

# New Technologies: Catalysts for Business Models and Finance Function

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## Abstract

To bridge performance gap, improve operational efficiency, enhance competitive advantage and secure corporate assets, business entities have continued to embrace new technologies with profound positive impact on their bottom-line. As new technologies replace humans through automation in the emerging business models, the demand for professionals, including chartered accountants, who are not IT-savvy is fast declining, taking with it, wages, salaries and a high percent of income taxes. These problems are compounded by the huge costs of technology acquisition and inevitable investment in human capacity building in the face of increasingly mobile staff. Using secondary information, the study observed that many professional accountants dread the transition from manual to automation as it would eliminate repetitive finance-related jobs in the midst of high unemployment rate in the country, dissuade new entrants into the accounting profession and alter the human side of enterprise. It therefore recommends that the training curricula of professional accountancy organisations should be rejigged and skewed towards technology while existing professional accountants should hone their IT skills to leverage technology to deliver value online, real time to their diverse stakeholders.

**Keywords:** Technology, Internet of things, automation, business models, artificial intelligence, robotics, machine learning, finance function.

## 1. Introduction

In the last fifty years, businesses and economies have been grappling with the critical issues of globalization and the wide dispersal of stakeholders of businesses across jurisdictions. Driven by technology, the emergent e-commerce has replaced physical markets with profound impact on the volume, value of business and the wealth created. In 2014, 2015, 2016 and 2017, the value of retail e-commerce worldwide amounted to US\$1,336b, US\$1,548b, US\$1.845b and US\$2.304b, respectively (Statista, 2018) representing a growth of 72.5% in 4 years.

Thus, the assumptions of the subsisting business models are now being challenged by emerging technology, new production inputs, the nature and environment of work. For instance, with increased sophistry in technology, organisations no longer need to invest in huge information technology servers as cloud computing is the vogue. Also, finance is no longer the only capital needed for wealth creation. Intangible assets in the form of intellectual capital, human capital, social and relationship capital as well as the tangible assets of natural or environmental capital now play critical roles in value creation. As a result, the increasingly sophisticated and diverse stakeholders of businesses now need financial and non-financial information, online real time, on how values are created and destroyed by entities in which they have interests (Bhasin, 2017).

The environment of business has changed. The quest for a green and paperless environment with optimal returns on investment has continued to raise issues about business models. The focus is no longer only on input, process and output, but also on outcomes and impact. For instance, the acquisition of resources by an organization to produce a given output is great. But how does its resource acquisition affect the environment in which it has its being? Who benefits? Who is negatively impacted and what remedial measures is the entity taking to address the externality? Here lies the propriety of integrated thinking which refers to “the conditions and processes that are conducive to inclusive process of decision making, management and reporting based on the connectivity and interdependencies between ranges of factors that affect an organisation’s ability to create value over time {Chartered Institute of Management Accountants (CIMA), 2017, p.4}”.

In the midst of the fierce competition for resources by entities and humans, the drive for innovation inclined to optimal efficiency is the new normal. As a result and as survival strategies, humans are adopting ingenuous communication strategies (e.g., social media) to reduce physical movements, to communicate faster and market their goods and services to mass audience while organisations are embracing technology and rejigging their business models as well as operational modalities to replace humans with more efficient machines. As sensor cards are used as door keys, payment modes and access rights, web-based encyclopaedias are replacing print encyclopaedias just as the cameras in various smart phones have altered the photography markets for Polaroid and Kodak. In the same vein, Google and related search engines have enhanced the access of students to learning resources but greatly diminishing the need for and use of physical libraries. Simply put, technology is disrupting age-long businesses and associated practices {Association of Chartered Certified Accountants (ACCA, 2013)}.

The traditional book keeping functions which involve the manual recording, summarising and analysis of all transactions of monetary nature, consolidation of this financial information on daily, weekly, monthly, quarterly and yearly bases to generate performance and financial statements, have been taken over by technology.

Currently, purchases, sales and other transactions including inventory and supply chain management are captured online real time while all accounting records and financial statements can easily be generated by technology. With a smart phone in a remote location of a city, you can conveniently order an Uber cab, book a flight, buy a product, make a payment, listen to music, watch a film or play a game (Schwab, 2015). For instance, Jumia.com, Konga.com, OLX Nigeria and Cars45.com exist for buying and selling of goods in Nigeria. The computer software, based on instructions, can calculate and credit various accounts with interest earned at month end, charge value added tax, stamp duties, deduct withholding tax and other applicable charges, and also notify bank customers of these transactions. With various electronic payment systems, bank reconciliations can easily be done thereby promoting e-commerce on a scale previously unimagined across jurisdictions.

The implications of this embrace of technology and tendency towards lean management, are manifesting in the unemployment of poorly IT-skilled but expensively trained accounting professionals, outsourcing of functions, job insecurity, job losses, increased cases of cybercrimes, fraud, sharp practices, insecurity as well as social unrest. With outsourcing, accounting departments are disappearing from “the organizations in the same proportion in which the organizations acquire integrated information systems, reducing the time invested in transcribing data and placing before company management, updated information of their operations” (Betancourt, 2016, p. 2). On the positive side, with huge number of manual activities being automated, efficiency of processes, optimal output and security of assets will be the new normal. The problem is how to effortlessly manage the transition from manual to automation, secure the jobs of professional accountants in the long term, and make technology a tool and a business enabler even as it disrupts the subsisting paradigm.

The objective of this paper is to appraise the impact of new technology on business models and finance function particularly in the context of emerging skills gap amongst accounting professionals. It will also seek to appraise the implications of the new workforce of corporate entities: man and machines in an emerging market like Nigeria with high population growth rate of 2.6% per annum according to National Population Commission (2016).

The remaining part of this paper is segmented into four parts: section two discusses the literature review while section three is on the methodology. Section four appraises the impact of technology on business models and finance functions. The final section contains the conclusion and recommendations.

## 2. Literature Review

### 2.1 Conceptual Review

**2.1.1 Artificial Intelligence:** Artificial intelligence (AI) describes a machine or software that can demonstrate behaviours indistinguishable from that of the human brain (ACCA, 2017). According to the New International Webster’s Comprehensive Dictionary of the English Language, Encyclopaedic Edition, “Artificial Intelligence is concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning and self-correction”. Britannica (2018) defines it as “the ability of a digital computer or computer controlled robots to perform tasks commonly associated with intelligent beings”. All these definitions point to the fact that AI is about imitating intelligent human behaviours (Kok, Boers, Kusters, Putten & Poel, 2009). With artificial intelligence, a machine or software can carry out accounting activities of gathering, analysing, summarising and processing of data into information in the form of financial statements. Although with its efficiency artificial intelligence can create opportunities, it poses a lot of challenges to professional accountants as it seeks to replace man.

**2.1.2 Robotics:** these are man-made and programmed machines that can carry-out instructions and execute tasks of repetitive nature. A visit to any soft drink or soap manufacturing company will drive home the precision with which robots carry out their various programmed functions. They are the emerging new colleagues of humans in the workplace. As robotics evolves and converges with other emerging technologies, a new world of ethical, financial, practical and operational possibilities will emerge (ACCA, 2013).

**2.1.3 Machine learning:** Machine learning has been defined by Faggella (2018, p.2) as “the science of getting computers to learn and act like humans do and improve their learning over time in autonomous fashion, by feeding them data and information in the form of observations and real-world interactions”. In other words, an un-programmed machine is thought to think, learn and act like humans. Through machine learning, a machine can perform some tasks without prompting.

**2.1.4 Blockchain:** this is a network of computers grouped as they were admitted into the chain. All who applied to be part of the network are grouped together as a block and processed as one unit to be admitted into the network. All existing and newly admitted members of the network (known as blocks) are connected together by a chain (i.e., linked network) in the form of blocks, hence, block-chain. Thus, block-chain will enable corporate entities to share a common infrastructure for database retention in the form of a shared ledger. Every member of the group, known as data miner, is an administrator and participates in the processes for admitting new members, building data and carrying out transactions. All data uploaded are encrypted and stored in the cloud and cannot be changed without the consensus of all. In other words, although the whole data in the database are accessible to

all, they can only be amended or altered through transactions with the consent of everyone in the network. Any new data accepted as a result of transaction between parties, is again encrypted and added to existing data. The previous encrypted data are not obliterated. But a new and improved version is created, encrypted and stored to reflect the new ownership rights arising from the transactions. In essence, the processes are transparent while the integrity of the data is never in doubt. It cannot be hacked because everyone has a secured and encrypted version of the original data while the consent of everyone is required to carry out transactions or alter data. Indeed, the incentive to hack is eliminated as the efforts will only succeed if all miners' approvals are obtained. Since this is a tall order, hacking and hackers will be frustrated. To encourage people to process any prospective transaction, bonuses are paid in the form of coin, known as bit coin. These bit coins can be traded as currency called crypto currency. All members are regarded as miners as they participate in the blockchain IT space and they validate new transactions and record them on the global ledger (Ankalkoti & Santhosh, 2017).

*2.1.4 Internet of things (IoT):* this is a phrase which describes a system where the internet is connected to the physical world via ubiquitous sensors. IoT involves sensing, networking, processing, security of systems, telecommunication equipment, software development and integration and application services. It is enabled by open wireless technology such as Bluetooth, radio frequency identification, WIFI and telephonic data services, sensor and actuator mode (Gunardi, Adriansyah, & Anindhito, 2015).

### 3. Theoretical Review

Organisations acquire inputs which they convert to output to meet the needs of their stakeholders. In line with the strategic managerial practices of cost minimisation and output maximisation, these entities strive to obtain more output from given inputs which are subsequently disposed-off for profit. This is illustrated by the two-input Cobb-Douglas (1928) Production Function Theory as follows:

$$P(L, K) = BL^\alpha K^\beta \text{ ----- equation 1.}$$

Where P=total production or output;

L= labour input

K=Capital input(machinery and equipment

B=total factor productivity (efficiency coefficient)

The  $\alpha$  and  $\beta$  which are constants, are determined by available technology and they represent the elasticity of labour and capital respectively.

According to the Cobb-Douglas Production Function theory, there is a possibility of increase in return to scale, constant returns to scale or decrease in return to scale. In other words, as capital is substituted for labour, output may increase by more than proportionate increase in input, remain constant or even decrease. Thus, two firms can be carrying out production activities with same combination of inputs but out may be different due to efficiency which is denoted as B in equation 1. Application of appropriate technology provides the explanation for the observed efficiency in resource utilisation (Cobb-Douglas, 1928).

All aspects of human endeavours are increasingly been affected by technology. With the emerging new technologies and their impact on businesses and the various professions including accountancy, there is a consensus that the world is experiencing its 4th major industrial revolution (Schwab, 2015). While the first, second and third industrial revolutions respectively witnessed mechanization and mass production, the development of electricity and the digital age, the 4<sup>th</sup> industrial revolution is driven by internet of things, artificial intelligence and robotics. The fourth industrial revolution is "characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres"(Schwab, 2015, p. 90). In terms of physical sphere, unmanned or autonomous vehicles and nanotechnology now exist; while in terms of digital sphere, the era of internet of things, big data, artificial intelligence and block-chain is here. With biological sphere, there are now biotechnology and new energy technologies {World Economic Forum (WEF, 2018)}.

Whether on the factory floor or the warehouses of manufacturing concerns or in the procurement of goods and services, technology is helping to catalyse inventory management, production and value creating processes thereby enhancing business operations, efficiency and profitability. Thus, what underlines the trend towards the embrace of technology is efficiency spurred by perceived performance gap between actual and desired results (March & Simon, 1958; Rogers, 1962).

A gap may be discovered in comparison to competitors' practices, missed opportunities in the market place, or unmet customer expectations. Or it may stem from managers complaining about business results, workers chafing over quality of their equipment, or professionals lobbying for technology that is more state-of-the-art. (Mirvis, Sales & Hackett, 2006, p.116).

The view is that improved efficiency will lead to the bridging of the subsisting gap, however defined. Efficiency theory deals with smart resource utilization. According to Archer (2010, p.1), "efficiency is defined as the measure of effectiveness that produces the minimum waste of time, effort and skills". The concept of efficiency can be viewed from the Pareto Optimality theory in which initial resource allocation is altered such that at least one person is better off without making anyone worse off. Given that the resources of an entity is

fixed, those with governance responsibilities must ensure that they are allocated in such a manner as to raise the bottom-line of the organization without creating additional costs.

In the application of the Pareto Optimality to the embrace of technology by businesses, the external stakeholders will benefit maximally whereas some of the internal stakeholders (especially the workers) will be disadvantaged through layoffs and lower wages. It is in this context that the Kaldor-Hicks Efficiency theory holds sway. The Kaldor-Hicks Efficiency theory is a theory where an outcome is considered more efficient if a Pareto Optimal outcome can be reached by arranging sufficient compensation from those who are made better off to those who are made worse off so that all (or none) would end up no worse than before. The Kaldor Hicks Efficiency theory builds upon the Pareto Efficiency theory since it has less stringent criteria. Applied to the Niger-Delta scenario, for instance, the oil companies and the government which benefits from exploration activities will contribute resources for the restoration of the environment such that the environment and inhabitants are not worse off than they were before the commencement of exploration.

In other words, those who are benefiting from the embrace of technology should be willing to invest in human capacity building to enhance the skills of their colleagues, invest in curricula of tertiary institutions to build the manpower of the future, invest in governance so that regulations that will promote the advancement of technology will be passed. Ultimately, all stakeholders will benefit as technology, as an enabler, will lead to the creation of more wealth for the global economy. The dichotomy between skilled/high pay and low skill/low pay will disappear. "We are a single national business providing the best of everything for our citizens. Society benefits as a whole when we make everything at the highest quality possible and at the lowest cost possible" (Archer, 2010, p.106).

#### **4. Methodology**

As an exploratory study, the study relies significantly on previous research works and secondary information to achieve its objective of appraising the impact of technology on business models and finance function in an emerging economy like Nigeria.

#### **5. The Impact of Technology on Business Models and Finance Functions in Nigeria**

Over the years, there has been a great trend towards the convergence of professions. The professional accountants of today are drawn from physical and natural sciences, engineering, economics, information technology and management resulting in the profound change in the complexion of the accountancy profession (Omoriegbe, 2001). This is a reflection of the robustness of the accountancy profession as the harbinger of the language of business. Currently, valuers, IT experts and actuary now play key roles in financial reporting and thus, are required to register with the Financial Reporting Council (FRC) of Nigeria, the body charged by law in 2011 to regulate financial reporting in the country. This fusion of the profession has implications for business model and the future of work (Omoriegbe, 2001).

##### *5.1 Impact of Technology on Business Models*

In the wake of the advancement in and embrace of technology by corporate entities, the evolving new business model point to a situation where humans and machines will cohabit in the office or factory setting raising a new world of ethical, financial, practical and operational possibilities. Since humans are being replaced in workplaces by automation, the new neighbours to the remaining employees will be machines. This would further compound the problem of diversity in workplaces by narrowing the possibility of harvesting ideas from as many people with different backgrounds as possible (Buchanan, Kelley, & Hatch, 2016).

Since machines cannot discuss and therefore, have no ideas to share, how do humans react to emergencies and decision making? If investment decisions by machines, made possible by machine learning, turn awry, who takes the blame and bears the sanctions? What level of premium should be placed on authorisations and other controls? As the complexion of the work place is significantly altered, the value of team spirit, consultations, empathy and emotional intelligence may gradually wane and disappear. In corporate entities therefore, the business model should take into consideration that humans and machines are being planned for. With machines, the model can assume, for instance, 24-hour operations whereas, for humans, the International Labour Organisation's standard 8 hours working day, can be contemplated. Additional rewards can be introduced to compensate for extra hours worked by humans. In place of huge investment in training, emphasis may shift to investment in newer machines with greater efficiency. This is not to argue that investment in humans will not be necessary. Rather the ratio will be tilted in favour of more efficient machines for all repetitive tasks that can be automated (Schwab, 2015).

One other fundamental impact of technology on business model is that employees may actually not work in a physical office. Since virtual offices enabled by internet are now a reality, fewer employees may actually work in offices. Many CEOs run their offices from their smart phones away from their physical offices. In essence, while it is expedient to agonize over the possibility of humans and machines sharing offices, the employees, with

cloud computing, may actually be working from anywhere anytime to deliver value to stakeholders. The hours of work on any day may no longer be cast in stone. This, itself, raises the parameters or metrics for measuring staff performance. Things like punctuality, appearance, empathy and physical relationship with immediate supervisor may now count for nothing. Trade unionism and its hallmarks of strikes and picketing will wane. The quantum of resources used up and the value created would now be critical factors in performance appraisal and reward system. Since social media may be the most important vehicle for marketing and delivering value, the organization must integrate same into its business model (Porter & Millar, 1985).

Above all, the emerging business model must take the entire organization as one entity with interdependent units irrespective of whether man or machine controls the unit. The issue of ergonomics has, also, to be taken into consideration (Noro & Imada, 1988). The machines to be acquired for the various offices must be human-friendly and suitable for the environment of work. The impact on value creation through more efficient service delivery should be the driving force in the increasingly complex work environment of the future. Today, to truly deliver a value proposition that is able to flourish, an understanding of the way that complex adaptive systems come together to create both outputs and outcomes, is required (ACCA, 2018).

Thus, a reshaping world is calling out for new business models that can navigate complexity, build resilience and make the most of opportunities to create new forms of value. According to ACCA(2017), business models of the future are ones that will navigate the complexity of tomorrow's world to help build economic and social systems where ingenuity, creativity and inclusion come together to help people unlock their potential and live well.

### *5.2 Impact of Technology on Finance Function*

Much more fundamental than the aforementioned changing complexion of the Accountancy Profession is the fact that technology and automation have profoundly impacted the existing paradigm. Software now performs most accounting functions at speed never previously imagined some decades back. Organisations no longer need to invest in huge servers to store business data. Cloud computing (i.e., storage of data in the cloud) is now the vogue resulting in the phenomenon of Big Data and its huge possibilities. Indeed, due to digitalisation, accountancy has increasingly become cloud-based and empowered by Big Data, making it more efficient and mobile (Abang, 2017).

With Big Data and analytics, all transactions can be reviewed or processed online real time, within minutes and with remarkable efficiency and possibilities. A maze of data can be processed into information and business intelligence for strategic decision making within a few minutes. In the fiscal terrain, technology will assist the government to expand its e-commerce-related tax revenues since all business data are captured. Indeed,

certain technology trends, including Big Data, analytics, artificial intelligence (AI), machine learning, the Internet of Things (IoT), mobility and cloud computing are all having huge impact on tax administrations. Taken individually or together, these trends have the power to increase taxpayer satisfaction, empower tax agency employees, optimize operations and modernize services. (PwC, 2017, p.7).

With the advancement in technology, some existing tax software have helped to improve computational accuracy, streamline external audit thereby minimizing the risks of tax penalties and its associated reputational damage as well as making assurance services more efficient and effective.

However, the annual statutory attestation function of the accountant is not spared as the emergence of Big Data may ultimately implies a shift from the provision of reasonable assurance to absolute assurance (Abang, 2017). In this context, the audit sampling technique and concept of materiality may become otiose with time. In this respect, the nature and content of audit opinion may change.

Given the unfolding trend, there is no doubt that the Accountancy Profession is in a flux but this instability, will certainly enhance its offerings. The consolation for professional accountants in public practice lies in the fact that the attestation franchise is still statutorily required. So irrespective of the "invasion" of the profession by non-accountants and technology, the signature, stamp and seal of the professional accountant in practice is protected by law in all jurisdictions. The same cannot be said of other repetitive, rules-based accounting functions.

With the emerging scenario of Artificial Intelligence (AI) and Robotics, repetitive, rules-based tasks can be easily executed by well-designed and programmed robots. Imbued with artificial intelligence, robots can execute programmable tasks. For instance, billing of customers at the end of the month, calculation of interests earned and crediting various accounts, generation of receipts and tracking the record of transactions, capturing and updating of records can be done by robots. "Today, financial controllers and CFOs use structured data, unstructured data, and predictive analytics to access massive banks of customer information, financial trends and industry information to make insightful forecasts for clients" (Najjar, 2018, p.1).

As the emerging technology continues to unfold, machine learning is also taking place. As noted above, machine learning involves getting computers to act or carry out assignments with improved performance, based

on data and algorithms, without being programmed. In other words, un-programmed machine or computer can analyse the available huge data on its own and make predictions of possible investment outcomes. In other words, the computer is attempting to think like humans and make informed decisions based on data and relationships that it has observed. With machine learning, the frontier of disruption of accounting and finance functions by technology is being expanded with serious implication for business models and the future of work. Since to disrupt means to unsettle or to interrupt the traditional ways of doing things, technology, as an enabler, is capable and indeed, has been changing the ways things are traditionally done in accounting. This is not unexpected. The history of the profession has been to adapt, leverage and utilize technology for the benefit of business, government and society. As noted by Archer (2015), “we must improve our efficiency to survive” (p.163).

The major implication is that only few accounting professionals will be required to carry out rudimentary accounting and finance functions as machines will continue to carry out these rules-based repetitive tasks with greater efficiency. As machine learning continues to take place at a faster rate, only skilled and IT-savvy accounting professionals will retain their jobs and earn handsome pay while the unskilled will exit or earn low pay. According to Schwab (2015, p.4), “this will give rise to a job market increasingly segregated into ‘low-skill/low pay’ and ‘high-skill/high-pay’ segments, which in turn will lead to an increase in social tensions.” The net effect of the displacement of workers by machines is the possible exacerbation of “the gap between the returns on capital and returns on labour” (Schwab, 2015, p.4). If capital continues to yield more returns, labour will increasingly be replaced causing in its wake some social tensions and crimes in addition to fundamentally altering the nature of the work environment and players therein.

What appears soothing is that robots are only as smart as their designers. So the performance or efficiency of robots depends on how well they are designed or configured. Since they are designed to carry on routine repetitive assignments, they will be efficient in rule-based environments.

But the International Financial Reporting Standards (IFRS) framework that Nigeria and many jurisdictions have adopted, are principles-based and therefore, robots may have issue of choice/decision to grapple with. The human angle cannot simply be ignored since value judgements will be involved. Professional accountants will therefore need to devise new methods of deploying and measuring the performance of robots in principles-based environments. They will also need to consider the impact of the deployment of robots and machine learning on portfolio investment, management accounting and internal controls. These are areas where the human judgement is crucial. Effectively, talent will still remain the critical factor of production irrespective of the dexterity of robots. In the emerging scenario of finance function, professional accountants will need to focus on higher value jobs (e.g., financial advisory services), to remain relevant.

Given the severity of the unfolding development, the World Economic Forum (2018) has recommended and segmented into three, the following skills required by humans and in particular, professional accountants, to be able to survive in the emerging work environment: complex problem solving skills, critical thinking skills, people management skills, coordinating with others, emotional intelligence, judgement and decision making, service orientation, negotiation and cognitive flexibility. These are soft skills that will reflect the human side of enterprise and professional accountants who desire to stay relevant must acquire them.

## 6. Conclusion and Recommendation

Humans, including professional accountants, must wake up to the reality that technology is here and that it will certainly continue to disrupt business models and finance function. What is not certain is when the disruption will stop at some point and stabilise. In the quest for efficiency, entities will continue to invest in technology and innovation to enhance their value proposition to their diverse stakeholders and so the disruption may continue un-end. To remain relevant in the scheme of things therefore, professional accountants must continually hone their skills and remain IT-savvy. New knowledge and soft skills are the key to survival.

As AI technology and expert systems become more commonplace accountants will need to become more adept at monitoring, assessing and exploiting them. Accountants will need to: stay informed and know what is possible, assess the potential to automate tasks and procedures, up-skill to take advantage of the potential to focus on higher value work. (ACCA, 2017, P.13).

While professional accountancy organisations like ICAN have continued to regularly review their certification training curricula and complemented them with mandatory continuing professional education programmes, the critical aspects of hands-on practical training is yet to be fully addressed. Accordingly, existing and new entrants into the profession must deliberately invest in practical IT training as survival strategies. Since the new work place is one driven by technology, only a smart, forward looking, IT-savvy professional accountant, who possesses the identified soft skills, will remain on the driving seat of the emerging world of business.

## References

Abang, S. (2017). Technology is disrupting accountancy profession. *NST Business*, The Malaysian Institute of

- Accountants, September 7.
- ACCA (2013). Technology trends: their impact on the global accountancy profession. *Accountancy Futures Academy*.<https://www.accaglobal.com/futures>, accessed on September 8, 2018
- ACCA (2016). Drivers of change and future skilled. Retrieved on July 21, 2018 from <https://www.accaglobal.com/content/dam/members-beta/docs/ea-patf-drivers-ofchange-and-future-skills.pdf>
- ACCA (2018). Business models of the future: Systems, convergence and characteristics.<https://www.accaglobal.com/.../business-models-of-the-future-systems-convergence...> Accessed on September 27, 2018.
- ACCA (2017a). Ethics and trust in a digital age. Retrieved September 2, 2018 from [https://www.accaglobal.com/content/dam/ACCA\\_Global/Technical/Future/pi-ethics-trustdigital-age.pdf](https://www.accaglobal.com/content/dam/ACCA_Global/Technical/Future/pi-ethics-trustdigital-age.pdf)
- ACCA (2017b), Business models of the future: Emerging value creation. [http://www.accaglobal.com/content/dam/ACCA\\_Global/Technical/Future/pi-business-models-of-the-future.pdf](http://www.accaglobal.com/content/dam/ACCA_Global/Technical/Future/pi-business-models-of-the-future.pdf), accessed September 2, 2018.
- ACCA (2018), Business forms: A brief guide to starting up [https://www. accaglobal.com/content/dam/ACCA\\_Global/professional-insights/business-forms/pi-business-forms-UK.pdf](https://www.accaglobal.com/content/dam/ACCA_Global/professional-insights/business-forms/pi-business-forms-UK.pdf), accessed on September 2, 2018.
- Ankalkoti, P., & Santhosh S. G. (2017). A Relative Study on Bitcoin Mining.*Imperial Journal of Interdisciplinary Research (IJIR)*, 3(5), 1757-1781.
- Archer, T. S. (2010). The Efficiency theory. Manuscript edited by Michael Aschenbach. ISBN: 1-4563-2007-6. [www.theefficiencytheory.com>the\\_Efficiency\\_Theory](http://www.theefficiencytheory.com/the_Efficiency_Theory), accessed on September 7, 2018
- Argote, L., Goodman, P. S., & Schkade, D. (1983). The human side of robotics: how workers react to a robot. *Sloan Management Review*, 24(3), 31-41
- Betancourt, R. R. (2016). The impact of technology on the public accounting profession.<https://www.mgi.world.com/.../the-impact-of-technology-on-the-public-accounting-profession>. Accessed on September 10, 2018.
- Bhasin, M. L. (2017). Integrated Reporting: The Future of Corporate Reporting. *International Journal of Management and Social Sciences Research*,6(2), 17-31.
- Brandasa, C., Megana, O.,& Didragaa, O. (2015). Global perspectives on accounting information systems: mobile and cloud approach. *Procedia Economics and Finance*,20 (2015) 88 – 93. 7th International Conference on Globalization and Higher Education in Economics and Business Administration, GEBA, 2013.
- Buchanan, J.; Kelley, B., & Hatch, A. (2016). How digital technologies are changing the workforce and how enterprises can adapt and evolve. Digital workplace and culture. <https://www2.deloitte.com/content/dam/.../us-cons-digital-workplace-culture-pdf>. Accessed on September 27, 2018
- Christensen (1997). *The Innovator's Dilemma:When New Technologies Cause Great Firms to Fail*. Boston, MA: Harvard Business School Press.
- CIMA (2017). Integrated Thinking-Aligning purpose and the business model to market opportunities and sustainable performance. *CIMA Research Executive Summary*,13(3), 4.
- Cobb, C., & Douglas, P. H. (1928). A theory of production. *American Economic Review* 18 (Supplement), 139-165. Retrieved on September 27, 2018.
- Cosset, D. (2018). Blockchain: What is mining? Retrieved on September 27, 2018 from <https://dev.to/damcosset/blockchain-what-is-mining-2eod>.
- CPA Canada, the AICPA, and the University of Waterloo (2017). Blockchain technology and Its potential impact on the audit and assurance profession. Retrieved from <https://www.aicpa.org/.../assuranceadvisoryservices/.../blockchain-technology-and-its...> on September 27, 2018.
- Crosby, M., Nachiappan, Pattanayak, P., Verma, S., & Kalyanaraman, V. (2015). Block chain technology: Beyond bitcoin. *University of California Berkeley Sutardja Center for Entrepreneurship & Technology Technical Report*, October 16. [www.scet.berkeley.edu](http://www.scet.berkeley.edu) Accessed on September 24, 2018.
- Dimitriu, O., & Mateia, M. (2014). Emerging Markets Queries in Finance and Business: A New Paradigm for Accounting through Cloud Computing. *Procedia Economics and Finance*,15, 840 – 846
- Dimitriu, O. & Mateia, M. (2015). Emerging Markets Queries in Finance and Business: Cloud accounting: a new business model in a challenging context. *Procedia Economics and Finance*, 32, 665 – 671.
- Docherty, P. (2018). *Technology: A Tale of Two Practices*. IFAC Global Knowledge Gate way, June 28. Retrieved on August 31, 2018
- Docherty, P. (2018). *Developing a Technology Strategy*. IFAC Global Knowledge Gate way, May 31.Retrieved

- on August 31, 2018
- Doostani, H. (2017). Impact of Information Technology in Evolution of Traditional Accounting to Modern Accounting. *International Journal of Management and Applied Science*, 3(5), May. ISSN: 2394-7926. <http://iraj.in>
- Elkington, J., & Johnson, R. (2018). We need breakthrough business models, not breakthrough technologies <<https://www.fastcompany.com/40540343/we-need-breakthrough-business-models-not-breakthrough-technology>>, accessed September 2, 2018.
- Faggella, D. (2018). What is machine learning? <https://www.techemergence.com/what-is-machine-learning/> . Retrieved on September 8, 2018
- Financial Reporting Council (FRC) of Nigeria Act, no.6, 2011
- Gould, S. (2017). *Disrupting the accountancy profession*. IFAC Global Knowledge Gate way, May 24. Retrieved on August 31, 2018
- Gunardi, Y., Adriansyah, A., & Anindhito, T. (2015). Small smart community: an application of internet of things. *ARPN Journal of Engineering and Applied Sciences*, 10(15), 6341-6347
- Guney, A. (2014). Role of technology in accounting and e-accounting. *Procedia - Social and Behavioural Sciences*, 152, 852 – 855.
- Hicks, J. R. (1939). The foundations of welfare economics. *Economic Journal*, 49(196), 696-712.
- Kaldor, N. (1939). Welfare propositions in Economics and Interpersonal Comparisons of Utility. *Economic Journal*, 49(145), 549-52
- Klovienė, L., & Gimzauskienė, E. (2015). The Effect of Information Technology on Accounting System's Conformity with Business Environment: A Case Study In Banking Sector Company. *Procedia Economics and Finance*, 32(2015), 1707 – 1712.
- Kok, J. N., Boers, E. J. W., Kusters, W. A., van der Putten, P., & Poel, M. (2009). Artificial Intelligence: Definition, Trends, Techniques and Cases. *Encyclopaedia of Life Support System (EOLSS)*. <http://www.eolss.net/Eolss-sampleAllChapter.aspx> Accessed on September 6, 2018.
- Lim, F. P. C. (2013). Impact of Information Technology on Accounting Systems. *Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology*, 3(2), 93-106. <http://dx.doi.org/10.14257/AJMAHS.2013.12.02>
- Lindsay, C., Findlay, P., & McQuarrie, J. (2017). Collaborative Innovation, New Technologies, and Work Design. *Public Administration Review*, Wiley Online Library. <https://doi.org/10.1111/puar.12843>
- Liyani, L. (2013). The impact of information technology on accounting theory, accounting profession, and Chinese Accounting education. WHICEB 2013 *Proceedings*. <http://aisel.aisnet.org/whiceb2013/103>. Wuhan International Conference on e-Business
- March, J. O., & Simon, H. A. (1958). *Organisations*. New York: Wiley
- McKinsey Global Institute (2017). Jobs lost, jobs gained: Workforce Transitions in a time of automation. Retrieved on August 27, 2018 from <https://www.mckinsey.com/~media/Mckinsey/Global/themes/futureoforganisation/whatthefutureofworkwilmeanforjobsskillsandwages/MGI-Jobs-Gained-Report-December-6-2017.ashx>
- Mirvis, P. H., Sales, A. L. & Hackett, E. J. (2006). The implementation and adoption of new technology in organisations: the impact on work, people and culture. *Human Resource Management*, Nov. DOI:10.1002/hrm.3930300107. {first published in *Human Resource Management Spring 1991*, 30(1), pp.113-139}.
- Najjar, D. (2018). 5 Trends Driving Disruption in the Accounting Industry. Retrieved from the blog of AccountingDepartment.com on August 28, 2018.
- Noro, K. & Imada, A. (1988). *Participatory ergonomics*. Philadelphia: Taylor & Francis
- Omeregbe, P.O. (2001). The future of the ACA holder. Being paper presented at the 31<sup>st</sup> Annual Accountants' Conference of the Institute of Chartered Accountants of Nigeria held at the Sheraton Hotels and Towers on October 10, 2001.
- Pasquarosa, N. (2016). How Technology Is Changing The Accounting And Bookkeeping Industry. *Forbes Technology Council*, Aug 3.
- Porter, M. E., & Millar, V. E. (1985). How information gives competitive advantage. *HBR*, July.
- PwC & Microsoft (2017). Digital Transformation of Tax Administration. Being a joint paper produced by Microsoft and PricewaterhouseCoopers Belastingadviseurs N.V., the Netherlands. <https://pwc.nl/nl/assets/documents/pwc-digital-transformation-tax-oct2017.pdf> Accessed on September 10, 2018.
- Rogers, E. M. (1962). *Diffusion of Innovations*. New York: The Free Press
- Schueller, S. M., Tomasino, K. N., & Mohr, D. C. (2016). Integrating human support into behavioural intervention technologies: The efficiency model of support. *Clinical Psychology: Science and Practice*, 24(1)



- Schwab, K. (2015). The Fourth Industrial Revolution: What It Means and How to Respond. Retrieved from <https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution> on August 23, 2018.
- Statista (2018). Retail e-commerce sales worldwide from 2014 to 2021(in billion US dollars). Retrieved from <https://www.statista.com>statistics>world>
- The New International Webster's Comprehensive Dictionary of the English Language, Encyclopaedic Edition, Trigoa, A., Belfo, F.,& Estébanezc, R.P. (2016). Accounting Information Systems: evolving towards a business process oriented accounting. *Procedia Computer Science,100*, 987 – 994 Conference on ENTERprise Information Systems / International Conference on Project MANagement / Conference on Health and Social Care Information Systems and Technologies, CENTERIS/ProjMAN / HCist 2016, October 5-7.
- White, L. (2018). The Changing Role of Accounting in Enterprise Performance Management, June 26.
- World Economic Forum (2016). The future of job report: Employment, skills and workforce strategy for the fourth industrial revolution, January 2016.Retrieved on August 31, 2018 from [www.report.weforum.org/future-of-jobs-2016/](http://www.report.weforum.org/future-of-jobs-2016/)
- World Economic Forum (2018). Innovation with a purpose: the role of technology innovation in accelerating food systems transformation. Prepared in collaboration with McKinsey & Company. [www.weforum.org](http://www.weforum.org)
- XU, M., David, J. M.,& Kim, S. H. (2018). The Fourth Industrial Revolution: Opportunities and Challenges. *International Journal of Financial Research*, 9(2), 90-95