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Information technology and the accountant today: What has really changed?

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One of the major advancements in information technology (IT) is the use of IT tools to perform accounting functions and processes. In this paper, we provide discussions on how IT has affected the accountancy profession. We argued that the traditional duty of accountants is the preparation of financial statements, and consequently, several tasks are carried out throughout that function. In the pre-IT era, accountants were faced with delays in transaction processing and reporting, continuous errors and misstatements, and difficulty in storing large data on papers. However, following the emergence of sophisticated IT tools, accountants in the IT era are now able to prepare and present financial statements more timely and accurately. The availability of the internet has also increased access to financial reports by external users. This paper further argues that in light of the continuous advancements in IT, future accountants and accounting processes are likely to; be cloud-based, communicate with and through Artificial Intelligence machines; invest in Big Data and cyber-security, and explore the potentials of Virtual Reality and Augmented Reality in meeting users' information needs. Hence, accountants and accountancy firms are advised to embrace new IT skills and tools, and keep up with technological trends.

Key words: Accountant, information technology, accountant, information technology, cloud computing, artificial intelligence and the big data.

INTRODUCTION

It is not debatable to say that a lot has changed in the accounting profession in the past few decades, especially following the emergence of information technology (IT). In fact, the use of modern IT tools to perform accounting and financial reporting functions is one of the most recent breakthroughs in technology that has really affected the profession. Technology has changed the traditional accounting system which was previously characterized by series of paper-based processes that required longer

periods into an entirely new IT-based model that gets the job done more effectively, efficiently and timely. Today, technology has successfully penetrated the business world and there is hardly any aspect of business that is not automated- such that, as simple as placing an order for materials required for production, the use of IT in this aspect has automated the inventory control system and hence, machines now independently place (Ghasemi et al., 2011) orders at certain re-order levels even without

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frequent intervention from management. This and many more file-related worries of accountants have been completely erased by technologies today- and these technologies are still evolving, which raises a lot of questions about the position of accountants in this IT era.

Traditionally, accounting is the art of recording, classifying and summarizing and reporting information (in terms of money, transactions and events), and interpreting the results in a manner that will facilitate decision making by users (Dandago and Rufai, 2014). Accounting as a profession has also been conceptualized as an organized system of activities that collects, measures, recognizes, processes and reports financial information about an economic entity (Ballada and Ballada, 2011). The accounting system works in cyclic manner- collecting information on transactions and events through various documents issued and received. These documents are traditionally referred to as source documents,-carrying information that accountants collect and compile into the year-end- financial statements that are useful to internal users (that is, management and employees) and external users for the purpose of decision making (Hall, 2012). However, traditionally, the accounting process encompasses a lot of tasks that require time to complete, and given that organizational operations are continuous- the responsibilities accountants have become demanding. Furthermore, apart from providing information for external users, accountants are also obligated to provide information for internal consumptions. One can begin to imagine how cumbersome the traditional or file-based accounting system would have been.

However, advancements in IT have undeniably improved the accounting system, and in turn transformed economic life. Computers and other digital IT tools have increased office productivity, facilitating quick exchange of information, enabling collaboration with distant business partners, and the collection and analysis of data. Now, every part of the accounting process has been automated. From the point of transaction, recordings and processing of periodic information to preparation of final financial reports, accountants now depend on these technologies to provide the required information that will facilitate the reporting process (Lim, 2013).

When we talk about technologies, it is important we demystify the concept to facilitate its contextual usages. Technologies may be in form of hardware (physical devices through which accountants input data, process the data and obtain information in form of reports), or software (computer programs installed into the hardware, to enable accountants perform their tasks effectively and efficiently). Accountants today depend on both hardware and software technologies to carry out major accounting functions and also ensure timely reporting, and this has also inspired the creation of highly sophisticated technologies deployed for collection, processing and

storage of financial information.

Today's accountants are exploiting emerging technologies to help them complete their tasks more effectively, efficiently, accurately and timely or simply: from the incised clay tablets of the Sumerian scribes, through the adding machines of the 19th century, to the calculators and computers of the 20th century. However all of these technological developments were simple propositions by comparison with the well sophisticated current technologies that are now rapidly reshaping the accounting profession in general, and accountants in particular. Accountants in practice are now changing the ways in which they communicate and collaborate with stakeholders they work with and for, shaping new working patterns that are technologically driven, and redefining their knowledge to cope with new demands (ACCA, 2013).

Many studies (Salehi and Torabi, 2012; Dandago and Rufai, 2014; Shirzad and Nikzad, 2014; Al-Zoubi, 2017) have provided evidences on the significance of these technologies in the accounting profession and a lot has been said of the benefits of these technologies to accountants in practice. However, not much has been said about how these technologies have really affected accountants in practice today- in terms of the specific changes that these technologies have made in the accounting profession and how these changes affect accountants in practice. This paper however applies theoretical approach to the concept of information technology, how these technologies have affected the routine of accountants today, and how accountants around the world are trying to cope with the significant changes in their tasks. The remainder part of this study will be organized into discussions on the implications of information technologies for practicing and aspiring accountants.

LITERATURE REVIEW

A number studies have provided evidence on transformational effect of information technologies (IT) on the accounting profession and the way accountants discharge their responsibilities. However, for the purpose of this study, we will review few of these studies as they relate to the current discourse.

Al-Zoubi (2017) provided evidence on the title "*The Effect of Cloud Computing on Elements of Accounting Information System*". The paper employed a descriptive approach implemented through the collection of prior literatures on cloud computing and information technology, and their impact on the accounting information system. However, based on the literatures reviewed, he concluded that cloud computing reduces the size of the enterprise in terms of the building and the offices because they allow property anywhere without management commitment to a specific location; improves

operational performance in terms of facilitating the completion of operations and accurate accounting operations; and it the use of software and physical equipment without necessarily buying the software and install it on their computers.

Nwakoby et al. (2015) also did a study titled "*Information Communication Technology (ICT): A Panacea for Accounting Practice in Nigeria*". The paper investigated the application of Information and Communication Technology (ICT) in efficiency and speeding up of the accounting process, and how these technologies have ensured efficient delivery of accounting works. Survey method was adopted and questionnaire was the major source of data collection. Data collected were analyzed with five point Likert scale and ANOVA was used to test the formulated hypotheses with the aids of SPSS version 20.0. From the results obtained, it was discovered that ICT application has a positive effect on the efficiency of accounting practice, specifically in the areas of ensuring timely delivery of accounting works in Nigeria. Hence, the authors encouraged accountants and accounting firms to incorporate ICT in all aspect of accounting practices for effectiveness.

Also, Dandago and Rufai (2014) did a study on "*Information Technology and Accounting Information System in the Nigerian Banking Industry*". In this paper, the authors argued through findings that the use of information technology can improve performance by reducing operational cost, facilitating transactions, relevant in simplifying issues and in the provision of quality information, and thereby recommends that Nigerian banks should invest more in IT tools for efficient service delivery and profitability. This finding conforms to the arguments of Moorthy et al. (2012) in their study titled "*Application of Information Technology in Management Accounting Decision Making*". This study also indicates that IT has major impact on operational costs, and reveals that IT can improve the efficiency of the accounting department, thereby producing result effortlessly, timely and accurately".

Ebenezer et al. (2014) also carried out a study titled "*Accounting in the Cloud: How Cloud Computing Can Transform Businesses*". The study shows that cloud computing can still be applied successfully for accounting purposes. Though cloud accounting may seem not too different from a desktop accounting in nature, but in practice, cloud computing has a lot of ways by which it can enhance accounting. The goal of an accounting information system is to conveniently collect and store data about transactions and events; process such data into useful information for the purpose of decision making; and ensure adequate controls are in place to safeguard the organization's assets. So, given the availability of cloud computing, accountants now have the opportunity to be mobile with everything they do; financial information can no more be delayed as the easy real-time

access provided by cloud computing makes room for continuous reporting (and possibly continuous auditing) Some evidences were also provided by Sacer and oluic (2013) in their study titled "*Information Technology and Accounting Information Systems Quality in Croatian Middle and Large Companies*" which revealed through findings that IT influence the way accounting information system operates, contributes to preparing, processing, presenting, and delivering accounting information. It significantly contributes the accuracy and timeliness of accounting reports and the quality of such reports.

Moghaddam et al. (2012) also provided evidence on "*The Impact of Information Technology on Accounting Scope in Iran*". The findings of the study reveal that information technology increases accuracy in the accounting process and decreases cost of gathering information. It has affected accountants, as they now require new skills in such areas as applied accounting software, excel and access (among others). Furthermore, the study reveals that IT is set to provide the necessary atmosphere for improving the accounting profession and the role-creating more suitable accountants in organizations".

Finally, Salehi and Torabi (2012), in their study titled "*The Role of Information Technology in Financial Reporting Quality: Iranian Scenario*" examined the role of information technology in financial reporting process and the quality of financial reports produced. To achieve this, a questionnaire was designed and distributed to a sample of respondents. For the purpose of testing the hypotheses, T-Test, ANOVA and Duncan's Test were employed. Finally, it revealed the information technology, the financial reporting process as well as the relevance of the resulting financial reports. It was also discovered that information technology enhances the comparability, and diminishes the negative impact of the dominant limitations on the qualitative characteristics of financial statements.

MATERIALS AND METHODS

This study adopts a qualitative design. A comparative analysis was done by collecting prior literatures on various areas of information technologies (IT) and how these technologies have transformed the accounting profession in general and the way accountants (in particular) carry out their tasks. The aim is to provide qualitative evidence on the interaction between accountants and IT through a comparative analysis between accountants in the pre-IT era and accountants in the IT era, as well as predicting what may be expected of accountants in the nearest future. To this end, we reviewed several literatures to support our discussions and also provide the basis for our conclusion.

The accounting profession and what accountants really do

In practice, accountants are either involved in preparing and presenting financial statements or auditing already prepared financial statements to ensure that they reflect a true and fair view of the economic reality being measured and reported. It is important



Figure 1. The Pre-I.T Accountant.
Source: Modified from Whatshappening (2018).

to note that either of these activities requires different processes that accountants have to go through in order to provide the required information for internal and external usage. The argument here is that, using numbers and financial statements, accountants describe the health of an organization (as a whole) or the various parts of the organization. Accounting numbers and ratios tell the story of the business, just like a picture tells a thousand words (Imhanzenobe, 2020) Accountants analyze revenue and profits/losses; supply owners and other users with the required information to make informed decisions overtime. This information forms the basis of a company's year-end financial report and legal filing reports.

Accountants usually operate within the organization by gathering information on transactions and events within a specific period and recognizing the costs relating to these transactions and events in the appropriate books of accounts. This process continues on a daily basis to enable accountants keep track of the financial condition of the business, and evidence of these transactions and events are kept. The accumulated information relating to transactions and events facilitates the preparation of periodic reports by accountants, upon management requests to facilitate decision making.

"The totality of what accountants do within and outside the organization has to do with information. The argument centers on the fact that accountants work with information on a daily basis. They receive information from transactions and events, record these information in the appropriate books, process the information into specific reports to meet internal (management) or external (that is. other stakeholders) needs" (Imene and Egbe, 2018).

At the end of the financial year, all books of accountants are closed and the aggregate figures are compiled into the year-end financial statements. These financial statements are first audited by the internal auditors in line with the established internal control system of the organization, and then the external auditors will audit the financial statements to ensure that they show a true and fair view of the economic reality being measured before such financial statements are released for public consumption. The major tasks of accountants within an organization are simply to; process monthly payrolls, demystify billing invoices and accounting policies to affected staff and clients, ensure the preparation of budgets, with

emphases on revenue, expenses and other core financial items, ensure appropriate review of budgets and expenditures for external funding purposes, prepare the core financial statements at the end of each financial year, interact with auditors (internal and external) in order to complete audit tasks, compile other significant information to prepare off-balance sheet engagements, monitor the input and handling of financial data, ensure and supervise the establishment, maintenance and coordination of accounting and internal control procedures, and recommend and work with IT experts to maintain financial data bases, computer software systems and manual filing systems among others.

Accountants in the pre-IT era: what 'was'

Prior to the information technology age, the accounting process was simply manual-based. At this point, accountants were charged with the responsibility of obtaining and keeping record (in files) of financial transactions and events. These files were often revisited from time to time, and updated manually as changes in business transactions and events may warrant. This process continues until the end of the accounting period when all books will be closed and the financial statements are prepared and made available.

The accountant in Figure 1 is an example of pre-IT accountants who are compelled to implement tasks manually. Most tasks may require the review of several files to be completed and this (among other factors) made the manual accounting system a dilemma for accountants (in particular) and organizations (in general). Other facts about accountants in the Pre-I.T era include the following;

RESULTS AND DISCUSSION

Manual recognition of transactions and events

In the pre-IT era, accountants were required to manually recognize transactions and events on papers in the appropriate books. This means that the transactions or events must meet the measurement and recognition

criteria of any element of accounting were recorded manually (Lim, 2013). Accountants were also required to reflect periodic adjustments which were also made manually. As much as transactions and events were manually recognized in the appropriate books, periodic adjustments for entries were also manually carried out by accountants in the pre-IT era. Here, accountants were forced to manually record and carryout arithmetical adjustments for entries as required by the daily operations of the organization.

Delay in preparation of periodic reports

Generally, one of the major tasks of accountants is to continuously provide management with periodic reports on internal operations- to enable management make strategic decisions. In the pre-IT era, these reports were often prepared manually, and hence, these reports were always delayed due to delayed access to the required information and subsequent verification of this information.

Complicated record keeping due to large number of files

The traditional Accountant is known for “book keeping”, a term that connotes custodian of papers and files. This is because business transactions and events are often evidenced by documents such as invoices, receipts, credit notes and debits notes among others. Hence, this made record keeping by accountants a very complex task, especially for big organizations where large volume of data are received and processed on a daily basis.

It was somewhat difficult for accountants in the pre-IT era to process transactions, as access to documents required to process these transactions were not often readily available. For example, as it may require accountants to determine the credit worthiness of a customer before a credit sale is granted, this transaction may be delayed until the accountant is able to access all credit record of the customer with the organization- a task which may take quite a tussle to be completed effectively and efficiently. When it comes to preparation and presentation of financial statements, this task was often delayed due to the tedious process of verifying all transactions and events, and closing all books of accounts before drawing out the final accountants (Salehi and Abdipour, 2011). Accountants would have to take enough time to verify entries from the point of initiation to the closing figures in order to ensure that information in the financial statements are error-free and without material misstatements.

Continuous errors and misstatements

As a result of the complex nature of accountants’ tasks in

the pre-IT era, financial statements were prone to errors and material misstatements. This can be traced to the point of recognizing transactions and events in the appropriate books and making subsequent adjustments manually.

Larger number of people to adequately meet the information needs of management and external users.

In the pre-IT era, the effectiveness and efficiency of the accounting and financial reporting process was directly linked with the staff strength of the accounting departments and their skills. Hence, the accounting departments were often run by the accountant and other accounting personnel in charge of various aspects of financial reporting such as payroll, asset management and internal control (among others). This was necessarily achieved by large organizations in order to facilitate the accounting and financial reporting process.

Accountants in the IT era: what ‘is’?

Today, the entire accounting and financial reporting process has been automated. Technologies have been designed to enable accountants carry out major tasks and execute complex operations more effectively, efficiently and timely (Shanker, 2013). The numerous tasks completed by accountants in the pre-IT era which required a rigorous process, more personnel and much time have been simplified into technologies that accountants can easily operate. These technologies today are in two forms; the software technologies and the hardware technologies (Abadi et al., 2013). The simple difference between these technologies is that while the accountants interact with the later directly and physically, their relationship with the former is only through the later. Figure 2 shows an I.T accountant working with a computer in an automated office environment. The technologies are further explained in subsequent paragraphs.

Hardware technologies

Hardware technologies are the “physical, tangible devices that form the computer” (Hejase and Hejase, 2011). Accountants are required to effectively perform and complete tasks by directly interacting with these technologies (Ballada and Ballada, 2011). These technologies range from simple devices like smart phones to computers and other more complex devices such as input devices, processing devices and output devices that accountants use in the preparation and preparation of financial statements, and auditors also use in auditing. These hardware technologies will be discussed in further paragraphs of this paper.

Software technologies

These are “program essentials for the startup, control,



Figure 2. The IT accountant.
Source: Shutterstock (2017).

and management of the computer system” (Hejase and Hejase, 2011). These programs actually enable accountants to perform specific tasks or group tasks through the hardware technologies. Some examples of such software technologies are accounting software for payroll, inventory management, enterprise resource planning (ERP) and others.

Accounting software

It is important to note that the combination of software and hardware technologies in the IT-era has changed the routine of accountants and also simplified the accounting and financial reporting process. From the point of recognizing transactions and events to the preparation of the financial statements, the numerous process involved as experienced in the pre-IT era has been simplified with just a click of the button. Today, accountants are able to get access to any information or prepare any form of internal or external report with just a click of the button. The IT-Accountant is now aware of the following;

Personal computers (PCs)

This consists of devices ranging from desktop computers to laptops, tablets and smart phones which accountants now use to collect and process and also report information to users. The emergence of computers and other electronic devices have simplified the tasks of accountants especially in the area of transaction processing, recording, storage of large information,

elimination of files, preparation and presentation of financial statements to users. Today, the accountant has the opportunity of meeting the information needs of all stakeholders in the financial reporting process more effectively and efficiently. Furthermore, the connection of computers through an information system within and outside the organization gives the accountants exclusive access to the right information at the right time.

Internet, intranet and extranet

The intranet is a type of network built to facilitate communication between computers and other electronic devices within an organization. This type of network enables communication and transfer of information between users within a single organization- so accountants are able to get access to information on transactions and events from any part of the organization with just a click of the button. The extranet unlike the former connects computers and other electronic devices between two or more organizations. Extranet is built to facilitate communication and corroboration between organizations- so accountants are able to get access to information on third-party transactions and events. The internet, unlike the other types of network is a network of computers around the world. It gives accountants unrestricted access to external information and also facilitates preparation and presentation of financial statements (Dandago and Rufai, 2014). The internet has made it possible for accountants to implement digital financial reporting, and it has also facilitated distribution of financial reports to all stakeholders.

Accounting software

This is an application computer program designed to execute, manipulate and manage (Hejase and Hejase, 2011) the basic accounting functions through a simplified 3-stage process of input, processing and output. All the processes involved in the accounting and financial reporting process have been built into the software, and therefore, accountants only need a computer device through which the software will work, and the skill required to execute tasks through the software. Furthermore, accounting software can be classified as *low-end* or *high-end*. The low-end software is “all-in-one” software, such that all functions of an accounting system are performed within the software- hence, it is mostly used by accountants in small firms. On the other hand, the high-end software creates a separate module for each accounting function, and each module checks data for correctness, processes it, and updates all relevant accounts, and finally, produces outputs such as documents and reports. The high-end software is often used by large organizations because it enables separate modules such as payroll, fixed assets management, inventory and so on to be handled by separate individuals in the accounting department

Tax preparation software

One of the most demanding aspects of accountants' job is tax planning and preparation. The continuous adjustment in tax laws in Nigeria makes it an exceedingly difficult task for accountants to deal with. Manually, the process has become more difficult and time consuming. Hence, with the availability of tax preparation software to accountants, this task can be performed easily and faster through the computer. As a result, even complex calculations can be performed via computers in a short period of time. It is important to note that some highly sophisticated high-end accounting software provides a separate module for this task.

Auditing software

Like the accounting software, technology has also facilitated the auditing process through the creation of auditing software. This is because if auditors perform auditing functions manually, it takes a lot of time and energy. However, audit software packages are currently available for auditors in low-end (for auditing small firms) and high-end (for auditing larger firms). For example, the trial balance software is a module under the high-end audit software that enables auditors to input the working trial balance, handles all adjusting entries, and automatically computes the adjusted trial balance. Furthermore, these audit software packages can access

customer's files, select a statistical sample of the accounts, and print a working paper sheet.

Word processing

Word processing is computer-assisted creation, editing, correcting, manipulation, storage, and printing of textual data (Ghasemi et al, 2011). Today's Accountants use word processing software to prepare reports, billings, memos, and financial statements.

Graphics software

The use of graphic software enables accountants to aestheticize the financial report. The graphical outputs can be printed on paper or displayed on slides, transparencies, and photos. It is important to note in practice today, auditors and managerial accountants use the graphics software to analyze financial reports into graphs and tables to facilitate decision making by users.

Database management software

One aspect of accountants' task is called record keeping. This means that accountants are custodians of information on transactions and events, and as a firm expands, so does the volume of transactions processed and stored by accountants. The emergence of database software systems has significantly reduced the rate of inefficiencies and redundancies in information handling. In fact, relational database systems such as enterprise resource planning (ERP) depart from the accounting equation method of organizing data- such that it enables accountants to capture both financial and non-financial data, and also, it facilitates storage of large files in simpler forms.

Payment technologies

The emergence of payment technologies (such as Remita) has enabled firms to connect to banks and implement electronic transfer of funds. Hence, firms are able to execute receipts and payments functions electronically, thereby reducing the risks that accountants face by holding cash (Shanker, 2013). The accountant today has been relieved of the burden of carrying physical cash or keeping cash (a function which accountants are traditionally known for).

The adoption of computerized database systems has also facilitated the automation of accounting information system. Accounting information systems equipped with such technologically advanced tools as mentioned above can now perform accounting functions more effectively

and efficiently and at reduced costs. Hence, accountants are now required to work in a digitalized environment with exclusive access to information with the click of a button. As a result of interactions between accountants and technologies (hardware and software), valuable opportunities became available to improve the services delivered to their business clients as a result of reducing and possibly eliminating those repetitive, time-consuming, and menial tasks (Rkein et al., 2019). The following can be observed of accountants in the IT era;

Digital recognition and adjustment of transactions and events

Accountants today recognize transactions and events digitally as opposed to the traditional file-based method. The recognition of transactions and events digitally has also enhanced fast and easy adjustments in accounting figures due to subsequent events.

Timely preparation of financial reports

Today, the combination of hardware and software technologies enables accountants to easily generate financial reports with a simple click of the button on the computer. However, this simplified task required a very long process that involves review of numerous files and a long period of time to achieve generate.

Record keeping and data storage has been simplified

One of the obvious benefits of IT adoption by accountants is the enhancement of record keeping and storage. IT has made it easier for accountants to store large data in simpler forms by converting most documents from paper to electronic forms.

Faster transaction processing

Transaction processing is now easier and faster for accountants in the IT era. For example, the credit worthiness of customer can be determined by retrieving the customer's information through the click of a button (Sacer and oluic, 2013).

Timely preparation and presentation of financial statements

When it comes to preparation and presentation of financial statements, IT has enhanced the entire financial reporting process (Moscove et al., 1999). Accountants (in small firms) are now able to generate final reports quickly and easily with just the click of a button on their computer,

while accountants in large firms are able to access all information required for compiling the final accountants easily and faster.

Improved accuracy and financial reporting quality

The emergence of IT has helped accountants to reduce or eliminate completely the problem of material errors and misstatements in financial reporting (Salehi et al., 2010). The problems of inaccuracy that are peculiar with the file-based accounting system have been completely taken care of (Shanker, 2013). However, one limitation of the IT-based based system is that output depends on input. Hence, accountants must ensure that correct and accurate information are put into the system.

Increased access to financial reports by external users

The existence of special IT tools has enabled accountants to effectively and efficiently make financial reports available to external users such as shareholders, creditors, the media and regulatory institutions. This has been facilitated through the use of internet and social medial channels such as emails, twitter, and Facebook page and so on (Moradi et al., 2011).

Enhanced auditing and investigation

The existence of special IT tools for auditors (e.g. the audit software) has helped to simplify the auditing process, and in turn enabled auditors work effectively and efficiently. Today's auditors are IT-based accountants that execute tasks using computer languages.

Accountants in the post IT era: what 'will be'?

While accountants around the world have witnessed a dramatic change in the ways of doing things in practice, we cannot but imagine what the future holds for accountants in practice. Technologies are evolving every day, and by implication, accountants in practice will continue to witness new technologies that can do more than the existing ones. However, for the purpose of this study, we have gathered evidences on possible expectations for accountants in practice, in relation to technological advancements. This is expected to give accountants a sense of what is to come and how they can prepare towards it (Figure 3).

The cloud-based accountants

This is one of the current technological trends and it has



Figure 3. The future IT accountant.
Source: iStock (2017).

enjoyed wider acceptance in the business world due to the numerous opportunities accompanying its adoption. Cloud computing has been defined as a technological platform that facilitates available, convenient and on-demand network access to a shared pool of configurable computing resources (such as networks, servers, storage, applications, services) that can be rapidly provided and released with minimal management effort or service provider interaction (Wang, 2011; Mell and Grance, 2011). It is simply a computing resource procurement and deployment model which enables an organization to obtain its computing resources and applications from any location via an Internet connection (Chan et al., 2012). The unique feature of cloud computing is its ability to provide a three-dimensional cloud services model, namely: Software as a service (SaaS), Platform as a service (PaaS), and Infrastructure as a service (IaaS). This means that users of cloud computing will be able to reduce costs by eliminating physical infrastructures, and tasks can be executed from any part of the world. Hence, we can boldly say that accountants in the future may be able to perform accounting functions on cloud without being limited by physical structures.

“We foresee that accountants and the organizations they work with and/or for will be exploiting the cloud as a result of the opportunities that comes with it. Accounting systems were among the first software to become available online, and joined by a growing range of business ‘software (ACCA, 2013).”

Cloud-based accounting systems are capable of raising

the prospects of an agile and competitive service delivery. Also, with the increasing reach of the internet, cloud computing is edging closer to ubiquity. In Australia, most accountants have started embracing these technologies; this is also the case for CPAs in the U.S. furthermore around the world, organizations of all sizes and accountancy firms are beginning to recognize its benefits, as increased adoption allows them to reduce their technology infrastructures and move away from expensive hardware storage solutions. Hence, it is expected that in the nearest future, accountants will be fully cloud-based and accounting services will also be fully cloud-based.

Accountants and the big data

One thing is certain of the business world, this is the fact that in the nearest future, following the converging technological trends, the shift from analogue to digital, widespread mobile device adoption, internet-connected systems and ‘exhaust data’ from physical objects (the internet of things), a vast amounts of structured and unstructured data will be created. Hence, this will place more responsibility on future accountants as they attempt to collate, manage and analyze it effectively, for better decisions and to generate a competitive advantage for business. It is also important to note that the technology to achieve this is becoming more accessible and affordable.

“Vendors of software for business intelligence, enterprise resource planning, sales management and more are

adding the capability to analyze vast amounts of data 'in-memory', and cloud-based platforms are emerging to provide on-demand access to the tools that "accountants" need to tap into the 'internet of things' and unlock the power of big data in the nearest future (ACCA, 2013)."

It is important to note that the "big data" is undeniably gaining popularity, as the vast amount of data being collected and stored is reshaping the business world in general. Firms are now creating data-driven goals, measuring these goals accurately through analytics, while many firms are now listing data as an asset. Hence, where accountants can make their mark is with distilling data - that is turning information into actionable insights.

Accountants and Artificial Intelligence (AI)

Artificial intelligence (AI) describes a machine or software that can demonstrate behaviour indistinguishable from that of the human brain. Also, according to Hejase and Hejase (2011), "Artificial intelligence is the sciences of making machines imitate human thinking and behaviour". This is not yet possible but there are many examples of software that can demonstrate limited 'intelligence' (depending on how you define this). Most of us have used software that can emulate the decision-making processes of an expert: lots of software now has expert knowledge built in and the capacity to 'learn' how to improve its own processes and performance. The internet is awash with software agents (bots) that mimic human behaviour as they make independent decisions, learn and interact with each other.

"It is predicted that by 2030, accountants will increasingly rely on the expert knowledge built into software in a range of scenarios. Given that auditors use smart software to automate parts of the auditing process, and there are other specialist applications to help with compliance in areas ranging from financial reporting to international tax (Yanian, 2018)."

AI systems are improving quickly. They are capable of providing results that can be very accurate, and so, superseding human efforts in most cases. However, AI has not been able to replicate the human intelligence (Institute of Chartered Accountants of England and Wales, 2017). Notwithstanding, it is important that we appreciate the strengths and limits of these various forms of intelligence, as this will help build our understanding of the best ways of combining humans and computers to work together effectively. Hence, Yanian (2018) noted that there have been recent emphases on AI by the big-4 accountancy firms as revealed below;

PwC, in their global AI study, discovered that 45% of the world's total economic gains by 2030 will be attributed to product enhancements and stimulating consumer

demands. This is because AI will drive greater product variety, with increased personalization; attractiveness and affordability over time (PwC, 2019).

EY is set to launch its first AI Center in India. This center will bring together teams of multi-disciplinary practitioners, combining expertise in AI, Robotics etc. along with domain experience in sectors to achieve more in the accountancy profession (Electronics Media, 2017).

KPMG is said to have been using innovations from McLaren Applied Technologies (MAT) in its audit processes since 2015. The firm also has an alliance with IBM's cognitive computer known as "Watson". This means that the firm has already introduced AI into its operations (O'Neill, 2016).

Deloitte on the other hand already uses an AI platform called "Kira Systems" to enhance its assurance services (O'Neill, 2016).

Accountants and cyber security

As the world is moving to a small global village and more data are made available as discussed earlier (the big data), we cannot over-emphasize the importance of cyber security to accountants. Cyber security is the protection of computers, networks, programs, and data against unauthorized access or attack. Accountants are, by nature, custodians of information, and by implication, they are expected to ensure that such information are secured. Therefore, it is evident that accountants and accountancy firms in the future will be investing in cyber security to protect their interests and the interest of their clients.

"Individuals charged with the responsibility of securing IT systems often face a daunting challenge in today's world full of unguided rapid technological advances," says Frank Colantonio, CPA, CA, CITP, and a director with CPA Canada. Furthermore, a security breach can trigger unpredictable costs, so it is not surprising to see professional accountants wanting companies to dedicate resources aimed at protection" (AICPA, 2015).

Security is the number one issue facing accountants in this IT-era, and it is evident that as accountants' use of technology increases further, investment in cyber security will become inevitable; and in fact, some accountants will be forced to specialize on cyber security, especially for digital reporting purposes. Hejase et al. (2015) argue that as information technology companies are improving the vulnerability of their software and hardware products, hackers, malicious intruders, and above all cyber warriors are targeting the weakest link of the chain: the operating people. Hence, it will be a bad idea if accountants and accountancy firms ignore cyber security and its potential danger. If accountants don't have a plan in place, in all likelihood, their services may be breached at some point in the future.

Accountants and Virtual Reality (VR)/Augmented Reality (AR)

Accounting and financial reporting has been about representing reality with numbers for the purpose of enhancing the decision of those affected by such reality. This means that accounting numbers have been the closest measure of reality prior to this time. However, the existence of virtual and augmented realities and their potentials can be seen as a promising ground for accountants to improve financial reporting. Virtual reality (VR) is simply a computer-generated simulation of a three-dimensional environment or image where a person can interact in what seems like a real or physical way by using special electronic equipment, such as a head-mounted display (HMD) helmet or sensor gloves. A space flight simulator is an example of VR (Bellini, 2016). While VR places a person in an artificial, computer generate world, AR technology combines the real world with images, video and information that enhance or supplement the person's experience.

“As virtual experiences become more immersive and interactive, accountants will face new opportunities and new challenges.” (ACCA, 2013).

With the existence of VR and AR as emerging technologies, it is certain that users' expectations will increase in the nearest future, and one of the resulting effects will be demand for more disclosures (something more than just numbers). Accountants can explore these technologies to provide users of accounting information a closer touch to the economic reality being measured by reporting numbers. Special VR and AR reports can be prepared to facilitate users' understanding of what is, why and what will be- in relation to the reporting entity.

Implication for accountants

Early accountants were awakened by new technologies that reshaped clients' demands and users' expectations, and as a result, many were forced to retirement (to pave way for the new generation “technology-driven” accountants), while others were forced to embrace IT knowledge in order to cope in the industry. This is because as much as accountants cannot control the pace of technological advancements, there is always a way out. The implication of technology for accountants today and those who wish to be relevant in the future is that accountants need to;

Investment in IT knowledge and skills

Following the growth in technology and its capabilities, it has become evident that accounting and finance knowledge and skills are not enough for the accountant

today. There is need for accountants or accountancy firms to invest in acquiring IT knowledge and skills, for the purpose of being relevant in this IT-era, and to be able to withstand the wave of the post-IT era. The accountant of the future will need to know more about technology. In fact, ACCA in 2013 revealed that unless accountants embrace technology they will follow the dinosaur into extinction – individually and as a profession.

Investment in IT Tools

The accountant today needs more than just the ability to get the work done, but the right tools that will enhance the working process. Along with acquiring IT skills, accountants will also need to invest in IT tools that will enhance their work, in order to remain competitive and meet the demand of clients and expectation of users in the future (Salehi and Huisi, 2011). In fact, according to ACCA (2013), it will be no surprise that accountancy firms will begin to give clients mobile applications to access their services and engagements.

Be open to IT ideas

The traditional accountant is known to be a very strict and forward person, not really open or friendly due to the nature of their job and the need to maintain confidentiality. However, the emergence of IT and its importance to accountants have compelled accountants in theory and practice to rely on relationships with IT experts and their supports to get tasks completed effectively and efficiently. Accountants need to be open to ideas from IT experts and software designers in order to solve on-the-job technological challenges.

Be cyber-security conscious

As explained earlier, one of the challenges of IT adoption by accountants is the existence of cyber threats. Hence, accountants must become increasingly aware of this threat and how to ensure maximum data security. This is a very important responsibility, as accountants are now custodians of sensitive information that must be proposed.

Accountants must be trendy

Today's accountants need to be trendy technologically, keeping touch with latest technological advancements that affect their jobs. This is because staying on the job and being competitive requires accountants to do so. For example, it is assumed that by 2020, audits may well be real-time and as a result, accountants will be required to pull data in from business systems and sensors embedded in everything (including from stock to livestock

and even human beings)- (ACCA, 2013).

Accountants must work closely with IT experts

Accountants and Chief Financial Officers (CFOs) will also need to work closely with IT experts and consultants to coordinate multidisciplinary teams for in-depth analysis. This is because accountancy firms (like the big-4) may require the help of IT-experts to complete certain engagements of tasks. In short, big data provides the perfect platform for accountants looking to develop an increasingly strategic relationship with their clients.

Conclusion

We cannot effectively discuss the impact of information technology on the daily operations of modern professional accountants through a single paper. However, through literatures reviewed in this paper, we have been able to create a link between advancements in technologies and changes in the way accountants discharge their professional duties and responsibilities. We identified several ways that IT has improved the accounting process; including digitization of the entire process (Al-Zoubi, 2017); timely preparation and presentation of financial reports (Nwakoby et al., 2015; Sacer and Oluic, 2013); simplified record keeping and data storage (Ebenezer et al., 2014); transaction processing speed and accuracy (Dandago and Rufai, 2014; Moorthy et al., 2012; Moghaddam et al., 2012). We have also presented the accounting profession as one evolving with technology, and as a result, accountants (individuals and corporate) are required to embrace this trend and be equipped intellectually and with the right tools.

At the moment, it seems very clear that, with technological advancements such as cloud computing, artificial intelligence, and virtual reality (VR) and augmented reality (AR) finding their way into the accounting profession, and the resulting big data, accountants in the future will require more than financial literacy (basic accounting knowledge) to meet their professional demands. Therefore, accountants must begin to think IT and invest in IT skills and tools, as they have a significant role to play in this increasingly connected and interconnected business environment. The internet and cloud-based technology resources are reshaping the business world today: from the way we finance, resource and develop new and existing enterprises, to the way we create, buy and sell products and services. Nothing in the future is certain, and the unforeseen interactions between these technologies promise to be both interesting and challenging.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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