REFLECTIONS ON THE IMPLICATIONS OF THE FOURTH INDUSTRIAL REVOLUTION (FIR) ON TAXATION

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Abstract

This article highlights the implications of the technologies driving the Fourth Industrial Revolution (FIR) on the taxation profession. The FIR is among the current issues of discussion across the world both, in general, and on the technologies that drive it. The FIR has been discussed in various places and contexts. These include in the 2016 World Economic Forum (WEF) and recently at Davos 2020. Technologies that drive this revolution include but are not limited to advanced robotics, artificial intelligence (AI), the internet of things (IoT), virtual and augmented reality, predictive analytics, autonomous/driverless vehicles including drones; sensors and automatic identification as well as corporate/enterprise wearables and additive manufacturing (AM).

Key words*: Fourth Industrial Revolution, taxation, digitalization, technology.*

1. INTRODUCTION

There have been three industrial revolutions before the Fourth Industrial Revolution (FIR). Different technologies have been driving, moving and shaking each of these revolutions. The transition from one industrial revolution to another has been a function of technological advancement and transformation. These advancements and transformations have been change makers. The change from one industrial revolution to another has been epochal rather than incremental change. The first industrial revolution is related to the use of water and steam power technology to mechanize production of goods and services. The second industrial revolution is related to the discovery and use of electricity technology for mass production and by implication enjoyment and reaping of advantages of economies of scale. The third revolution has been driven by the discovery and use of electronics and information technology (IT) for automation of production processes and enjoyment of the many and far-reaching implications of automation (Shwab 2016).

Since the middle of the 20th century, the world has seen a transition to the FIR which is in its infancy stage and still taking shape. Characterized by digitization, the FIR is a digital revolution building on the third one. What is unique in it, is its characteristic of a fusion of technologies related to the physical, digital and biological spheres (Shwab 2016, Luhanga 2018 and

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Ngowi 2018). The revolution is characterized by disruption in virtually all industries across the world. It is transforming all production, management, governance and many other systems. The technological revolution is basically altering many spheres of life including the way people live, work and interact.

The FIR is characterized by various forms of disruptive technologies. It is a technological revolution that will fundamentally alter the way we live, work and relate to one another. It is characterized by unprecedented exponential as opposed to linear growth of technological advancement that is disrupting almost every industry including in the finance and development spaces. For example, finance is increasingly being digitalized. Therefore, taxation has to be able to capture digital transactions in order to be able to raise funds needed to finance development by way of providing public goods and services by governments. Thus, discussing the implications of the technologies driving the Fourth Industrial Revolution (FIR) on the taxation profession is the crux of this article.

2. IMPACT ON PROFESSIONS

Although in its infancy stage of development, the technologies of the FIR have, are and will move and shake virtually all sectors of all economies and professions in them. The technologies have, are and will disrupt the world of business in unprecedented manner, scale and speed. Whereas the disruptions have never been this fast in the past, they will never be this slow in the future. Sectors such as industry, agriculture, mining, education, health, transport and communication, tourism, construction, financial and indeed many others will be disrupted sooner or later. In the context of this article this has many and far-reaching implications on taxation. This is because the FIR has, is and will keep on bringing new dynamics in the tax space. Among other things, there are new business models and products introduced by the FIR that are not in the tax systems yet.

To be disrupted by the technologies of the FIR too are various professions in all sectors of all economies in the world. They include tax professionals, accountants and auditors, procurement and supplies professionals, bankers, medics, entertainers, drivers, data entry, economists, lawyers, educators in all of their forms, engineers and many other professions and institutions they serve such as Tanzania Revenue Authority (TRA) in the case of taxation and those serving them. Status quo and comfort zones as well as business as usual are being challenged and tested – and correctly so - by the disruptions. The disruption is brought about by way of new and hitherto not existing business models and practices. For example, the FIR is bringing with it digital

transactions that might not be easily captures by some revenue authorities especially in developing countries such as Tanzania.

The technologies have many and far reaching implications not only on high and middle skilled professionals (including those in the tax space) but also on people without professions such as low skilled and casual workers in all sectors across the globe. The technologies are of many and far-reaching implications to policy, law and decision makers as well as regulators in all spheres of life including in tax matters in the context of this article. They have many and far-reaching implications on policy, legal and regulatory frameworks of various countries, regional blocks or even global governance institutions. Luhanga (2018) correctly argues that the earlier three industrial revolutions have been missed by many developing countries including Tanzania in a big way. These countries cannot afford missing the fourth revolution. The good thing is that they can and some have shown ability to frog-leap into the FIR despite of missing some aspects of the first three revolutions. The impacts and implications of the revolution in literally all spheres of life including taxation make it very relevant for a country like Tanzania.

The disruptions that accompany it include labour market disruptions with potentials of machines displacing labour due to artificial intelligence (AI) related to machine learning among others. This has many and far-reaching implications on unemployment debate in general and employment-creating industries goals of the fifth phase government in Tanzania in particular (Ngowi 2017, 2016, URT 2016). Among other things, it stands to displace some taxation jobs especially the repetitive, routine, low skilled and low-end jobs. The revolution is introducing new systems, structures, products and business models in all economies with many and far-reaching implications on ways of life including labour market and by extension employment and future of jobs as well as taxation. It also has many and far-reaching implications on policies (including fiscal and monetary policies and their related policy instruments), legal and regulatory frameworks governing economies. It is bringing products such crypto currencies including bitcoins and systems such as digital market places and platforms and other related technological disruptions characterized and driven by digitization of almost everything sooner than later (Berenstsen and Schar, 2018). All these have major and far-reaching implications on taxation and the taxman in the context of this article

All these have started and will indeed keep on disrupting what have been normalcy and comfort zones including in taxation and other spaces in the public and private sectors as well as academic, civil society, politics,

development partners and general public spaces. It is important to pose and answer the question on whether the taxman in general and individual tax practitioners and stakeholders are ready to operate in, with and within these new systems, structures, and digital business models and products brought by the FIR technologies. Accordingly, this article seeks to answer the following questions are tax authorities ready to operate (to tax) in blockchain, AI, IoT, enterprise wearables etc environment with such products as cryptocurrencies such as bitcoins and Ethereum? If not, what are the implications in situations where taxpayers have embraced these technologies? Luhanga (2018) has specifically dwelt at length on blockchain technology of the FIR and its many potential and actual use cases. These include use in education, health, agriculture and many business and related areas such as in supply chain and by extension taxation. He correctly insists that Tanzania should not miss the FIR vehicle in general and in the context of blockchain technology in particular in the context of industry 4.0 for example.

3. TECHNOLOGIES DRIVING THE FOURTH INDUSTRIAL REVOLUTION

At the core of the FIR is technology. There are several new and advanced technologies that are driving the FIR. The FIR is characterized by convergence and fusion of breakthrough technologies. They include but are not limited to advanced robotics (example Sophia the Robot from Saudi Arabia who 'visited' Rwanda in 2019); artificial intelligence (AI) including machine learning; the Internet of Things (IoT); virtual and augmented reality; predictive analytics; autonomous/driverless vehicles including drones and cars; big data; wireless connections; blockchain; nanotechnology; sensors and automatic identification as well as corporate wearables[1] and additive manufacturing[2].

Other technologies include those listed in Luhanga (2018). These are new materials, nanotechnology, energy storage technologies, quantum computing, cloud computing, big data analytics, genetics (gene sequencing

[1]Smart electronic devices (electronic device with micro-controllers) that can be incorporated into clothing or worn on the body as implants or accessories electronics that can be worn on the body, either as an accessory or as part of material used in clothing. There are many types of wearable technology but some of the most popular devices are activity trackers and smart watches.

[2]It is the process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies. The primary applications of additive fabrication are design/modeling, fit and function prototyping, and direct part production. Around the world, AM is changing the way organizations design and manufacture products. When used correctly, it can save impressive amounts of time and money. AM is said to have helped trim time of design, prototyping, and manufacturing, while avoiding costly errors and enhancing product quality.

and gene editing), synthetic biology (linking genetic variations and traits with diseases). All these technologies and similar ones are transforming productions processes used to produce goods and services in all economies and sectors. They are also transforming systems, structures, products and business models across virtually all industries and sectors globally and professions in them including the tax profession. These include industrial, agricultural, transportation, construction, services and many other sectors listed earlier in this work. In what follows below, some of the disruptive technologies of the FIR are outlined.

3.1. Internet of Things (IoT)

The Internet of Things (IoT) is the virtual interconnection of intelligent assets and devices to achieve improved user experience and/or usability. There are many (billions) interconnected devices (such as computers and mobile phones) worldwide. These are generating data on a continuous basis and are at the core and forefront of the digital transformation of economic activities. Interconnected warehouses for example are linked to intelligent transportation systems. Introduction of IoT platforms which allow for the tracking of all assets and devices in real time, are among case examples of IoT applications. Connected devices ensure the availability of real-time data, enable the geographic distribution of operations and manufacturing and result in improvements in operational efficiency, processing time and operating and management costs. IoT is about connecting things to the Internet. Devices are sensing (for example where one is in terms of physical location, what one is saying, what steps one is taking, weather in or outside a room including having light on when entering a room and off when out). It is about things talking to things for example thermostat with Air Condition (AC), coffee maker with bed; sprinklers with irrigation system having sensed the state of humidity etc. It is important to question on whether various professions including those in the tax space and category are ready for the FIR driven by IoT.

3.2. Artificial Intelligence (AI)

Artificial Intelligence (AI) or self-learning systems is the collective term for machines that replicate the cognitive abilities of human beings. AI is about thinking machines that learn and make decision and execute them. Within the broader technological landscape, predictive maintenance in the cognitive era has the potential to transform global production systems. Artificial intelligence, particularly machine learning, is one of the most important general-purpose technologies. AI can significantly help improve performance without human intervention and allows for constant analysis of

performance data. This enables machines to improve over time. It can be a robot installed in a factory or a distribution warehouse. Machine-generated insights will pave the way for greater precision and accuracy. While repetitive tasks are performed by machines, people including those in the accountancy profession, can focus on more complex activities. Physical assets replace low-skilled labour, which requires investment in and up-skilling of the existing workforce. This has many and far-reaching implications to many professions including those in the tax profession. The key question is on whether these professions and authorities governing them (for example TRA and by extension Ministry of Finance are ready for the FIR driven by AI.

3.3. Advanced robotics

Advanced robotics is defined as devices that act largely or partially autonomously, interact physically with people or their environment and are capable of modifying their behaviour based on sensor data. Robotic innovations have been used for recursive manufacturing processes and have proven useful for workplace safety. Robotics and automation technologies result in shorter cycle times while achieving better floor space utilization and higher levels of productivity. Concerns about human job security and the question of the appropriate level of automation is a major concern. This is true in various professions including tax.

3.4. Enterprise wearables

Enterprise wearables are permanently switched-on, interconnected computing displays that are worn on the human body. They can be used for easy and hands-free access to contextually relevant information. These bionic enhancement technologies do expand the boundaries of physical barriers. Virtually all professions in the FIR including tax profession are likely to be subjected to enterprise wearables environment in various contexts. The question is on whether they are ready including being aware of and exposed to this technology and many implications related to their works such as taxing them.

3.5. Additive manufacturing (AM)

Additive manufacturing is fully automated manufacturing process of building three-dimensional (3D) objects from a digital blueprint or model. It paves the way for new designs, manufacturing concepts and logistical services. Additive manufacturing could impact goods transportation in much the same way as email impacted letters. AM is considered a disruptive

technology that adds new diversity to products and manufacturing strategies while also creating opportunities for new business models. The most prominent use case example is 3D micro manufacturing. This scaled production and the customization options are becoming even more interesting as manufacturing and inventories can be located closer to consumer markets. AM has implications for all professions including tax. It is up to those in these professions to understand AM implications for them, for example in all tax matters such as estimation and actual collection of revenues. Below is a specific case of the FIR technologies and how it can impact various professions including those in taxation and related ones. It is the blockchain technologies.

3.6. Blockchain Technology

Unless otherwise stated, the text on blockchain technology borrows heavily from Luhanga (2018).

Blockchain technology and the FIR

A blockchain is a growing list of records known as blocks. The blocks are linked using cryptography which is hidden writing. It protects information and communications using codes that make only those people the information is intended for to be able to read and process it. A blockchain is resistant to modification of the data. See more on blockchain in Crosby et al (2015) who state that a blockchain is essentially a distributed database of records or public ledger of all transactions or digital events that have been executed and shared among participating parties. Each transaction in the public ledger is verified by consensus of a majority of the participants in the system. Convergence of blockchain technology and other emerging technologies is anticipated to have wide ranging, disruptive impacts in manufacturing and industrial processes, health, agriculture, energy, and other sectors of the economy. The convergence of emerging technologies has meant that the FIR will be characterized by digitization, democratization, disintermediation and decentralization.

Convergence of Blockchain Technology and the IoT

The widespread use of IoT devices is expected to impact all socio-economic sectors. It is anticipated to cause a

revolution equal in impact to the electrification of industry a century ago. It is easy to see how IoT will impact every major industry. Integration of IoT and blockchain technology can make it possible to create new business models. Examples include companies which lease cars and aircraft from manufacturers in order to provide a service. Car and aircraft manufacturers can use blockchains to securely track and store the reams of data on performance, usage and maintenance collected from IoT devices.

Convergence of Blockchain Technology, IoT, AI, 3D Printing and Big Data Analytics

The economy of the FIR will be a consumer-centric economy. It can be brought about by seamless integration of consumers, smart factories, agile, digitized supply chains and broadband Internet. Smart factories would not maintain inventories and provide platforms and Apps which connect consumers to the factories, bypassing all intermediaries. With agreement of regulatory authorities there are no technological barriers today to prevent consumers from producing (using 3D Printers) pharmaceutical drugs in their residences. This can have substantial implications to virtually all sectors and professions in an economy.

Tanzania and Initial Steps in the Fourth Industrial Revolution

The industrialization of Tanzania, and of Africa in general, involves the adoption of Industry 1.0, Industry 2.o and a bit of Industry 3.0 technologies. But Tanzania could not afford to stand by and let the rest of the world move on with the FIR. It has to exploit every opportunity of getting involved in the FIR while industrializing in the sense of Industry 1.0, Industry 2.0 and Industry 3.0.

Human Capital Required for FIR

The quantity and quality of the human capital of any country is the most important determinant of the success in the FIR in which industry would be ICT-intensive. Africa's readiness to enter and prosper in the FIR is low.

Specifically, for Tanzania this is evidenced by the following observations:

(a) A low *Human Capacity Index (HCI)* (measured by the extent to which human capital is optimized through education and skills development and its deployment throughout life). Tanzania has an HCI of 0.52 compared to a global average of 0.65.
(b) A low capacity of adapting to the requirements of future jobs (measured by the quality and extent of secondary and tertiary education and staff training schemes) relative to the exposure to these future jobs (measured by assessing the impact of latest technologies, local economic diversification and complexity, employee productivity and unemployment). Tanzania's capacity to adapt is 0.6 (0.63) whereas its exposure is 0.35 (0.44). The quantities in brackets represent the global averages, clearly showing that the scores for Tanzania are below average.
(c) High skilled employees constitute less than 3% of formal employment compared to a global average of 24% and an African average of 6%.
(d) 55% of employees are in firms employing 99 or less employees. Such small firms have limited resources to invest in up-skilling or reskilling of employees.
(e) 41% of employers in Tanzania perceive the lack of skilled employees as a major constraint to business expansion.

Better understanding of the disruptive changes underway is crucial for workforce planning.

Source: Extracted from Luhanga (2018)

In the context of this article, blockchain technology is of great implications to virtually all professions including the tax profession. Among other things, countries, companies and organizations are increasingly adopting blockchain technology. Professions serving and being served by those embracing blockchain technology need to be blockchain-ready at least by knowing what it is, the way it works and the way is disrupts these professions and most importantly how to be blockchain-ready.

4. TAXATION IMPLICATIONS OF TECHNOLOGIES OF THE FIR

Taxation is very important in development. It is among the major and sustainable ways of financing development of countries. It is through taxation that governments are able to finance provision of public goods and

service. Public goods include but are not limited to infrastructure including roads, ports, airports, railways and Internet. Public services include water, education, health and security among others. Given the very big role of taxation in development, it is very important to consider implications of any change that can affect taxation positively or negatively.

Development financing especially in developing countries such as Tanzania depends a lot on fiscal policy generally and tax policy in particular. Taxation of businesses through corporate income tax (CIT), taxation of employees through Pay As You Earn (PAYE) and taxation of consumption through Value Added Tax (VAT) form major sources of public funds to finance development projects in Tanzania. Due to the FIR technologies however, there are new dynamics on the ways companies operate including having new business models, on the nature of employment including digital jobs and on consumption including online transactions. All these new dynamics might not be capture by tax systems developed before the emergence and development of the FIR. With the public sector growing rapidly, the need to collect more internal revenues mainly through taxation cannot be overemphasized. It is in this context that taxation implications of the technologies of the FIR are discussed here.

Technologies of the FIR have, are and will have many and far-reaching potential and actual transformations and disruptive developments to the future of production and many professions including taxation. There is a need to understand potential transformations and disruptions in the taxation profession. According to UNCTAD (2019), countries are rethinking how taxation rights should be allocated to prevent possibilities for under taxation of major digital platforms in the fast-evolving digital economy thanks to the FIR. The tax landscape is evolving with the FIR. Discussion on taxation of the digital economy is very important. Governments require policy space to regulate the digital economy including the taxation space. Tax authorities and the taxman need to be able to interpret, address and cope with the FIR technologies.

Laws, policies and regulations of digital data including on taxation are complex. According to UNCTAD (2019), this is because they touch on issues related to human rights, trade, economic value creation and capture, law enforcement and national security. Formulating policies, including on tax matters, that take these various dimensions into account is hard, but necessary. It is necessary to cope with digital disruptions in the tax space brought by the FIR. This calls for among other things re-skilling workers including those in the tax space. Due to the digital economy driven by the FIR technologies, several policy challenges may be more effectively

addressed at the regional or international level. This applies, for example, to taxation among others.

Disruptive technologies are transforming all end-to-end steps in production and business models in most sectors of the economy globally. This necessarily affects taxation in many ways. These include identifying tax payers in the digital space, estimating their tax dues and collecting the tax from digitalized businesses. Products that consumers demand, and factories processes are being re-shaped to an unprecedented degree and pace by the technologies driving the FIR. New technological solutions in the context of the FIR have, are and will revolutionize traditional ways of doing things including taxation. Taxation of analogy economy cannot be the same as taxation of digital economy. There is a need for new approaches, skills and knowledge to capture tax revenues from digital transactions.

In this context, tax professionals have to be ready to cope with these changes brought by disruptive technologies of the FIR. A vast range of the technologies are already impacting production systems and by extension taxation. Digital transformation of industries brings new opportunities for innovative business models. These new business models have implications on taxation. The way these models operate is different from traditional models and therefore have tax implications. In the transport industry for example one sees such business models as those operated by Uber and in the accommodation industry one sees business models such as those operated by AirBnB. The way these new models are to be taxed differ from the way the old models have been taxed. This has major and far-reaching implications on taxation.

Technological advances will continue to innovate and by extension disrupt the tax profession. Robotics and other new technologies driving the FIR will disrupt current operating practices, systems and structures and create new competitive advantages. The taxation profession has to be ready to cope with these technologies and what they imply. Short of that, the taxman may fail to net the tax revenues from the new business models. In an environment where development financing depends heavily on taxation this cannot be accepted.

According to Thompson (2017) new technologies such as advanced robotics, autonomous systems and additive manufacturing will collectively disrupt the way of transforming many accepted models of production and transmission of products to consumers and end users. These include offshoring and localized scale production for export. This has many and far-reaching implications to the taxman. The taxman has to be aware of the disruptions,

their tax implication and how to deal with the same with the aim of making sure that there is no revenue lost.

Thomson (2017) further argues and correctly so, that new technologies will bring profound, challenging business models and players. The future (which has arguably arrived) will favour the bold, agile and most digitally connected players, including the taxman, who are digital natives. This (boldness, agility and digital connection) has a very important implication of the disruptive technologies to economies in general and specific sectors and professions in them in particular. Tax profession is not an exception. The question is on whether the profession is ready for the needed agility, boldness and digital connection needed to raise tax revenues amidst the FIR. If not ready, the key question is how to be ready for these particular taxation requirements of the FIR technologies. It is to be noted that it is beyond the scope of this article to answer these questions.

Advances in technologies such as those brought by the FIR and therefore their disruption powers, are fundamentally and completely changing the world. They are disrupting the way various production, storage, distribution and consumption of goods and services are done. All these have implications on taxation. Technological advances will continue to innovate and disrupt economic activities and the way they are organized. These include disruption of taxation in general and the taxation profession in particular. Technologies driving the FIR will disrupt current operating practices (including taxation), systems and structures and create new competitive advantages mainly based on brain power. Those in the taxation profession need to ask whether they have the needed brain power of the FIR technologies and whether they are ready to tax brain power. If not, they need to ask what it takes to have the needed brain power to create new competitiveness.

The FIR has caused, is causing and keeps on causing supply-side miracles. The disruptions of the FIR have, are and will impact businesses that either work in taxation or which rely on it. Automation of more systems could lead to cuts in personnel as technology displaces labour. This is among the labour market implications, including in the taxation labour market, of the FIR disruptions and its many and far-reaching implications. The question here is on whether those in the taxation profession are ready for the labour market disruption thanks to the FIR technologies.

5. CONCLUSION

Given what has been discussed in this article, it is very clear that the disruptive technologies of the FIR have, are and will keep on changing

everything in virtually all spheres of life including taxation. All sectors in all economies and professions working in them, including the taxman, are undergoing fundamental epochal transformations towards the FIR. This does not mean that everything is moving towards the FIR at once and at the same speed. Some aspects of taxation for example will still be outside the FIR space while some, especially for the digitalized transactions, will have to embrace FIR-related taxation practices and techniques. The FIR and technologies behind it are still evolving, taking shape and in their different relative infancy stages of development. This implies that taxation in the FIR can be gradual by following the various stages of development of the FIR.

It is very important for tax authorities to make sure that they are not left behind as the FIR technologies unfold and develop. For competitiveness of countries, companies, institutions and professionals in them and indeed for each individual, the FIR is unavoidable. This is also the case in the taxation space. At the minimum, there is a need to be FIR-ready by among other things knowing what it is and its many and far-reaching implications in the taxation space in the context of this article. Most importantly there is a need to know how to cope with the FIR technologies in taxation especially in the environment where many aspects of the earlier industrial revolutions (especially the third and the second revolutions) are still with us.

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