2011), "Information and communication technology and banks profitability in Nigeria", *Australian Journal of Business and Management Research*, Vol. 1 No. 4, pp. 102-107, doi: [10.52283/nswrca.ajbmr.20110104a11](https://doi.org/10.52283/nswrca.ajbmr.20110104a11).
- Akter, A., Majumder, T.H. and Uddin, M.J. (2018), "Do capital regulation and risk taking behavior affect bank performance? Evidence from Bangladesh", *Asian Economic and Financial Review*, Vol. 8 No. 8, pp. 1042-1074, doi: [10.18488/journal.aefr.2018.88.1042.1074](https://doi.org/10.18488/journal.aefr.2018.88.1042.1074).
- Alimi, A.S. and Adediran, I.A. (2020), "ICT diffusion and the finance-growth nexus: a panel analysis on ECOWAS countries", *Future Business Journal*, Vol. 6 No. 16, doi: [10.1186/s43093-020-00024-x](https://doi.org/10.1186/s43093-020-00024-x).
- Almaw, S. (2020), "The effect of bank regulation on the banks performance: a literature review approach", *Global Scientific Journals*, Vol. 8 No. 7.
- Alshubiri, F., Jamil, S.A. and Elheddad, M. (2019), "The impact of ICT on financial development: empirical evidence from the Gulf cooperation Council countries", *International Journal of Engineering Business Management*, Vol. 11, doi: [10.1177/1847979019870670](https://doi.org/10.1177/1847979019870670).
- Aluko, O.A. (2020), "The foreign aid-foreign direct investment relationship in Africa: the mediating role of institutional quality and financial development", *Economic Affairs*, Vol. 40 No. 1, pp. 77-84, doi: [10.1111/ecaf.12386](https://doi.org/10.1111/ecaf.12386).
- Aluko, O.A. and Ibrahim, M. (2021), "Institutions and financial development in ECOWAS", *Journal of Sustainable Finance and Investment*, Vol. 11 No. 2, pp. 187-198.
- Asongu S.A. and De Moor, L. (2017), "Financial globalisation dynamic thresholds for financial development: evidence from Africa", *European Journal of Development Research*, Vol. 29 No. 1, pp. 192-212.
- Asongu, S.A. and Kodila-Tedika, O. (2016), "Fighting African conflicts and crimes: which governance tools matter?", *International Journal of Social Economics*, Vol. 43 No. 5, pp. 466-485.
- Bagh, T., Khan M.A. and Razzaq, S. (2017), "The underlying impact of risk management practices on banks financial performance: an empirical analysis on financial sector of Pakistan", *International Journal of Research in Business Studies and Management*, Vol. 4 No. 7, pp. 10-23.
- Bailey, D. and Katz, J.N. (2011), "Implementing panel corrected standard errors in R: the PCSE Package", *Journal of Statistical Software*, Vol. 42 No. CS1, pp. 1-11, doi: [10.18637/jss.v042.c01](https://doi.org/10.18637/jss.v042.c01).
- Barseghyan, L. (2008), "Entry costs and cross-country differences in productivity and output", *Journal of Economic Growth*, Vol. 13 No. 2, pp. 145-167, doi: [10.1007/s10887-008-9026-6](https://doi.org/10.1007/s10887-008-9026-6).
- Baum, C.F., Caglayan, M. and Xu, B. (2021), "The impact of uncertainty on financial institutions: a cross-country study", *International Journal of Finance and Economics*, Vol. 26 No. 3, pp. 3719-3739, doi: [10.1002/ijfe.1983](https://doi.org/10.1002/ijfe.1983).
- Beck, N. and Katz, J.N. (1995), "What to do (and not to do) with time-series cross-section data", *American Political Science Review*, Vol. 89 No. 3, pp. 634-647, doi: [10.2307/2082979](https://doi.org/10.2307/2082979).
- Binuyo, A.O. and Aregbeshola, R.A. (2014), "The impact of information and communication technology (ICT) on commercial bank performance: evidence from South Africa", *Problems and Perspectives in Management*, Vol. 12 No. 3, pp. 59-68.

- Brynjolfsson, E. and Hitt, L.M. (1998), "Beyond the productivity paradox", *Communications of the ACM*, Vol. 41 No. 8, pp. 49-55, doi: [10.1145/280324.280332](https://doi.org/10.1145/280324.280332).
- Buchak, G., Matvos, G., Piskorski, T. and Seru, A. (2018), "Fintech, regulatory arbitrage, and the rise of shadow banks", *Journal of Financial Economics*, Vol. 130 No. 3, pp. 453-483, doi: [10.1016/j.jfineco.2018.03.011](https://doi.org/10.1016/j.jfineco.2018.03.011).
- Cameron, A.C. and Trivedi, P.K. (2009), *Microeconometrics: Methods and Applications*, Cambridge University Press, Cambridge, UK.
- Chowdhury, S. (2006), "Investments in ICT-capital and economic performance of small and medium scale enterprises in East Africa", *Journal of International Development*, Vol. 18 No. 4, pp. 533-552, doi: [10.1002/jid.1250](https://doi.org/10.1002/jid.1250).
- Computer Economics (2019), "IT spending & staffing benchmarks 2018/2019".
- Dewan, S. and Ramaprasad, J. (2014), "Social media, traditional media and music sales", *MIS Quarterly*, Vol. 38 No. 1, pp. 101-128, doi: [10.25300/misq/2014/38.1.05](https://doi.org/10.25300/misq/2014/38.1.05).
- Draca, M., Sadun, R. and Van Reenen, J. (2006), "Productivity and ICT: a review of the evidence".
- Eferakeya, E.I. and Erhijakpor, A.E.O. (2020), "Determinants of operating efficiency of Nigeria's banking sector", *Palarch's Journal of Archaeology of Egypt/Egyptology*, Vol. 17 No. 7, pp. 13151-13166, ISSN 1567-214x.
- Fabritz, N. (2015), "Investment in ICT: determinants and economic implications (No. 60)", *ifo Beiträge zur Wirtschaftsforschung*.
- Fuster, A., Plosser, M., Schnabl, P. and Vickery, J. (2019), "The role of technology in mortgage lending", *The Review of Financial Studies*, Vol. 32, pp. 1854-1899, doi: [10.1093/rfs/hhz018](https://doi.org/10.1093/rfs/hhz018).
- Garicano L. and Rossi-Hansberg E. (2006), "Organization and inequality in a knowledge economy", *Quarterly Journal of Economics*, Vol. 121 No. 4, pp. 1383-1435, doi: [10.1162/qjec.121.4.1383](https://doi.org/10.1162/qjec.121.4.1383).
- Horvey, S.S. and Ankamah, J. (2020), "Enterprise risk management and firm performance: empirical evidence from Ghana equity market", *Cogent Economics and Finance*, Vol. 8 No. 1, 1840102, doi: [10.1080/23322039.2020.1840102](https://doi.org/10.1080/23322039.2020.1840102).
- Jaara, B.O.A. (2021), "Political instability and banks performance in the light of arab spring: evidence from GCC region", *International Journal of Financial Research*, Vol. 12 No. 3, pp. 284-299, doi: [10.5430/ijfr.v12n3p284](https://doi.org/10.5430/ijfr.v12n3p284).
- Jain, P.K., Kuvvet, E. and Pagano, M.S. (2017), "Corruption's impact on foreign portfolio investment", *International Business Review*, Vol. 26 No. 1, pp. 23-35.
- Jerbashian, V. and Kochanova, A. (2015), "The impact of doing business regulations on investments in ICT", *UB Economics Working Paper 2014/313*, Vol. 50 No. 3, pp. 991-1008, doi: [10.1007/s00181-015-0953-8](https://doi.org/10.1007/s00181-015-0953-8).
- Karim, A.J. and Hamdan, A.M. (2010), "The impact of information technology on improving banking performance matrix: Jordanian banks as case study. European", *Mediterranean and Middle Eastern Conference on Information Systems (April 12-13)*, Abu Dhabi, UAE.
- Kirui, O.K., Okello, J.J., Nyikal, R.A. and Njiraini, G.W. (2013), "Impact of mobile phone-based money transfer services in agriculture: evidence from Kenya", *Quarterly Journal of International Agriculture*, Vol. 52 No. 2, pp. 141-162.
- Law, S.H. and Azman-Saini, W.N.W. (2012), "Institutional quality, governance, and financial development", *Economics of Governance*, Vol. 13 No. 3, pp. 217-236, doi: [10.1007/s10101-012-0112-z](https://doi.org/10.1007/s10101-012-0112-z).
- Leckey, Q.T.Y.L., Osei, K.A. and Harvey, S.K. (2011), "Investments in information technology (IT) and bank business performance in Ghana", *International Journal of Economics and Finance*, Vol. 3 No. 2, pp. 133-142.
- Liao, D. and Valliant, R. (2012), "Variance inflation factors in the analysis of complex survey data", *Survey Methodology*, Vol. 38 No. 1, pp. 53-62.
- Majumder, T.H. and Li, X. (2017), "Bank risk and performance in an emerging market setting: the case of Bangladesh", *Journal of Economics, Finance and Administrative Science*, Vol. 23 No. 46, pp. 199-229, doi: [10.1108/jefas-07-2017-0084](https://doi.org/10.1108/jefas-07-2017-0084).

- Oesterreich, T.D. and Teuteberg, F. (2018), "Why one big picture is worth a thousand numbers: measuring intangible benefits of investments in augmented reality based assistive technology using utility effect chains and system dynamics", *Information Systems and e-Business Management*, Vol. 16 No. 2, pp. 407-441, doi: [10.1007/s10257-017-0367-6](https://doi.org/10.1007/s10257-017-0367-6).
- Ogunyomi, O.O. and Obi, E. (2016), "Information and communication technology investment and firm productivity: evidence from the Nigerian banking industry (2005-2013)", *Research Journal of Finance and Accounting*, Vol. 7 No. 8, pp. 47-59.
- Okibo, B.W. and Wario, A.Y. (2014), "Effects of e-banking on growth of customer base in Kenyan banks", *International Journal of Research in Management and Business Studies*, Vol. 1 No. 1, pp. 78-84.
- Oladejo, K.S. and Agbeja, O. (2012), "Information and communication technology: effect on profitability and survival of Nigerian commercial banks", *International Journal of Social Science Tomorrow*, Vol. 1 No. 3.
- Onay, C., Ozsoz, E. and Helvacioğlu, A.D. (2008), *The Impact of Internet Banking on Banks Profitability- The Case of Turkey*, Oxford Business and Economics Program, (June 22-24), St. Hugh's College, Oxford.
- Oyewole, O.S., Abba, M., Gambo, J. and Abam, I.A. (2013), "E-Banking and bank performance: evidence from Nigeria", *International Journal of Scientific Engineering and Technology*, Vol. 2 No. 8, pp. 766-771.
- Ozen, E., Letife, O., Grima, S. and Bezzina, H.F. (2014), "Investigating causality effects in return volatility among five major futures markets in European countries with a mediterranean connection", *Journal of Financial Management, Markets and Institutions*, Vol. 2 No. 2, pp. 207-220.
- Peace, N.N., Philip, S.C. and Abobmeh, O.S. (2018), "Impact of information and communication technology on the performance of deposit money banks in Nigeria", *International Journal of Management and Sustainability*, Vol. 7 No. 4, pp. 225-239, doi: [10.18488/journal.11.2018.74.225.239](https://doi.org/10.18488/journal.11.2018.74.225.239).
- Quinn, J.B. and Baily, M.N. (1994), "Information technology: increasing productivity in services", *Academy of Management Perspectives*, Vol. 8 No. 3, pp. 28-48.
- Sabherwal, R. and Jeyaraj, A. (2015), "Information technology impacts on firm performance", *MIS Quarterly*, Vol. 39 No. 4, pp. 809-836.
- Sassi, S. and Goaid, M. (2013), "Financial development, ICT diffusion and economic growth: lessons from MENA region", *Telecommunications Policy*, Vol. 37 Nos 4-5, pp. 252-261, doi: [10.1016/j.telpol.2012.12.004](https://doi.org/10.1016/j.telpol.2012.12.004).
- Schryen, G. (2013), "Revisiting IS business value research: what we already know, what we still need to know, and how we can get there", *European Journal of Information Systems*, Vol. 22 No. 2, pp. 139-169, doi: [10.1057/ejis.2012.45](https://doi.org/10.1057/ejis.2012.45).
- Solow, R.M. (1956), "A contribution to the theory of economic growth", *The Quarterly Journal of Economics*, Vol. 70 No. 1, pp. 65-94.
- Sundjo, F. and Aziseh, F. (2018), "An empirical investigation into the key drivers of economic performance in the CEMAC zone: a panel corrected standard errors approach", *International Journal of Business, Economics and Management*, Vol. 5 No. 6, pp. 189-200, doi: [10.18488/journal.62.2018.56.189.200](https://doi.org/10.18488/journal.62.2018.56.189.200).
- Suzuki, N., Olson, D.H. and Reilly, E.C. (2008), "Developing landscape habitat models for rare amphibians with small geographic ranges: a case study of Siskiyou Mountains salamanders in the western USA", *Biodiversity and Conservation*, Vol. 17 No. 9, pp. 2197-2218, doi: [10.1007/s10531-007-9281-4](https://doi.org/10.1007/s10531-007-9281-4).
- Vekya, J.M. (2017), "Impact of electronic banking on the profitability of commercial banks in Kenya", *Journal of Technology and Systems*, Vol. 1 No. 1, pp. 18-39.
- Waverman, L., Meloria, M. and Melvyn, F. (2005), "The impact of telecoms on economic growth in developing countries", *The Vodafone Policy Paper Series*, Vol. 3 No. 2, pp. 10-23.

Wiredu, Labaran, U.I., Nketiah, E. and Osibo, B.K. (2020), “The impact of information and communication technology (ICT) on rural banks management. A case study of atiwa-rural bank limited in Ghana”, *American Journal of Industrial and Business Management*, Vol. 10, pp. 1681-1706, doi: [10.4236/ajibm.2020.1010106](https://doi.org/10.4236/ajibm.2020.1010106).

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