An Assessment of How Industry 4.0 Technology is Transforming Audit Landscape and Business Models.

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Abstract: *This paper aims to explore the impact of the latest advances in technology on audit profession and business models. Specifically, the study examined the effects and usage of the technologies that encompass Industry 4.0 upon the audit process. The study makes use of a qualitative research approach, which is based on a literature review and survey results from different research and consulting companies publications. The literature is primarily sourced from Professional Accounting bodies, the Big 4 publications, Newspapers publications, Google Scholars etc. The finding revealed that audit profession is at an important crossroads, as advances in technology and the massive proliferation of available information have created a new landscape for financial reporting and opening up the needs for a new skill sets that are relevant to the industry now and in the future. Therefore, it is imperative that those in the audit and finance profession invest in understanding and developing these technologies to benefit their respective sectors.*

Keywords: Industry 4.0 Technology, audit profession and business models

1. BACKGROUND OF THE STUDY

The term Industry 4.0 was introduced at the 2011 Hannover Fair by the German government. Matteo Talmassons described it as 'the time for cyber-physical systems (CPS's), which are the integration of computation, networking, and physical processes, and which are promising to transform the way people interact with engineered systems, just as the internet has transformed the way people interact with information' (quoted in Mhycke, 2018).The Fourth Industrial Revolution is characterized by highly intelligent connected systems that create a fully digital value chain.

Industry 4.0 has many facets to it including the upcoming trend of automation and data exchange in manufacturing technologies, cyber-physical systems, the Internet of things (IoT), cloud computing and lot more (Grant, 2017). It creates what has been called a "smart factory" (Grant, 2017). In smart factories, machinery, storage systems and production are capable of carrying out complex tasks, exchanging information and giving instructions to each other, without the need for human involvement (Grant, 2017). In their study Indian Readiness for Industry 4.0, Grant Thornton (2017) opined that the vision of Industry 4.0 is likely to be adopted worldwide and it might influence other initiatives and cooperative efforts. In general, there are nine key technological components that progressively make up the foundation of Industry 4.0: Autonomous robots, big data, augmented reality (AR), additive manufacturing, cloud computing, cyber security, Internet of things (IoT), system integration, and simulation (Grant, 2017).

Emerging technologies are altering the financial reporting environment substantially, and this change is accelerating, for example, artificial intelligence (AI), robotic process automation, and block chain are changing the way business gets done, and auditors are leading by transforming their own processes (Julie el ta, 2019). In this evolving environment, it is more important than ever for the key players in financial reporting—auditors, audit committees, and management—to have a strong grasp of roles and responsibilities (Julie el ta, 2019). As the use of emerging technologies in the financial reporting process increases, it becomes less likely auditors can design traditional substantive tests (e.g., test of details or substantive analytical procedures) that, by themselves, would provide sufficient appropriate audit evidence that respond to identified assertion-level risks (Julie el ta, 2019).

This evolution in the sufficiency and source of audit evidence puts further emphasis on management's internal control over financial reporting (Julie el ta, 2019). As industry moves toward the next generation, auditing should also adapt to the new environment (Jun & Vasarhelyi, 2016). Auditors can leverage new technologies to collect a large range of real-time, audit-related data, automate repetitive processes involving few or simple judgments, and eventually achieve comprehensive, timely, and accurate assurance (Jun & Vasarhelyi, 2016). Technology is changing the way business is conducted and data is analyzed (ICAEW, 2017). There is an increasing focus on data management; 'Know Your Data' (KYD) is the new buzzword replacing 'Know Your Client' (KYC)(ICAEW, 2017). Artificial intelligence, block chain and data analytics are game changers for both the finance and accounting sector and the audit profession, transforming the roles of both finance professionals and auditors (ICAEW, 2017).The advent of cloud computing and cloud storage has opened up the possibilities of collecting and analyzing data on a previously unimaginable scale (ICAEW, 2017). Advances in technology are changing the day-to-day

business operations and transforming firms' business models (ICAEW, 2017). Robotic process automation, data analytics, artificial intelligence, machine learning, distributed ledger technology…to name but a few: a seemingly endless list of transformation technologies at varying stages of evolution is already having, and will continue to have, an indelible impact on the audit process. (ACCA et al., 2019).

This paper aims to explore the impact of the latest advances in technology on audit and accounting profession as well as business information. Specifically, the study will examine the effects and usage of the technologies that encompass Industry 4.0 upon the audit process.

2. STATEMENT OF PROBLEM

When we think of changes to the financial statement audit, we tend to think in big, broad strokes (Susan, 2018). The period right after the stock market crash of 1929, for example, ushered in the modern era of independent audit of financial statements, a key to public confidence in our global markets (Susan, 2018).Automation and the digitization of business information are now reshaping the finance function, altering the way we, our clients and our employers approach our work (Susan, 2018).

3. RESEARCH QUESTIONS

As digital innovation is speeding ahead, the audit profession is forced to follow and it is not a question of whether the auditor needs to change, but rather when or how fast? (Mark, 2017). The following research questions formed the focal points of this study;

1. What are the factors motivating technological change in audit?
2. Which of the latest advances technologies that is changing audit?
3. What are the principles of industry 4.0 technologies and their impact on audit 4.0?
4. What are key technology risks and challenges auditors have to watch for in the evolution of industry 4.0 technology?
5. What are the skills required of auditors, finance and accounting professionals and regulators which has implications for educators, recruitment policies and staff development needs?

4. REVIEW OF RELATED LITERATURE

This section provides a discussion on the factors that motivate technological change in audit, the latest advances technologies that is changing audit, the principles of Industry 4.0 technologies and their impacts on audit 4.0. The section also made a review on the key technology risks and

challenges on auditors as well as skills required of auditors to catch up with the Industry.

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4.1 FACTORS DRIVING TECHNOLOGICAL CHANGE IN AUDIT

Sheila Fraser, FCPA, Canada's auditor general from 2001 to 2011, cited in (CPA, 2018) "recalls a sobering moment underlined what she considers the biggest long-term threat facing CPAs today. The increasing lack of reliance on financial statements and on audited information is a very serious situation for the profession, she further says. In the age of instant data, investors and analysts increasingly rely on non-GAAP and other measures to assess a company's performance (CPA, 2018). In their quest for up-to-date information, they may inadvertently trust sources that can be of dubious accuracy, consistency or comparability or those that stray into hype, including news releases on a company's latest acquisitions. "Investors are even looking at sales figures by tracking trucks leaving factories," says Fraser. "They don't seem to appreciate whether the information they're using is audited or not. To me, coming from the world of audit, it's all rather frightening."(CPA, 2018).

According to ACCA et al (2019) the latest advances in technology promise significant benefits for the audit profession, with a number of key drivers signaling the need for technological change in audit. Such drivers include the rapid increase in volume of data, changes in business models, the shift towards automation and the demand for a proactive and forward-looking approach to audit (CPA, 2018). These developments require auditors to be technologically sound to enable them to continue servicing businesses and to execute high quality (ACCA et al, 2019).

Similarly, Marr 2018, cited in ACCA et al., 2019, Dimitris Sourbis, 2019 cited in ACCA et al., 2019, emphasized that the volume of transactions and data in businesses has increased dramatically since 2016 and is expected to keep increasing in the future as well Changes in Business Models that businesses across almost every industry are in the front line. It has been estimated that over 90% of the world's data has been generated since 2016, and significant amounts of it are financial data (Marr 2018, cited in ACCA et al., 2019). Shift towards Automation and the demand for proactive and forward-looking approach in audit technology now offers an opportunity to produce higher-quality audits that better serve for their existing purpose (ACCA et al., 2019).

4.2 THE TECHNOLOGIES CHANGING THE FACE OF AUDITING

According to ACCA et al., (2019) businesses across almost every industry are experiencing at first hand the disruptive changes that are also affecting their auditors (ACCA et al., 2019). The following three classes of advanced technologies that are impacting the audit profession, referring

to both the tools available to auditors and the systems that need to be audited were explored; Cognitive technology which involves algorithms that enable software to absorb information, reason and think in ways similar to humans such as Artificial intelligence, Machine learning, Business intelligence, Big data, (Techopedia, 2019, Forbes, 2018, Britannica, 2019, Gabe.D et al, 2019, Chen et al., 2012 cited in Henrik Toni, 2018, Davenport & Harris, 2007, pp. 7 cited in Henrik Toni, 2018, Wikipedia: 2019, McAfee & Brynjolfsson, 2012; Davenport, 2014 and Bhimani & Willcocks, 2014 cited in Henrik, 2018); The Predictive Analytics Technology that looks at patterns in data to determine if those patterns are likely to emerge again, which allows businesses and investors to adjust where they use their resources to take advantage of possible future events (Investopedia, 2019) and the Smart Digital Hubs which serve as "smart platforms," whereby auditors can work remotely, and in real time, utilizing data and analytics, automation and visualization (Forbes, 2018). Such Smart Digital Hubs as Blockchain Technology, Distributed Ledger Technology and Drone Technology, Internet of Things and Sensor Technologies (Chui, Loffler, and Roberts 2010; O'Leary 2013; Pisching, Junqueira, Santos Filho, and Miyagi 2015; Shrouf et al. 2014, ACCA 2017a and ACCA et al., 2019).

4.3 PRINCIPLES OF INDUSTRY 4.0 TECHNOLOGIES AND THEIR IMPACTS ON AUDIT PROFESSION

Industry 4.0 is an initiative started by the German Government in 2006 (Grant, 2017). The initiative's intention is to digitize the manufacturing sector in order to increase productivity. The German industry is expected to invest a total of €40 billion in Industry 4.0 by 2020 (Grant, 2017). Similarly, "Industry 4.0 focuses on the establishment of intelligent products and production processes" (Brettel et al., 2014, p.38 quoted in Kajanth, 2016). Other authors argue that Industry 4.0 is the process of evolution rather than solely the development of a revolution and define the term as: "Essentially, Industry 4.0 is the technical integration of CPS 1 in production and logistics as well as the application of the Internet and its services for industrial processes (Kajanth, 2016). The resulting consequences have also an effect on the value chain, the business models, the downstream services and the work in progress" (Wolter et al., 2015 quoted in Kajanth, 2016). A recent study of the audit and advisory company Deloitte (2015) quoted in (Kajanth, 2016) reveals that Industry 4.0 could be defined as merging the real and virtual world, which essentially reflects the interpretation of CPS. Originating in Europe and spreading to the U.S., Industry 4.0 emphasizes six major principles in its design and implementation: Interoperability, Virtualization, Decentralization, Real-Time Capability, Service Orientation, and Modularity (Hermann & Otto 2015). On the impact of industry 4.0 on audit profession, Robotic process automation

(RPA) is already being used in audit execution, particularly for repetitive tasks like revenue and payroll testing (ICAEW, 2017). Technology offers the ability both to improve the quality of audit and to add value to it: audit is moving from being a reactive, backward-looking exercise to a proactive, predictive, forward-looking one, working in real time (ACCA et al., 2019). As such, it provides further opportunity to help businesses through timely insights (ACCA et al., 2019). Describing what the future audit would look like, (ICAEW, 2017) stated that, 'the way audit is performed may change significantly in the future. We are moving from continuous control monitoring (CCM) to continuous transaction monitoring (CTM), which happens on the client site, in real-time, with a copy created for the auditors, (ICAEW, 2017). The use of block chain technology makes these huge changes possible. Considering the above, it can be argued that Industry 4.0 will present a new mind-set within which accountants must learn to operate. Industry 4.0 can be expected to influence accounting practice in the following ways (Roger & Katherine, 2016):

a. Enable accountants to obtain previously unobtainable data in real time – through embedded sensors.
b. Facilitate data extraction from large common pools – for all types of decisions, all types of managers, all types of gatekeepers and all kinds of stakeholders.
c. Raise the quality of data – through greater timeliness and higher accuracy and detail to improve efficiency, data assurance and other decision-making purposes
d. Improve transfer of data for management planning and control e.g., in supply and value chains and between countries.
e. Increase the credibility and relevance of reporting – through self-controlling; self-auditing systems and demand pull custom accounting for individuals.

4.4 KEY TECHNOLOGIES AND ASSOCIATED RISKS

The auditing profession is standards driven, making it impractical for the profession to adopt any new technology or methodology if not required or approved by the standard-setting boards (PWC el ta, 2019). According to Hussein, el al (2016) the auditing profession will face the challenge of adjusting the current auditing standards in order for the adoption of such a disruptive technology to prevail. An example is continuous auditing, where the adoption reluctance of external auditors seems to be driven by the current auditing standards. The standards are still based on traditional auditing procedures, which were effective when the sizes of databases were small, but became ineffective in today's real-time digital economy.

4.5 SKILLS REQUIRED OF AUDITORS IN THE INDUSTRY 4.0 ERA

According to Michal Stepan (cited in ACCA et al, 2019), It is clear that some tasks will no longer be done by the auditors. In the long term, it is likely that the profession will see a shift in its focus with more emotional intelligence expected from auditors rather focusing on data testing. While technology is automating away all the administrative and routine work, accountancy and many other professionals can focus on value-added activities (ACCA et al., 2019). This analysis suggests that to add value for their employers and clients, the professional accountant of the future will need an optimal and changing combination of professional competencies, a collection of technical knowledge, skills and abilities, combined with interpersonal behaviors and qualities (ACCA, 2016). By 2020, all professional accountants will need to develop and balance the necessary professional quotients to fit their role and stage of career. Each accountant's professional quotients (PQ) will reflect their competency and skill across seven constituent areas (ACCA, 2016). Technical skills and ethics (TEQ) and experience (XQ) will be combined with intelligence (IQ) and digital awareness (DQ); interpersonal behaviors, skills and qualities will be reflected in quotients for creativity (CQ), emotional intelligence (EQ) and vision (VQ) (ACCA, 2016). Just as individual IQ scores can be raised (sometimes significantly) by appropriate teaching, experience, training and development, so too can TEQ, CQ, EQ, VQ and XQ (ACCA, 2016).

5. RESEARCH METHODOLOGY

The research methodology adopted for this study is selected on the basis of previous analysis from different studies and scholars. Key scholars rely on a quantitative approach rather than a qualitative one to analyze the success of digital transformation (Deloitte, 2015; Blanchet, 2014; Geissbauer et al., 2013 quoted in Kajanth, 2016). Further quantitative research methods are especially used for objective measurement including statistical or numerical analysis of polls, such as surveys or questionnaires (Babbie, 2010 quoted in Kajanth, 2016). The Industry 4.0 technology is a recent topic, which is not discussed excessively. Therefore the study makes use of a qualitative approach, which is based on a literature review and survey results from different research and consulting companies. The literature is primarily sourced from Professional Accounting bodies, the Big 4 publications, Newspapers publications, Google Scholars etc. The research study is structured in such a way as to provide sufficient answers to the guiding research questions

6. DISCUSSION OF FINDINGS

The study examines the effects and usage of the technologies that encompass Industry 4.0 upon the audit process. The study makes use of a qualitative research approach, which is based on a literature review and survey results from different research and consulting companies publications. It was found that Industry 4.0 improves audit effectiveness through the integration of new types of evidence, such as Auditor Implications (AI). Instead of manually examining a sample of transactions, auditors can take advantage of AI methodologies to examine complete populations of transactions in a much shorter time. Rather than spending their time on manual labor, auditors will be able to put their professional skills to better use on high-value tasks by focusing their efforts on the interpretation of the results produced by AI. Thus corroborates the findings of Vasarhelyi, Alles, and Williams (2010) that through auditor implication more data are continuously generated and collected, and demand for more frequent audits increases. Hussein, el al (2016) added that AI application in auditing can significantly improve audit efficiency. Similarly, Smart contracts bridge the gap between the physical world and the digital world by encoding complex business, financial and legal arrangements onto the block chain (PWC el at, 2019). However, it was discovered from the study that auditors may face the challenges with evolution of industry 4.0 technology such as Digital Crime, particularly the issue of cyber security, as the power of technology can be used to steal massive amounts of information without obvious traces (Jun & Vasarhelyi, 2016) and Security and Privacy Issues of Companies' Data, Shapiro and Baker 2002, cited in Jun &Vasarhelyi, (2016) asserted that emerging technology poses a significant threat to the security and privacy of organizational information.

7. CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study and given the speed of technological and digital advances, it is imperative that those in the audit and finance profession invest in understanding the basics of these technologies. The audit profession is at an important crossroads and advances in technology and the massive proliferation of available information have created a new landscape for financial reporting. The audit technology tools that are in the cloud today, that integrate platform and methodology, are very good starting points to move to the future.

Therefore, it is recommended that one, lower level accounting and auditing skills be replaced easily by technology, human business acumen and communication skills. Two, Audit firms need to invest in digital initiatives, including AI, blockchain, cyber security and developments in data capabilities. Three, the challenges with evolution of industry 4.0 technologies such as Digital Crime and Security and Privacy Issues of Companies' Data could be overcome by giving training and re-training to auditors and accountants on the use and adaptability to the new technology. Four, Auditors must possess extensive technical and analytical skills that are currently not components of most traditional four year university accounting programs particularly in Nigerian context.

Other recommendations from ACCA, (2018) and ACCA etal, (2019) are that Auditors:

i.   Need to adapt to the changes in business models.

ii.   Must note that among the available technologies, data analytics is currently the most mature and is currently used by most firms.

iii.   Must understand that the audit profession is still at a very early stage with AI and has not embedded it as deeply as it could.

iv.   Should note that the human relationship between client and auditor remains important: not everything can be replaced by technology.

v.   Will need to be more adaptable to change in future.

1. REFERENCES

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ."

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