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INFORMATION AND COMMUNICATION TECHNOLOGY, BOARD ATTRIBUTES AND CORPORATE PERFORMANCE

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ABSTRACT: *Effectiveness and efficiency are goal congruences that are primacy to the heart of capital users, to achieve these, information communication and technology (ICT) is in the center of gravity that can enhance these goals. Hence, the study investigates empirically the nexus between ICT investment, board traits and corporate performance. Multivariate regression and panel data regression tools are used to dissect the presumed direct link between the firms' performance (FP), ICT investment and the moderating influence board attributes. The result shows in three fold findings, firstly, there is adverse linked between firms' performance and ICT investment, secondly, there are also adverse association between board size (BS), board independent(BI) and while on the other side, there are positive link between, nonexecutive directors, board gender diversity (BGD), firm size and firms' performance, lastly, there are significant improvement of the moderating influence of board size, board independent, BGD on the connection between investment in ICT and firms' performance, while there is adverse effect on firms' performance when nonexecutive directors interacts the nexus between investment in ICT and firms' performance. Thus, the study concludes close monitoring of board traits can bring about enhancement of corporate performance when investing in ICT technologies.*

KEYWORDS: board attributes, firms' performance, ICT investment, Information, Communication Technology (ICT).

INTRODUCTION

The primacy of computer technologies and the internet are crucial which has brought about drastic changes in business transactions in the digitized world. One of the critical success factors in the global village, which corporate firms must take advantage of the new information technology (IT), especially internet and globalization (Ayatse, 2006). In this ICT era, the digital ages have led to complexities in corporate operations. Information technology and management, therefore plays a crucial role to the extent that quick access to information could enhance goal congruence, while improper management of information could lead to huge problems and losses of opportunities.

ICT architectures have radically changed firms and industries, becoming the largest component of capital investment in many industrialized societies. Information systems are transforming business and the visible results of this include wireless telecommunication devices and the increased deployment of ICT has boomed e-commerce and e-administration. Laudon and Laudon (2007) argue that these changes have brought about the uprising of the digital firm, a firm in which; most of the firm's significant business relationships with stakeholders are digitized. Information system (IS) is important and necessary for conducting daily transactions and business which enhances achievement of strategic corporate intents.

It is in acknowledgement of the strategy of ICT, corporate governance (CG) and corporate performance (CP) of any economy and the need for the diffusion of information on influences of ICT which led to an increased awareness of the value of information systems in Nigerian business and Industries. However, concerted effort to match this increased awareness with profitability of ICT investments of the campaign have been reduced giving rise to an information gap.

Board attributes are part of corporate governance, which is a framework that is ultimately used to control and guide by the organizations. Top managerial staff is responsible for the governance of organizations. Cadbury Report (1992) opines that corporate governance which agrees with their components guarantees that enterprises get a return based on their ventures (Shleifer & Robert 1999). Board attributes are inherent in corporate governance, CG is concerned with monitoring the corporate entities. The board trait protects the interests of all the stakeholders from deprivation. Which play a major role toward stability in terms of economics and enhance the corporate performance of businesses. These board features set a public policy objective. It reduces the vulnerability of the financial crises.

Ganeshkumar and Nambirajan (2013) cite that firm performance was measured by the following measurements: Market share, Sales growth, Profit margin, Average selling price, revenue per employee, Overall product quality, Return on investment, overall competitive position, and profit per employee and the Return on turnovers. The method for measuring firm performance can be divided into two categories which are financial measures and non-financial measures. Alternative, firm performance was proxied by strategic measures and financial measures. Non-financial measures include aspects such as employee satisfaction, customer satisfaction, social performance, environmental performance, efficiency, economic effectiveness and relevance. In line with the above literature, financial measures and non-financial measures will be adopted to proxy corporate performance in this study. Ertugrul and Hegde, (2009), Javid and Iqbal, (2009), Zubaidah, Nurmala, and Kamaruzaman, (2009) these studies have inconclusive or mixed conclusion on the dearth of few researches on the evolving economy in the domain of ICT and firm performance by moderating the established nexus with board attributes, hence, this study intend to harness on the dearth empirical dissection in this sphere of study

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Concept of ICT

Information and Communication Technology can simply be defined in its simplest form as an electronic medium for creating, storing, manipulating, receiving and sending information from one place to another. It makes message delivery faster, more convenient, easy to access, understand and interpret. It uses gadgets such as cell phones, the Internet, wireless network, computer, radio, television, Satellites, base stations etc. These resources are used to create, store, communicate, transmit and manage information.

Information Technology (IT): The technological side of Information System is named Information Technology. Thus, IT is only the assemblage of computing arrangements used by an organization which includes hardware gadgets, software applications, databases domains, webs domains and further electronic networking devices (Turban & McLeanm 2004). As wide as its application, ICT technology has a diverse impact in a firm. Literature in this field is rapidly growing in number and each focus on different aspects of ICT. To classify this literature, there is a communication concept.

Concept Communication:

Communication is the process in which information is shared from one end to another. Information has been passed when a receiver comprehends what the sender intended and decoded it. The main concept of communication is that it requires a sender, a message, and a receiver for it to be most effective. The idea behind communication is not only to share information, but to make sure that information is understood by the receiver. There are the three concepts of communication that are associated with communication, which are the sender-message-receiver. These are also known as the information, encoding, and decoding processes respectively. The first concept is where you communicate something to someone through a medium. The second is transforming your thoughts into symbols or linguistic forms that can be understood by others for example writing or speaking. The final concept is where the receiver must decode the message using their cognitive skills and understanding to determine what was sent.

Communication is a key process in the survival of an organization, whether it be a small business or an international conglomerate. In order to get things done and get on the same page, people have to communicate effectively. Here are five concepts that will help you understand how communication works within organizations: Communication model, Cultural differences, Communication channels, Organizational climate and Organizational structure. Hence, Communication is an important key to success in any business. It can be difficult for some people, but it does not have to be if you follow these tips on how to communicate effectively.

Communications using ICT technology can involve one or several IT-supported media, such as text, voice, graphics, radio, pictures, and animation. Using different media to improve efficiency and the effectiveness of a message sent. The expedited learning also enhances problem solving (Bouwman & Hoof 2005). Examples of ICT applications which fulfill this role are: - Internal and external networks (such as tcp/ip, LAN or other networks) - Electronic

Mail - Web-Based Call Centers – Multimedia call centers - Electronic boardroom - Call centers - Electronic Chat Rooms - Voice Communication - Weblogging (Blogging) - Electronic meeting systems - Interactive whiteboards – allows different users to simultaneously write on the whiteboard - Screen sharing software – allows different users to work on one document which is separately visible for every user - Electronic teleconferencing (video teleconferencing, web conferencing). ICT improves the speed of communication significantly in firm performance.

Concept of Information:

Information is processed, organized and structured data. It provides context for data and enables the decision making process. ICT applications continuously deal with data. It continuously conducts activities on data. These processes are divided into two: first level and second level processing. First level processing includes all the initial activities done to data. ICT applications belonging to this role store, conduct simple operations, protect, update and retrieve information. After receiving data, the initial step is to store it (Johannessen 1999; Tarafdar, 2007). Simple operations such as ordering, organizing, categorizing, summarizing, etc. follow (Attewell and Rule 1984). In this way the information would be easily accessible and much faster. Being able to retrieve this information is another first level process. Security of the data (protection from viruses, external access, hacking, etc) is essential for any data.

Examples of ICT applications attributed to this role are: - Standalone software such as spreadsheet, excel, word, etc - Databases (including online databases) - Data warehouses - are repositories of an organization's electronically stored data (adopted from Wikipedia). Data warehouses are designed to facilitate analysis and reporting (Inmon 1995). - Anti-viruses - Anti-hack - Backup systems - Electronic signature - Data encryption software – Firewalls. ICT has enabled storage of data. With improvement in this technology the storage capacity has also increased using large data warehouses. Security of the data is ensured through ICT applications. This security protects the data against viruses, hack and external access. This issue is of great importance since it is related to confidentiality of information which cannot be accessible to all. In addition, providing back-ups preserves the data. Speed of information retrieval is increased by ICT usage (Huber, 1990 in Johannessen 1994). Data is digitally stored and categorized; information processes will be conducted more quickly (Brynjolffsson, 1993).

Concept of Corporate Performance

The comparison of the performance of different indices of corporations is easily facilitated where measurement of performance is visible. These could be intra and inter industries or corporations evaluations or a different time, is a function of precise measurement metrics (Al-materi, et al., 2014). The view of Kiel and Nicholson (2003) on the performance of companies is evident in the numbers of embryos of research on CG, executive remuneration, CSR, earnings management does consider both market-based, balanced scorecard measures and accounting-based measures. However, there are divergent views and perceptions on the reliability, validity and representability of the pragmatic evidence that the connection between the measures of corporate performance attributes are affirmed inconclusive. Hence, no definite performance metrics with the capacity to accurately measure every single performance aspect

of a functional organization has been recommended by (Snow & Herbiniak, 1980), that the most used ones were market-based measures and accounting-based measures.

Performance measurement deployed by the previous studies is another critical issue. Most of these extant literature used ROA, ROE and Tobin Q, (Ataay, 2018; Basu, Hwang, Mitsudome, & Weintrop, 2007; Finkelstein & Boyd, 1998; Gomez-Mejia *et al*., 2003; Werner *et al*., 2005). The measures are accounting-based measures and market-based measures. But this study introduced and used market-based measures, and responsibility accounting measures. We perceive these measures are more efficient than the previous ones.

Responsibility Accounting (RA)

Performance measurement in the contemporary business environment has moved away from conventional accounting and market based on Activities Based Costing (ABC) and Responsibility Accounting (RA) of evaluating the remuneration of employees in corporate companies. Existing literature has comprehensively established on the practical and theoretical aspect of profit Per employee (ppey) and revenue per employees (rpey) as a performance measurement that is more evident of evaluating efficiency vis-à-vis investment in ICT (Berman, 2010, Bryan, 2007; Levy, 2007; Lichtenstein et al. 2010; Ilic, 2012; Gauri, 2013; Teng, 2014, McGoldrick, 2002). Revenue per employee and profit per employee have been affirmed in practice as performance measurement and employee productivity metrics. Investigation has revealed that in order to compute these performance metrics, the following factors which affect them are sales revenue, number of employees and earnings before interest and tax (Lukic, 2015). The measurement provides the basis to anticipate and take appropriate measures to increase revenue and profit per employee, as a very significant indicator of operational efficiency that can respond proportionally to investment ICT in corporate entities (Yuan, Hua, & Junxi, 2008).

In sum, both accounting-based and stock market-based measures have adequate use in the literature but, revenue and profit per employee as a performance metrics have not been domesticated empirically, which has been the choice of this study.

Concept of Corporate Governance

CG has inexhaustible potential apparatus since its introduction into the corporate world over three decades (Zhang, Fan, & Wang, 2012). The frequent fraudulent activities, inevitably resulting in the collapse of blue-chip companies in the late nineteenth century, and the early twentieth century are as a result of the most dysfunctional of CG apparatus. Where functional and sound CG is in existence and being in operation, it enhances corporate organization to flourish in its going concern fit.

Therefore, the CG mechanism is institutionalized measure, controls, rules, regulations etc., that are prescribed by the stakeholders to be installed into corporate entities' systems in order to improve optimal utilization of resources in the best interests of these legitimate stakeholders, thereby minimizing managerial opportunism (Gunasekhar & Dinesh, 2017), and parochial attitude of executive officers that is always detrimental to corporate goals congruence (Babatunde & Olaniran, 2009).

Nowadays, corporations have affirmed the interconnectivity of CG structures and CSR with the evidence of substantial and positive influence which they have on each other (Sharif & Rashid, 2014). This shows that the application of CG brings about influence in organizational activities and invariably affects the economic well-being of stakeholders where the corporation domiciled.

The Nigerian code of CG was issued by the Securities and Exchange Commission (SEC) in 2011 in order to align corporate entities in the country with the best practices of doing business that are acceptable globally (Ibadin & Dabor, 2015). CG is the edifice of rules, guidelines, practices, processes and procedures by which corporate organizations are directed and meticulously organized. It fundamentally involves the ways and manner of striking balance within the interests and stakes of a company's diverse stakeholders, such as shareholders, management, customers, creditors, investors, government and the public. It is an interesting area for experimental research among academics and practitioners in recent times. Series of definitions has been provided to facilitate understanding and meaning of CG.

According to Magdi and Nedareh (2002) CG is everything about the daily routine operation of an organization to guarantee that its stockholders receive reasonable earnings on their investment, especially investment in ICT, while the expectations of other stakeholders are also met. Likewise, CG defines the way companies are managed, directed and controlled (Collier & Hoeffler, 2005) and the stake of the non-controlling group can be protected, and other allied interests (Odia & Ogiedu, 2013). In the light of the above meaning, we see CG as the building block of corporate organizations as well as the motivation of good employee behaviour as a result of a good package of compensation for the employee. The organization targets effective and functional CG as a means of striking balance amongst stakeholders' legitimate stakes in the organization, and the critical success factor is quantum investment in ICT in the digital economy.

CG has the background of guidelines and structures that the board of executive directors employ to confirm transparency, fairness, and accountability in the corporate organization with its all inclusive stakeholders with a target to facilitate effective, entrepreneurial and prudent management that can deliver a successful future of perpetuity of the corporate entity. The target and achievement of CG is the welfare of all-inclusive stakeholders. Substantial numbers of past studies had a proxy, CG mechanism differently, according to Dharmastuti and Wahyudi (2013) divided corporate governance proxy into external and internal apparatuses. The goal of the study is to use board characteristics as a moderating apparatus of the nexus between CP and ICT investment. The CP system in a firm is likened to the internal control system developed by management. Hence, corporate governance entails rules, regulations, procedures, measures and mechanisms set up by the organized external bodies of stakeholder with the aim of ensuring the enhancement, optimal utilization of firm resources by the managers in order to harmonize and converge the diversity of interest in consonance with goal congruence.

Therefore, several empirical studies have shown that CG apparatuses are crucial in the determining, monitoring and moderating performance and ICT investment (Main & Johnston, 1993; Williamson, 1985; Jensen, 1993).
The choice of the CG proxy used in the study is informed by the facts adduced from existing literature. There has been much emphasis on the crucial roles of board structures in public

firms, in the areas of discipline, monitoring and coordination, in order to impair the excessive managerial prowess in the firms' administration. Moreover, the important role in potentially illuminating the agency problem that exists between principals (shareholders) and agents (managers). Where there is an absence board structure, this would allow executive directors to single-handedly write their employment contracts and sign them with others at the detriment of investors' interest (Williamson, 1985).

Hypotheses Development
ICT Investment and Corporate Performance

ICT investment is the asset acquisition in IT tangible assets and technologies infrastructure. ICT is a compound term which consists of any computer and network communication device and application, hardware, mobile phones, software, the Internet, satellite systems, human wares, and so on. As ICT becomes complex, the investment cost includes maintaining and repairing costs and manpower training cost (Chari et al., 2008; Kobelsky et al., 2008). The ICT investment also connotes where corporate entities have in-house IT design and development ICT facilities such costs are characterized as capital expenditure. According to Marrano et al (2009) categorized ICT investment as tangible and intangible equipment. Some scholars like Graham, (1999) are of the opinion that ICT investment technologies as a capital investment does not automatically enhance corporate performance. This is because capital users do not intend to adopt such investment for the corporation on a long term basis. Likewise, Dutta et al., (2003) discovered from his findings that among countries sampled, ICT investment apparatus is not adequately sufficient to enhance or yield high corporate performance or high performance. As a result of inconclusive findings of nexus between CP and ICT investment in extant literature, we develop the following alternative hypothesis:

Hypothesis 1 : ***ICT investment has significant connection with corporate performance***

Denis and McConnell, (2003), Ho, Wu, and Xu, (2011) have dissected CG apparatuses, and discovered that these followings apparatuses: size of the board, independence of the board, board gender diversity and nonexecutive directors were to be consistently crucial influential in ICT decision across countries.

Board Independence moderates the connection between ICT investment and corporate performance.
Many empirical studies have agreed on the cruciality of independent directors to the success of companies. Elloumi and Gueyié (2001) opined that corporations with a high ratio of nonexecutive directors in a board of directors' face less frequent financial pressure. In addition, companies with several independent directors have had lower likelihood of filing for liquidation when a business environment worsens (Daily, Dalton & Cannela 2003). Board independence is also an important variable. The key element of an effective board is to have a majority of an independent outsider's involvement. This means the greater the number of outside members the better.

Our study findings found that around 68.08% on average of the corporate entities during the years 2007-2011 their board of directors were not controlled by more than 50% independent directors for the firm. This means that more than half of the corporate entities in the data

selected were not applying the board independence strategy. An independent outsider was described as an individual who has never worked at the corporation and has no relationship to any of the employees, customers or any service providers such as accountants, investment bankers, lawyers, etc. Unfortunately, this is misapplied in reality because the "outsider" label is often given to a retired CEO or a family member where in fact an insider with interest conflicts. Besides, few outside board members provide a low level of CP to shareholders leading to less independent board members especially if there is no separation of the positions between the chairman and the CEO.

Board independence connotes a high percentage of outside directors (not employees) to the number of inside directors (employees). The influential potency of board of directors has been established in extant literature that boards' influence ICT decision in both indirect and direct ways. Kor, (2006) opined that the authorized, approval and monitoring ICT investments have been carried out by the board because of its significant and strategic impulse, this is direct influence. On the other side, the indirect is associated with the monitor ICT decision through meeting with external and internal auditors, to review financial statements and important corporate operation. (Bhagat & Black, 2002)

Dalton et al. (2003) and Wincent et al., (2008) argued that outside directors possessed independence and expert knowledge that enable better advisory roles and monitoring the firm innovation in ICT that give competitive edge. Hence, extant literature provided inconclusive findings associated with board independence improves corporate performance. Colecchia and Schreyer, (2002); Rahman, (2007) and Fredriksson, (2012) predicted that board independence has the capacity to alleviate the problem associated with agency problems and agency cost and enable ICT investment decisions that will enhance corporate performance. Thus, we formulate the following hypothesis in alternative form

Hypothesis 2: *Board Independence positively and significantly moderates the connection between ICT investment and corporate performance*.

Hypothesis 3: *Non Executive Director positively and significantly moderates the connection between ICT investment and corporate performance*.

Board Size moderates the connection between ICT investment and corporate performance.

Dalton and co-workers (1999; 2005) enumerated that the holistic duties of larger board size include first, greater collective information that enhance and lead to higher corporate performance. Second, larger boards have larger capacities of obligation to discipline, monitor and remove unproductive managerial teams. And last, big board size ensured that management team are not parochial in pursuance of opportunist behaviours, rather made them to pursue goal congruence of the firm, which result to pursue interest of the stakeholders that have legitimate interests. Lehn, Sukesh, and Zhao (2004) argued that the benefit of big board size included an increase in the number of non-executive directors which has the collective information that is greater and possessed by the board, which is also valuable for the monitoring function. Larmou, and Vafeas (2010) explain and predict an initial improvement in board performance as board size increases, and increases in the number of non-executives are expected to have a more

positive impact than increases in the number of executive directors. Hence, we formulate the following hypothesis in alternative form.

Hypothesis 4: *Board Size positively and significant moderates the nexus between ICT investment and corporate performance.*

Board Gender Diversity moderates the connection between ICT investment and corporate performance.

Gender diversity (GD) on a firms' board has been germane in the issue of board composition which has attracted attention from different stakeholders in the business community, the parties include government, academicians, corporate entities, and the general public. This premonition was initiated due to frequent occurrences of corporate scandals, such as WorldCom, Enron, Parmalat and Tyco, these have also strengthened the interest in the influence of gender diversity on corporate value and corporate performance (Carter *et al.,* 2003).

Brahma, Nwafor, & Boateng, (2021) said governments of different countries have responded that female's under representation on the board of corporate entities as a reform in the board composition, this has spurred increment of female forks in the boardrooms of different entities. These reforms started in the USA in the case of 2002 Sarbanes-Oxley Act, in 2017 United Kingdom government published the Hampton alexander report that the corporate entities to have 33% females in management team by 2020. Other countries that have mandated the increment statutorily include Norway, Spain, France, Belgium, Finland, Kenya and Germany.

Ahern and Dittmar, (2012) Matsa and Miller, (2013) Wang and Kelan, (2013) the outcomes of these researches after mandatory inclusion of females into board of corporate entities of the above countries. Studies evidence indicates that BGD proportion has led to the recruitment of a huge number of females that lack experience into management teams, and hence affect the corporate performance negatively. In contrast, but, the UK has implemented a voluntary approach scheme as against the compulsory quota-based approach. Where the internal mechanism of corporate entities to fashion out the number of female forks in board teams. The study evidence shows a direct influence on corporate performance. Hence, we hypnotized in an alternative form.

Hypothesis 5: *Board Gender Diversity positively and significant moderates the connection between ICT investment and corporate performance.*

THEORETICAL INSIGHTFUL

Dynamic capabilities theory:

The term "dynamic" refers to as "the capacity to renew competences so as to achieve harmony with the changes in the environment where business domiciled, this is relevant in situations where time to market is critical and the landscape of competition is difficult to determine". Capabilities are described as "the vital function of strategic management in appropriately integrating, adapting, and reconfiguring, external and internal organizational services, resources, and purposeful competences that commensurate the requirements of a changing in the domain of business environment". According to Beske, Land, and Seuring, (2014) explain

that the theory was initiated firstly to explain performance in corporate entities in ever-changing business environments, concentrating on the competences and proficiencies that corporate entities engage to influence competitive advantage. Therefore, in an attempt to maintain a competitive advantage over other firm; entities should employ ICT capabilities (ICT investment) to boost the CP that are advanced and in conformity with the emerging trends in ever-changing and operation.

ICT capabilities theory:

ICT can be described as a family of technologies used to process, store and disseminate information, facilitating the performance of information-related human activities, provided by, and serving both the public at-large as well as the institutional and business sectors (Salomon & Cohen, 1999). The role of ICT is viewed as critical within the economic challenges faced by government and businesses, whether small or large. The same applies to the field of insurance and financial services, ICT is highly fundamental to the competitiveness and overall success of financial institutions. The effective and efficient use of ICT provides companies with competitive advantage. In Supply Chain Management (SCM), ICT is highly regarded as a major enabler in achieving effective SCM. As a supply chain spans many organizations in delivering products to customers both upstream and downstream and many functional areas inside a business, the employment of IT allows companies to increase communication and coordination of various value adding accomplishments with their associates and between roles within their own operations (Simchi-Levi, Kaminski, Simchi-Levi, & Simchi 2003).

Knowledge based theory:

This perspective is common among corporate strategy theorists which see firm as a body of knowledge (Spender 1996). This perspective is an extension of the resource-based perception, where the resources of the company are considered to be knowledge. It emphasizes the importance of knowledge on combining different resources of the firm. Thus, in this perspective the existing knowledge is not per se important and rather the firm's ability to apply the existing knowledge to reach an optimum combination of resources is important (Alavi and Leidner 2001). Before this view was introduced, a firm's primary role was considered to be knowledge creation but according to this theory the primary role of a firm is rather application of knowledge (Kogut and Zander 1992). This is where information technology can play a major role in by effectively applying existing knowledge to create knowledge and take the first steps toward forming competitive advantage (Alavi & Leidner 2001). The knowledge of a company can be affirmed as possessing a portfolio of opportunities, or podia, on future developments. (Kogut & Zander 1992)

METHODOLOGY

Data

The study aims empirically to find out the presumed moderatibility of the board attributes to influence the established association in extant literature between ICT investment and corporate performance. The data used were sourced from audited annual financial reports. It was made up of 75 listed companies within (2008-2018). The choice of the period was due to unavailability of investment in ICT are not categorically stated in some of listed companies

The firms were nonfinancial sectors in Nigerian Exchange Group (NGX). The explained variable is corporate performance. The novel of the study is the measurement of corporate performance, there is a complete departure from the use of ROA, ROE, Tobin Q. The paper introduced a proxy of Responsibility Accounting (revenue per employee (rpey), profit per employee (ppey). Explanatory variable is *Information communication and technology (ICT)* proxy as (itinv) information investment. This is the total amount of investment in ICT and all other incidental expenditures (hardware, software, maintenance cost and human ware cost).

Model Specification

Multivariate regression and panel data regression were the statistical tools employed to dissect and achieve stated objectives and hypotheses. The multivariate regression model relates more than endogenous variables and more than one exogenous variable. The multivariate regression enables researchers to opt for dependent variables that have high coefficient of determination and are statistically significant with the associated F-statistics level of significance. While the panel data regression to resolve the issue of stochastic error been correlated with variables of the model and provide leeway by the assistance of Hausman test

Model 1

$$€_1\ rpey_{it} = Ω_1\ itinv_{it} + Ω_2\ bsize_{it} + Ω_3\ boidn_{it} + Ω_4\ bodgd_{it} + Ω_5\ nnexd_{it} + Ω_6\ fsize_{it} + Ω_7$$

$$bsize*ict_{it} + Ω_8\ boidn*ict_{it} + Ω_9\ bodgd*ict_{it} + Ω_{10}\ nnexd*ict_{it} + fage_{it} + deta_{it} + μ_{it}$$

Model 2

$$€_1 ppey_{it} + €_2\ tobq_{it} + €_3\ rpey_{it} = Ω_1\ itinv_{it} + Ω_2\ bsize_{it} + Ω_3\ boidn_{it} + Ω_4\ bodgd_{it} + Ω_5\ nnexd_{it} +$$

$$Ω_6\ fsize_{it} + Ω_7\ bsize*ict_{it} + Ω_8\ boidn*ict_{it} + Ω_9\ bodgd*ict_{it} + Ω_{10}\ nnexd*ict_{it} + fage_{it} + deta_{it}$$

$$+ μ_{it}$$

Table 1 Measurement of Variables

variables	Definition of proxy
Dependent variables	
ppey	Profit per employee
tobq	Tobin Q
rpey	Revenue per employee
Explanatory variables	
itinv	Investment in ICT
Board attributes	
bsize	Board size
boidn	Board independence
bodgd	Board gender diversity
nnexd	Non executive directors
fsize	Firm size
Moderating variables	
Bsize*ict	Board size interacting with investment in ICT
Boidn*ict	Board independence interacting with investment in ICT
Bodgd*ict	Board gender diversity interacting with investment in ICT
Nnexd*ict	Non Executive directors interacting with investment in ICT
Control variables	
fage	Firm age
deta	Leverage

Source: Authors' Compilation (2021)

Data Analysis and Discussion of the findings

This section houses empirical analyses on the study such as table of descriptive statistics and discussion on it, correlation matrix table and discussion is presented here and the tables of multivariate regression and panel data are presented here and herein their discussions.

Table 2 Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
rpey	814	108000	360000	110.65	5100000
bsize	809	8.982	2.703	1.67	19
boidn	809	.653	.177	0.01	0.91
bodgd	809	.096	.107	0.001	0.08
nnexd	807	6.016	2.522	0.33	23
itinv	813	3938.54	7940.615	47.7	170000
fsize	815	7.043	.769	5.09	9.03
Bsize*ict	825	36999.75	90452.67	0	2040000
Boidn*ict	825	2351.895	4520.531	0	99352.86
Bodgd*ict	825	463.898	1109.844	0	14193.27
Nnexd*ict	825	23095.18	52965.53	-1928.34	1190000
fage	815	25.518	12.846	1	54
deta	815	64.01	33.351	4.1	395.45

Source: Authors' Computation (2021)

The above table houses the summary statistics of endogenous variables and exogenous variables with their descriptive values: total number of observations, mean standard deviation, minimum and maximum values. The mean value of revenue per employee (rpey) is 108000 with associated standard deviation, minimum and maximum values are 360000, 110.65 and 510000 respectively. The average size of the board (bsize) stands at 8 and associated standard deviation of 2 and maximum size of 19 and minimum size is 2. The proportion mean independence of the board (boidn) is 0.653 with standard deviation 0.177, while the minimum is 0.01 and maximum is 0.91. The average of board gender diversity (bodgd) in the distribution stands at 0.096 with associated standard deviation, minimum and maximum value stand at 0.107, 0.001 and 0.91 correspondingly. This means on the average it is extremely rare to have one female to the proportion of male counterparts in the board. The mean of nonexecutive (nnexd) stands at 6 and with standard deviation is 2.5, minimum value is 0.33 and maximum value of 23. The average investment in ICT (itinv) stands at 3938.54 with attendant standard deviation, minimum and maximum value stand at 7940.615, 47.7 and 170000 respectively. The mean of size of the firms under review stands at 7.043, while the standard deviation value stands at 0.769 with minimum and maximum value stand at5.09 and 9.03 respectively.

Table 3 Correlation Coefficient Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) rpey	1.000												
(2) bsize	-0.016	1.000											
(3) boidn	-0.121	0.070	1.000										
(4) bodgd	0.145	0.047	-0.079	1.000									
(5) nnexd	-0.109	0.682	0.610	0.020	1.000								
(6) itinv	0.754	0.106	-0.134	0.108	-0.007	1.000							
(7) fsize	0.320	0.402	-0.129	0.145	0.219	0.364	1.000						
(8) bsize*ict	0.698	0.256	-0.101	0.090	0.094	0.964	0.384	1.000					
(9) boidn*ict	0.720	0.127	0.011	0.096	0.090	0.974	0.356	0.959	1.000				
(10) bodgd*ict	0.675	0.092	-0.160	0.504	-0.007	0.779	0.363	0.711	0.728	1.000			
(11) nnexd*ict	0.652	0.253	0.002	0.095	0.209	0.941	0.377	0.977	0.971	0.682	1.000		
(12) fage	0.086	0.134	-0.184	0.048	0.059	0.143	0.146	0.130	0.118	0.190	0.134	1.000	
(13) deta	0.059	-0.070	-0.009	-0.031	-0.055	0.127	0.010	0.092	0.133	0.116	0.096	0.015	1.000

Source : Authors' computation, (2021)

The table 3 results shows that there exists a positive and a negative but weak association among the endogenous variables, exogenous variables and moderating variables. A look at the correlation among these concerned variables show the weak association among variables which suggest the absence of multicollinearity within these variables.

Table 4 Panel Data Regression Coefficient Result

VARIABLES	(Fixed) rpey	(Random) rpey	(Fixed) rpey	(Random) rpey	(Fixed) rpey	(Random) rpey
itinv	25.53***	26.82***	-2.072	-3.057	-3.544	-3.676
bsize	-5,754	-6,187	-29,483***	-34,367***	-29,282***	-34,252***
	(5,270)	(5,011)	(7,486)	(7,271)	(7,463)	(7,261)
boidn	99,285	112,186*	-59,913	-135,851	-91,657	-154,941
	(67,504)	(66,370)	(102,467)	(101,593)	(103,050)	(102,132)
bodgd	365,845***	348,751***	52,059	30,327	92,951	34,613
	(86,865)	(81,137)	(117,260)	(109,204)	(118,188)	(109,025)
nnexd	-8,794	-12,121**	18,788*	27,609***	20,950*	29,077***
	(6,248)	(6,132)	(10,753)	(10,663)	(10,751)	(10,671)
fsize	104,126***	74,489***	100,485***	67,712***	130,457***	65,553***
	(34,376)	(21,082)	(33,671)	(19,567)	(42,997)	(19,939)
	(1.047)	(1.019)	(9.008)	(8.832)	(9.001)	(8.824)
bsizeict			3.867***	4.479***	3.887***	4.427***
			(0.874)	(0.866)	(0.875)	(0.866)
boidnict			21.07	41.25**	26.54	45.11**
			(18.20)	(17.79)	(18.26)	(17.83)
bodgdict			55.31***	59.29***	57.53***	61.95***
			(14.55)	(14.25)	(14.53)	(14.29)
nnexdict			-4.902***	-7.407***	-5.177***	-7.570***
			(1.731)	(1.698)	(1.731)	(1.697)
fage					-4,437*	-799.3
					(2,588)	(1,147)
deta					-393.6	-497.1**
					(259.9)	(237.4)
Constant	-721,814***	-501,526***	-512,235**	-249,723*	-584,688**	-182,156
	(248,064)	(153,425)	(246,703)	(150,016)	(280,129)	(152,097)
Observations	805	805	805	805	805	805
F statistics					70.49	932.45
Probability					0.000	0.000
R-squared	0.497		0.525		0.529	
Number of id	75	75	75	75	75	75
Huasman test					0.000	0.000

Source: Authors' Computation (2021) Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4 shows the outcome of panel regression of the information communication and technology and CP : moderating effect of corporate board attributes. F-statistics for both random effect and fixed effect are 932.45 and 70.46 respectively and they are statistically significant at 5% level of significance. This implies that the model is overall statistically significant that it can be used as an inferential information. The value of the coefficient of determination is 0.529. This means that 52.9% systemic variation in the endogenous variable has been jointly described by the exogenous variables in the model. The interpretation of the panel regression result is based on the advice of the Hausman test. The result of the hausman test is statistically significant. Hence, fixed random effect result is interpreted

From the above table, this is an adverse connection between CP metric and investment in ICT, which means investment in ICT did not improve the performance of the firms. In the same vein the board attributes: size of the board and board independence have a negative association with performance proxy. This implies these board attributes did not enhance the firm's performance, the impact of board size is statistically significant whereas board independence is statistically significant. On the other side, board gender diversity, numbers of nonexecutive directors and firm size have positive nexus with firm performance. This suggests that these attributes bring about an improvement to firm performance.

The result of the moderating effect of corporate board attributes.

The board attributes proxy are used as the moderators between ICT and firm performance. The moderating effect of board size, board independent and board gender diversity have a positive association with firm performance. This suggests that the intervening or interaction of board attributes with investment in ICT have added a high improvement in the firm performance of corporate entities. The enhancement of board size and board gender diversity on performance is statistically significant at 5% level. While board independence is statistically insignificant in its enhancement to firm performance. On the side of number of nonexecutive directors interacting with ICT has a negative association with firm performance; this suggests that the interaction of nonexecutive directors has added no improvement to the firm performance.

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Table 5 Multivariate regression result

VARIABLES	(model 1) ppey	(model 2) tobq	(model 3) rpey	(model 4) ppey	(model 5) tobq	(model 6) rpey	(model 7) ppey	(model 8) tobq	(model 9) rpey
itinv	1.264***	9.59e-06	32.80***	2.633***	6.46e-05	-22.45**	2.441***	7.33e-05	-23.31**
	(0.0933)	(6.28e-06)	(1.106)	(0.866)	(5.94e-05)	(9.862)	(0.849)	(5.74e-05)	(9.832)
bsize	-401.9	0.0278	-4,026	-767.3	0.0727	-46,244***	-822.6	0.0725	-46,392***
	(442.4)	(0.0298)	(5,243)	(701.1)	(0.0480)	(7,982)	(686.6)	(0.0465)	(7,953)
boidn	3,116	-0.0524	212,499***	17,067*	0.0313	-411,480***	16,242	0.605	-434,960***
	(6,359)	(0.428)	(75,362)	(10,132)	(0.694)	(115,365)	(10,021)	(0.678)	(116,086)
bodgd	11,366*	1.502***	218,444***	-3,756	1.273**	-61,167	-7,136	1.786***	-89,575
	(6,539)	(0.440)	(77,490)	(8,856)	(0.607)	(100,827)	(8,729)	(0.591)	(101,125)
nnexd	-170.8	-0.0145	-24,594***	122.4	-0.0298	58,281***	146.5	-0.0543	59,253***
	(589.2)	(0.0397)	(6,983)	(1,074)	(0.0736)	(12,225)	(1,053)	(0.0713)	(12,200)
fsize	-695.2	-0.0971	52,057***	-493.5	-0.121*	39,013***	-664.2	-0.111	38,142***
	(1,062)	(0.0715)	(12,581)	(1,059)	(0.0726)	(12,053)	(1,037)	(0.0702)	(12,012)
Bsize*ict				0.0660	-6.50e-06	7.166***	0.0654	-4.50e-06	7.091***
				(0.0883)	(6.05e-06)	(1.006)	(0.0866)	(5.86e-06)	(1.004)
Boidn*ict				-3.973**	2.13e-05	125.5***	-3.123*	-4.07e-05	130.1***
				(1.714)	(0.000117)	(19.51)	(1.684)	(0.000114)	(19.51)
Bodgd*ict				3.550**	3.46e-05	67.73***	3.937***	-5.33e-05	72.06***
				(1.410)	(9.66e-05)	(16.06)	(1.393)	(9.43e-05)	(16.14)
Nnexd*ict				-0.0327	1.49e-07	-15.92***	-0.0733	1.04e-06	-16.07***
				(0.170)	(1.16e-05)	(1.931)	(0.166)	(1.13e-05)	(1.926)
fage							60.97	0.0166***	-442.3
							(55.06)	(0.00373)	(637.9)
deta							-119.7***	0.00847***	-647.8***
							(20.24)	(0.00137)	(234.4)
Constant	3,955	1.921***	-364,333***	-2,890	1.705***	34,516	5,166	0.443	103,654
	(8,186)	(0.551)	(97,008)	(9,548)	(0.654)	(108,715)	(9,677)	(0.655)	(112,108)
Observations	805	805	805	805	805	805	805	805	805
F statistics							25.28759	6.914941	120.6979
probability							0.000	0.000	0.000
R-squared	0.210	0.020	0.596	0.244	0.029	0.643	0.277	0.095	0.646

Source: Authors' Computation (2021)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 provides the findings of all models estimated. In the model I to III, we dissect how investment in ICT (itinv) as exogenous variable and board attributes have nexus with the endogenous variables of diverse proxies: profit per employee (ppey), revenue per employee (rpey) and Tobin Q as performance metrics. In model IV to VI we introduced moderators of board attributes to interact between the endogenous variables and exogenous variables. In the last models VII to IX, control variables were introduced.

In model 1, the variable of information technology (itinv) has a positive influence on firm performance and the influence is statistically significant on the corporate performance. The result is contrary to the findings of Houqe, *et al*, (2019) whereas the *ICT_INV* is adversely and not significantly related with *ROA* in less competitive firms. On the other hand, the board attributes: board independent (boidn), board gender diversity (bodgd) and number of nonexecutive directors (nnexd) have also a positive relation with firm performance but, they are all statistically insignificant, except for board gender diversity (bodgd) that is statistically significant. Whereas, board size and firm size have negative association with firm performance, but also the influence is statistically insignificant. The R squared of this model reveals that systematic variation that occurs in dependent variables, 21% can only be explained by the independent variables in this model. While 79% explanations are not captured in the model, that is the level of error term or disturbance or stochastic term

The result of Model II reveals that Tobin Q is used as a proxy for corporate performance which is the endogenous variable. There is a positive association between information technology investment (itinv) and Tobin Q (toq) ; this implies investment in information technology enhances the firm performance, but is statistically insignificant. On the other side, there are positive association among investment in technology and board attributes: board size and board gender diversity, only board gender diversity association exhibits statistical significance, but, board size is statistically insignificant, while other like board independent, nonexecutive directors and firm size exhibit adverse association with information technology investment, also their association are statistically insignificant. The coefficient of determination of this model reveals that systematic variation that occurs in explained variables is 2% can only be explained by the explanatory variables in this model. While 98% explanations are not capture in the model, that is the level of error term or disturbance or stochastic term

Model III shows the regression result of revenue per employee (rpey) as dependent variable and investment in information technology (itinv). There is a positive nexus between the two variables and statistically significant. This also shows investment in ICT improves corporate performance significantly. On the other side of board attributes: where board independent, board gender diversity and firm size are positively related with performance and statistically significant, whereas board size and nonexecutive director number have a negative nexus with firm performance, when the negativity is statistically significant with nonexecutive directors numbers, while it is negatively statistically insignificant with board size. The R squared of this model III reveals that systemic variation that occurs in endogenous variables is 59.6% can only be explained by the exogenous variables in this model. While 31.4% explanations are not capture in the model, that is the level of error term or disturbance or stochastic term

Model IV deals with the moderating effect of board attributes resulting with the dependent variable of profit per employee (ppey) and independent variable of investment in ICT. When

board size interacts with ICT, there is a positive association with the corporate performance. This implies that when the size of the board intervenes in the issue of investment in ICT, there is a paradigm shift from negativity to positivity. This means an enhancement with size of the board interacted in the ICT, but not statistically significant. The interaction of board independent and ICT have a negativity relation with firm performance. This means it adversely affects the corporate performance. That is, the interaction of board independent moves from positive to negativity, such moderating effect did not enhance the firm performance and was statistically significant. The result of the moderating effect of board gender diversity and ICT reveals positivity in association with firm performance. This suggests that there is enhancement in firm performance but increasing at a decreasing rate. The moderating effect of the number of non-executive directors and ICT have a negative nexus with firm performance. This suggests that they jointly affect the performance poorly, but statistically insignificant. The R squared of this model reveals that systematic variation that occurs in dependent variables is 24.4% can only be explained by the independent variables in this model. While 63.6% explanations are not capture in the model, that is the level of error term or disturbance or stochastic term

Model V deals with the moderating effect of board attributes resulting with the dependent variable of tobin Q (tobq) and independent variable of investment in ICT. When board size networks with ICT, there is a negative association with the corporate performance. This implies that when size of the board mediates in the issue of investment in ICT, there is a paradigm shift from positivity to negativity. This means no improvement when size of the board interacts in the ICT, but not statistically significant. The interface of board independent and ICT have a positive relation with firm performance. This means there is an enhancement that affects the corporate performance. That is, the interaction of board independent moves from negativity to positivity, such moderating effect did enhance the firm performance and was statistically significant. The result of the moderating effect of board gender diversity and ICT reveals positivity in association with firm performance. This suggests that there is enhancement in firm performance but increasing at an increasing rate. The moderating effect of the number of non-executive directors and ICT have a positive nexus with firm performance. This suggests that they jointly affect the performance enhancement, but statistically insignificant. The R squared of this model reveals that systematic variation that occurs in dependent variables is 2.9% can only be explained by the independent variables in this model. While 97.1% explanations are not capture in the model, that is the level of error term or disturbance or stochastic term

Model VI deals with the moderating effect of board attributes resulting from the dependent variable of revenue per employee (rpey) and independent variable of investment in ICT. When board size interrelates with ICT, there is a positive association with the corporate performance. This implies that when size of the board mediates in the issue of investment in ICT, there is a paradigm shift from negativity to positivity. This means an enhancement with size of the board interacted in the ICT, and statistically significant. The interaction of board independent and ICT have a positive relation with firm performance. This means there is an enhancement that affects the corporate performance. That is, the interaction of board independent moves positively, such a moderating effect did enhance the firm performance and was statistically significant. The result of the moderating effect of board gender diversity and ICT reveals positivity in association with firm performance. This suggests that there is enhancement in firm performance but increasing at a decreasing rate. The moderating effect of the number of non-executive directors and ICT have a negative nexus with firm performance. This suggests that

they jointly affect the performance poorly, and are statistically significant. The coefficient of determination of this model reveals that systemic variation that occurs in dependent variables is 64.3% can only be explained by the independent variables in this model. Despite the fact that 25.7% explanations are not capture in the model, that is the level of error term or disturbance or stochastic term

Model VII to IX account for control variables introduced to the model in order to enhance the coefficient of determination of the multivariate regressions. The dependent variable of model vii is profit per employee which the study regressed on the firm age (fage). They have positive association with each other, but, statistically insignificant, while on the contrary there is a negative relationship between debt to asset ratio (deta) and dependent variable. When Tobin Q is substituted as explained variable, both firm age (fage) and debt to asset (deta) ratio have positive nexus with dependent variable and that association is statistically significant. But, R-squared of the model viii is 9.5% systematic variation that occurs in dependent variables can be explained by independent variables while the remainder of 90.5% systematic variations are not captured in the model. Lastly, both firm age and debt to asset ratio have a negative association with revenue per employee (rpey) as dependent variable, but firm age is statistically insignificant while debt to asset ratio is statistically significant. The determination of coefficient is 64.6% which means systemic variation in dependent variables can only be explained by 64.6% by explanatory variables while the complement values are not captured in the model.

DISCUSSION OF FINDINGS

The study dissects the direction of relationship between information and communication technology and firm performance: moderating influence of corporate board attributes, across nonfinancial companies listed in Nigerian Exchange Group (NGX). These days corporate firms' kitty ICT into the main spectrum of operations. ICT provides crucial and critical enablers for business policies, constituting an important component of firms' performance (Dittmeier, 2011).

The study sample covers 75 listed companies for the period of eleven years purposefully. ICT application was a proxy for the investment in ICT by different companies. It serves as an explanatory variable that explains the dependent variable which is the performance metric of revenue per employee. For the robustness of the study results, the study deploys multivariate regression analysis to obtain the most fitted model of different dependent variables. Model 6 and model 9 have R-squared coefficients of 0.643 and 0.646 respectively. As a result, model 9 was considered most appropriate.

Therefore, the result of direct association between the dependent variable of performance metric and independent variable of investment in ICT (itinv) analyses by panel data regression tool, shows there is adverse association between revenue per employee and ICT investment. This suggests investment in ICT brings about decline in performance, but statistically insignificant.
In contrast to the above result, the introduction of moderator variables of board size, board independent and board gender diversity into the relationship between ICT investment and performance metric. Their moderating influence is positive. This implies that the moderators

interacting in the relationship enhances performance. Contrariwise, the moderating effect of non-executive directors shows negative association, this suggests the activities of non-executive directors adversely affect the performance of corporate entities.

Implication to Research and Practice

The study reveals some salient issues that need practical implementation in corporate firms in this digital era. First, the data on ICT used were extracted from the financial reports of the listed firms in Nigeria. Evidence has shown that most companies in emerging economies have not created such CIO, unlike evolved economies where corporate firms have a Chief Information Technology Officer (CIO). This CIO is part of board members who is empowered to formulate strategic policies related to the company's ICT decision making process. This also enables CEO and CIO to operate at corporate level or strategic level (Shao et al. 2016; Wang et al. 2015). Second, the issue of productivity paradox has been the problem in emerging economy, where heavy and quantum investment in ICT has counter-productive, in term of performance inefficient, but the findings of this study shows where corporate board has decisive interaction, assuredly improvement will emerge, this will spur survival and stay competitively in the growing business world.

CONCLUSION

The intensifying import of managing ICT has gained extensive attention in the global business arena. This study espoused a broader conceptualization of IT capability to demonstrate the effect of board attributes components to mediate the role of supervision IT on firm performance. Finding revealed particularly, managing IT is observed to be a significant mediator which facilitates board attributes component of the effect on firm performance. The positive and significant relationship demonstrated among the ideas, and all the hypotheses are accepted. This research fills the gap in the literature that board attributes components rarely used in IT management empirical research, and this research offers insight from the Nigerian firm's context. This study's resource-centric approach in managing IT would give clear track for the deeper explorations which are crucial to drive firm performance

Future research

This study has some future research areas, first, data on board attributes that were used are but few compared to other board attributes that are inexhaustible, hence, the scope for future research can be expanded. Second, sample size was captured purposefully, thus, the sample size can be broadened.

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