

BIG DATA SECURITY CONCERNS AND COMMERCIAL BANK'S FINANCIAL MANAGEMENT PRACTICES AS BUSINESS INTERMEDIARIES: THE CALL FOR A THEORETICAL MODEL

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Abstract

Banks have invested heavily in e-commerce solutions to better play their intermediary role of providing funds for consumption and investment related transactions. This has inevitably brought about the phenomenon of big data which enables enhanced customer care services and targeted marketing for competitiveness. However, Big data and cloud based storage integration is a prime concern due to security threats and privacy challenges for customers. This study therefore focused on published literature related to big data security. The study concluded that there is need for scholars to develop additional theoretical frameworks upon which propositions at the abstraction level can be advanced and empirically tested as hypotheses. This study proposes a theoretical model to show the interplay of key factors for big data security. This is useful in the design and reconfiguration of big data infrastructure and policies addressing security and privacy concerns by e-commerce compliant banks.

Key Words: Big Data Security, Commercial Bank, Competitive advantage.

1. Introduction

The development of an efficient banking system is widely considered to be critical to nations especially through their capital formation ability necessary for national economic development. Commercial Banks provide financial services through their intermediation role of availing funds from savers to borrowers thus enabling consumption and investment related transactions to occur (San & Heng, 2013; Driga, 2006). Beside playing an intermediary role for individual customer and business enterprises, the financial management practices of commercial banks have implications to economic development of nations because of its correlation to financial deepening in a country (Otuori, 2013). According to Ongore, (2013), financial deepening implies increased ratio of money supply relative to Gross Domestic Product (GDP), thus stimulating investment, increased growth rate, job creation and enhanced standards of living for citizenry. However, commercial banks are only able to effectively play their role of mobilizing savings, capital accumulation and availing resources to growth inducing sectors such as manufacturing, only if they are profitable (Lee, *et.al.*, 2012).

Due to tremendous improvement in information and communication technology, trade and other business operations have now been globalized (World Bank, 2007). Accompanying this is the emergence of new international power brokers, who have changed the focus of environmental forecasting especially at the macro level (European Union, 2007). Moreover, availability of scarce resources in diverse corners of the world, and political decisions that have operationalised international institutions such as World Bank, International Monetary Fund and World Trade Organization, there has been increased interconnectedness of countries and liberalisation of markets, resulting in expansion of businesses from their home markets to foreign markets (Gbolagade, *et al.*, 2013; Jara&Esaith, 2012). The opening up of markets has facilitated easier exchange of factors of production and products at various stages in the production process. At the same time, globalization drivers such as progress in information technology has not only made it easier to source for goods and services, but has also facilitated rapid escalation of competition. The implication is that firms and especially those in the banking sector must contend with the new arrangement including the competitive pressures accessioned both by local and international firms (Brinkmsnn, *et al.*, 2010; OECD, 1994). Only the most competitive banks can survive a globalised business environment.

Globalization has also brought with it the emergence of e-commerce as a new frontier for local and international trade (Kinuthia&Akinnusi, 2014). Banks have as a result not only taken up the intermediary role, but has also invested heavily in e-commerce solutions over the last few years (Nath, 2013). In adopting e-commerce, banking practices have had to change in many ways to keep up with technology innovations, customer service preferences and the need for convenience in carrying out financial transactions without necessarily having to go to a conventional banking hall. Banks are now able to offer services such as deposits, money transfers, online bill payment and other conveniences such as faster account opening. This embracing of e-commerce by banks has therefore made it easier for people and institutions to pay for goods and services through websites or specifically designed smart technologies, without which, outsourcing phenomena, international trade and global value chains would be impossible (Callahan, *et al.*, 2013). Adoption of e-commerce has inevitably brought about the phenomenon of big data that is nothing new to international firms, but is now gaining popularity among smaller and medium sized firms due to cost reduction and ease of data management (Guerreiro, 2015).

2. Problem Statement

Accumulation of big data which are dataset measured in terms of volume, variety, velocity and value arises from the increasing number of data collected from various sources, such as bank transactions that would culminate in a credit or debit entry in a customer account (Curry, *et al.*, 2013). On the brighter side, amassing of big data by business intermediaries such as banks can enhance customer care services and targeted marketing, and thus a key dimension for companies and leading individual firms to gain an edge over their competitors. However, big data and cloud based storage integration continues to be a prime concern due to security threats for any organization and privacy challenges for customers who want to leverage public cloud services (Sagiroglu & Sinanc, 2013). According to Roy (2013) and Zeng, *et al.*, (2013), big data security breach through cybercrime may not only expose the banks to legal suits from clients, but may also negatively impact on a firm's competitiveness in the form of loss of customer confidence on a bank, pornography and violation of privacy, ransomware, botnets, eavesdropping, stolen business strategies and intellectual property. The effects of cybercrimes have therefore continued to negatively affect individual customers and banks in terms of identity theft, cyber bullying and stalking, denial of service attack that takes over a firm's online platform, computer viruses, transaction fraud, security costs and immense monetary losses (Hayashi, 2013;

Despite attempts by Abualloush, *et al.*, (2016) and Kuang (2011) studies seeking to explain the importance of adoption of electronic solutions, there still exist a debate about confidentiality, integrity and availability of big data and the performance of business intermediaries. A major challenge is that cloud based storage has facilitated data mining and collection. However, data stored in a storage medium, such as transaction logs and other sensitive information still have security concerns in that the auto-tiering method for big data storage does not keep track of data storage location. Moreover, a simple regular security check for datasets with big volumes of data cannot detect security patches for continuous streaming data. In the context of financial intermediaries such as banks, the effect of e-commerce is still not fully understood (Huang & Lee, 2013). Studies such the one by Kuang (2011) examined e-commerce capabilities and its influence on organization performance, but failed to take cognizance of the back-end intergradation. Another study by Zhu (2004) on e-commerce capabilities relied on Return on Assets as a measure of financial performance despite its limitation in ignoring an organization's debt vs equity capital structure. Several other studies have assessed the role of e-commerce on organizational performance, but have not examined financial management practices, nor demonstrated the mediation effect of strategic competencies and the moderating effect of laws and regulations at local and international level (Das & Teng, 2003). Many studies have also not analyzed a number of contextual factors using cross-sectional or time series data sets (Hernando & Nieto, 2006). Based on intensive review of literature, this study concluded that there is need for scholars to develop additional theoretical frameworks upon which propositions at the abstraction level can be advanced and empirically tested. Therefore, the current study proposes a theoretical model to show the interplay of dimensions of big data security and performance of business intermediary organizations in the context of commercial banks.

3. Review of Relevant Literature

3.1 Technology Adoption and Dimensions of Big Data Security

The Unified theory of acceptance and use of technology by Venkatesh, *et al.*, (2003) seeks to explain user intention to adopt technology and subsequent use behaviour. Oshlansky, *et al.*, (2007)

observed that the UTAUT is a robust theory with higher explanatory power on innovation acceptance as compared to other technology propositions. Venkatesh, *et al.*, (2003) study identified conducive factors as one of the constructs that impacts on an individual's perception and use behaviour, while Lee *et al.*, (2012) pointed out that bank consumers can individually choose between several platforms such as mobile phone, computer, automated teller machines, or visit to a conventional banking hall to conduct financial related transactions.

The resource based theory initially developed by Wernerfelt (1984) has been applied in seeking to explain a variety of phenomena including information systems (Santhanam & Hartono, 2003; Wade & Hulland, 2004). The Resource Based View (RBV) model identifies an organization's internal resources as a driver for obtaining competitive advantage. Peteraf, (1993) used RBV model to examine the relationship between Information Technology and e-commerce capabilities and firm performance. In line with studies by Lee *et al.*, (2012) the results were that e-commerce business value is more derived from a firm's internal skills and capability to align technological innovations to a firm's strategic objectives, rather than the adopted technology in itself. This position was also amplified by Powell, (2001) who argues that the focus of inquiry changed from the structure of the industry, that is, Structure-Conduct-Performance paradigm and Porter's five forces model, to the firm's internal structure, resources and capabilities. Since then, the resource-based view of (RBV) strategy has emerged as a popular theory of competitiveness (Wang, 2014). However, it has been argued that the RBV ignores the nature of market demand and only focuses on internal resources.

E-commerce capabilities have been modelled in four dimensions namely, information, transaction, customization and back-end integration (Zhu & Kramer, 2002). Information capability seeks to offer adequate and clear information about a firm's products through its online platforms and websites. According to Shah, *et al.*, (2007), firms endeavour to cost minimise its operational expenses by conducting online transactions capabilities, hence the second dimension that drives technology adoption by commercial banks. In seeking competitive advantage, organizations adopt e-commerce in order to enhance customer interaction efficiency through online registration, content personalization and real-time online support through the third dimension of customization capability (Zhu, 2004). Zhu and Kramer, (2002) further observes that the connectivity and open standard nature of data exchange over the internet allows the fourth dimension of e-commerce capability hence back-end integration that results in incorporated accounts for customers. According to Shah, *et al.*, (2007), effective deployment of e-commerce capabilities leads to enhanced organizational financial performance. Similarly, Merono-Cerda and Soto-Acosta, (2007) established a correlation between e-commerce capability allocation and strong financial performance of a business enterprise.

Various reviews have generated big data security determinants that have been recognized as common denominators among business enterprises that have adopted e-commerce. National Institute of Standards and Technology (NIST) Cybersecurity policy framework for instance has been developed to provide a guideline for risk based data security management processes including carrying out risk analysis on data to identify threat source, threat events, vulnerabilities, likelihood of occurrence and impact, before and proactively putting in place appropriate mitigation measures. Such measures include protecting transaction logs and data, validation and filtration of end-point inputs, securing distributed framework calculations, securing and protecting data in real time, protecting access control, encryption and granular auditing. Specific big data securing protocols include authentication through user name and password usage that seeks to establish whether the identity of the service users

and hosts are whom they claim to be. This process of identifying an entity differ from authorization, which relates to the level of permission that a user data, service, system is supposed to have. Authorization is therefore usually preceded by authentication, both of which aims at ensuring that data is protected from disclosure or modification. In addition to these two, there is also auditing that seeks to ensure that there is a permanent record of who did what at which time.

3.2 Financial Management Practices

Effective financial management is critical for business survival and growth (Banjoko, *et. al.*, 2012). For the banks, it is even more prominent because of the role they play as an intermediary and facilitator of trade. Without clear financial controls and targets linked to strategic objectives, a Bank and indeed any enterprise can under-perform, no matter how entrepreneurial and enthusiastic its owners, investors and staff are (McKinsey & Company, 2010). Moreover, the realities of the new world of super-fast communications, supply chain logistics and information network through which international trade is conducted, means that business intermediary firms, including Banks, must change their mind set and adopt new financial and management practices in order to survive and prosper in a globalised business environment. This means that they need to embrace proper financial management and practice good corporate governance and business transparency so as to gain the confidence and trust of their bankers as well as international customers (Tuan & Takahashi, 2009).

In many respects, financial management practices and policies are the most critical influences upon financial condition and hence competitiveness of a given enterprise (McKinsey & Company; 2010). It is through these practices and policies that a Bank can exert leverage especially when struggling with financial difficulties. As pointed out by citation financial Management practices and policies are central to the performance of an enterprise in the market place. A firm's response to changes in environmental factors is enabled through the formation of an effective financial strategy that in turn result financial health. Particularly amongst small businesses, it is not uncommon to discover businesses that are successful in sales and possibly in profitability terms, but who may be experiencing persistent and frequently terminal, cash-flow or liquidity difficulties (McKinsey & Company, 2010). This is most obviously due to the impact of unsustainably high rates of sales growth upon working capital and fixed asset requirements, that is, due to overtrading. Poor financial management practices allow such circumstances to develop difficult to redeem problems as warning signs go unnoticed or are misunderstood. For this reason, particular attention needs to be paid to financial reporting that might reveal or anticipate cash-flow problems.

Sound financial practices require a broad view of what is included amongst financial reporting practices. In this respect, both historical and future-oriented financial reporting practices should be fully implemented within a business enterprise (McKinsey & Company, 2010). This extends to the analysis and interpretation of historical financial statements. Also, related matters such as financial systems used, undertaking financial audits, availability of internal and external financial advice, and responsibility for financial decision-making are also core components in safeguarding the financial health of any enterprise and for purposes of competitiveness (IFC, 2010; Bankable Frontier Associates, 2009). The primary concern is with the preparation and use of general-purpose financial reports for financial management purposes within financial intermediaries such as Banks.

Around the world, many of the past studies on Banks financial reporting suggest that these are prepared predominantly by external accountants at annual intervals, and they normally comprise just

the balance sheet and the profit and loss statement (Lunati, 2007). The content and presentation of financial reports appear to be greatly influenced by taxation and corporate statutory reporting requirements. In some instances, there is evidence that entrepreneurs do not consider the financial reports they receive particularly useful for decision-making purposes. Other studies in relation to financial policies and the production of financial statements by Banks have been conducted in several parts of the world. The general purpose has mainly been to investigate the types of financial reports produced by Banks, the frequency of their preparation, and their perceived usefulness for management purposes and thus competitiveness (Tuan & Takahashi, 2009).

4 Task Environment

The external environment within which Banks operate consists of many variables which can influence an organization's ability to realize its objectives. Given the role of the banking system in the growth and development of national economies, governments through a myriad of agencies provide specialized programmes, projects and policies geared towards facilitating effective operations (Njeule, 2013). This regulatory climate for the banking sector as a whole influences Banks particularly in relation to compliance costs, technological upgrading, duration and predictability of the permitting process. According to Fink (2011), some of these factors within the task environment can be considered as moderators. For instance, Akanni, *et al.*, (2015) posits that the legal framework in an organization's task environment can be viewed through the set laws to regulate business operations. As a step towards crafting a viable strategy, banks must analyse and understand the following external environmental factors in the form of Political and legal, social cultural, technological and ecological factors (Rahman, 2012; Robson, 1997). These present opportunities, threats and constraints to an enterprise as it seeks to reposition itself for competitiveness in the face of big data security.

4.1 Political Factors

These are a major influence on banks' competitiveness as individual firms seek to maximize the benefits of available marketing opportunities (Nwankwo & Gbadamosi 2010; Kotler, 2007). Political factors are therefore a major consideration for banks as they formulate their competitive strategies. These factors define the legal and regulatory parameters within which banks must operate. Political constraints are placed on banks through legislations such as anti-monopoly laws, tax regimes, preferential trade agreements, minimum wage guidelines, pollution and pricing policies and other actions aimed at protecting employees, consumers, the general public and the environment (Corwin & Puckett, 2009). Other legal requirements for commercial banks include licensing requirements, corporate governance standards, capital adequacy requirement, anti-money laundering, liquidity management and foreign exchange exposure limits. Since such laws and regulations are most commonly restrictive, they tend to influence the potential profits and competitiveness of a banks (WEF, 2013). However, some political actions are designed to benefit the firms they influence. Such actions include patent laws, government subsidies and product research grants. Moreover, political activity also has a major impact on the supplier and customer functions. On the supplier fiction, government decisions regarding the accessibility of private business to government owned natural resources does affect profoundly the viability of the strategies adopted by banks in their intermediary role. Similarly, government demand for products and services can create, sustain, enhance or eliminate many market opportunities, many of which are facilitated through the banking system (WEF, 2013; Bankable Frontier Associates, 2009).

4.2 Economic Factors

Economic factors concern the nature and direction of the economy in which banks operates (Brinkmsnn, *et. al.*, 2010). On both the national and international level, a bank must consider the general availability of credit in the market, the level of disposable income, and the prosperity of people. Lending interest rates regulations, inflation rates, trends in the growth of the gross national product, and Gross Domestic Products are other economic factors a firm must consider (WEF, 2013). These are important because they influence the spending patterns and pricing decisions (Bankable Frontier Associates, 2009).

4.3 Social Factors

The social factors that affect a business enterprise include the beliefs, values, attitudes, opinions and lifestyles of persons in a bank and within its external environment, as developed from religious, ethnic and educational conditioning (Nwankwo&Gbadamosi, 2010). For instance, a profound social change in recent years has been the entry of large number of women into the labour market. This has not only affected the hiring, compensation policies and the resource capabilities of the employers, but has also created or greatly expanded the demand for a wide range of products and services necessitated by their absence from the home. Business enterprises that anticipated or reacted quickly to this social change offered such products and services as convenience foods, microwave ovens and day care centres (Storey & Westhead, 2007; Brinkmsnn, *et. al.*, 2010). All these are facilitated through the banking system. To Banks, this does not only imply keeping a grip on the changing social factors, but also appropriately pricing their products within the range that can be affordable to senior citizens in order to remain competitive.

4.4 Technological Factors

To avoid obsolescence and promote innovation, a bank must be aware of technological changes that might influence its industry (Rahman, 2012; OECD, 2004). Adoption of smart technologies can suggest possibilities for new products, for improvements in the existing products, or in marketing techniques. A technology breakthrough can have a sudden and dramatic effect on banks' environment. It may spawn sophisticated new markets and products or significantly shorten the anticipated life of an existing technology. Thus, all banks must strive for an understanding of both the existing technological advances and the probable future innovations that can affect their products and services. This quasi science of attempting to foresee advancement and estimate its impact on a bank's operation is known as the technological forecasting (Rahman, 2012). Technological forecasting can help protect banks from big data security challenges, and also improve profitability in growing industries. It alerts banks to both impeding challenges and promising opportunities. The key to beneficial capabilities and their probable impacts requires a comprehensive analysis of changing nature of cybercrimes, the study of the expected impact of new technologies on the remote environment, on the competitive business situation and on the business-society interface (Bos-brouwers, 2010).

4.5 Ecological Factors

The most prominent factors in a firm's external environment are often the reciprocal relationship between business and the ecology (EU, 2005; OECD, 2004). The term ecology refers to

the relationships among human being and other living things, the air, soils and water that support them (Chinedu, 2013). Threats to life's supporting ecology caused principally by human activities in an industrial society are commonly referred to as pollutants. This is more so because the global climate has been changing for ages. However, it is now evident that humanity, due in part to ozone layer depletion, causes global warming. Solar radiation that is normally absorbed into the atmosphere reaches the earth's surface, heating the soil, water and air. Hence the need to have sustainable use of environmental resources. To banks, environmental legislations impact on corporate strategies worldwide. Some enterprises fear the consequences of high restrictions and costly environmental legislations. However, many business view these new controls as an opportunity for capturing markets with green innovative products that help customers satisfy their own regulatory standards, thus creating an opening for banks to play their intermediary role.

5. The Call for a Theoretical Model

This study reviewed extensive literature related to big data security in the context of commercial banks. The study established that commercial banks have invested heavily in e-commerce solutions to better play an intermediary role in facilitating trade. This has inevitably brought about the phenomenon of big data which enables enhanced customer care services. However, existing protocols have not fully ensured immunity of big data to security threats and vulnerabilities. This study therefore proposes the following theoretical model to show the interplay of relevant factors for big data security upon which propositions at the abstraction level can be advanced and empirically tested as hypotheses

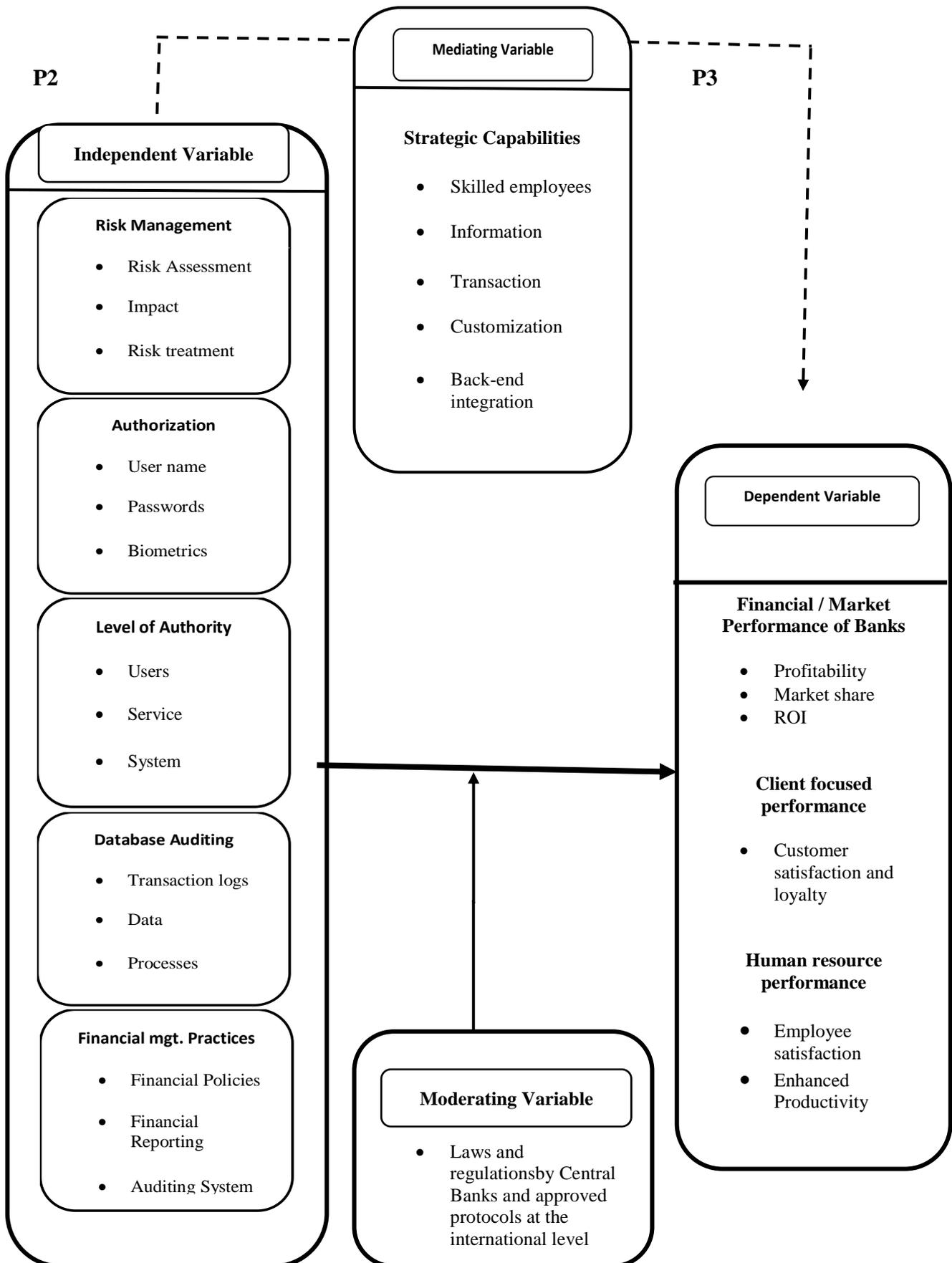


Figure 1. The conceptual framework of big data security indicators, strategic capabilities and performance of Commercial Banks.

5.1 Propositions

5.1.1 Indicators of Big Data Security

E-commerce has become the new frontier for local and international trade in a globalised and hyper competitive business environment. Commercial banks have as a result invested heavily in e-commerce solutions to better play its intermediary role. This has inevitably brought about the phenomenon of big data for competitive advantage, but at the same time security concern and privacy challenges for customers. Consistent with several empirical findings discussed in this paper, it is important to link indicators of big data security and performance of commercial banks. Thus the study proposes that:

Proposition 1(P1): *Indicators of big data security determines performance of Banks but moderated by the regulatory framework.*

5.1.2 The role of Strategic Capabilities

An effective strategic choice positions an organization towards achievement of its objectives. Effective organizations therefore continuously scan both internal and external environment to predict future trends, seize opportunities, and shape market direction through employing indicators of competitiveness and making use of strategic assets. From both empirical and theoretical literature reviewed above, strategic competences have a positive and significant effect on SME performance. Based on this, the study proposes that:

Proposition 2 (P2) & 3 (P3): *Strategic capabilities mediates the relationship between big data security indicators and performance of commercial Banks.*

5.1.3 The role of Regulatory Framework

Regulatory framework is the environment in which businesses operates and which can directly or indirectly impact on Bank operations (Gonzalez-Torre & Adenso-Diaz, 2010). From the theoretical framework, the dotted line P3 moderates influence of big data security indicators on the performance of Commercial Banks. Consistent with both conceptual and empirical literature reviewed in this study, it is important to link the adopted regulatory framework and performance of Banks. Thus the study proposes that:

Proposition 4: *Regulatory Framework moderates the relationship between big data security indicator and performance of Commercial Banks.*

6. Conclusions

The objective of this theoretical study was to review existing literature to identify gaps on issues of bog data security, strategic competencies, regulatory framework and performance in the context of Commercial Banks and finally propose a conceptual model providing propositions for filling up the identified gaps. This is useful in the design and reconfiguration of big data infrastructure policies and programs addressing security and privacy concerns, and also in coming up with capacity

building guidelines and standard operating procedures that focuses on identification, analysis and management of risk by an e-commerce compliant bank.

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