

Should Mzumbe University be transformed into Mzumbe University 4.0?

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Abstract

The Fourth Industrial Revolution (FIR) is already under way. The potential disruption of the FIR on the university mission is described. Initial steps, which Mzumbe University could take should it wish to evolve into a university relevant to the FIR (University 4.0) are proposed. Given the uncertainty surrounding the evolution of the FIR, which has relevance to university evolution, a proposal on the use of Foresight in university strategic planning under uncertainty is made.

The question in this paper is contextualized within the reality that, universities in Tanzania need to undergo a digital transformation if they are to succeed in playing the leadership roles expected of them in defining the contents of the FIR that are relevant to Tanzania and if universities are to articulate development and industrialization strategies needed if Tanzania is to expand its industrialization strategy to include industrialization in the sense of the FIR.

Key words: *block chain technology, cloud computing, data analytics, financial technology, fourth industrial revolution, information technology law, university 4.0*

1.0 INTRODUCTION

The world has gone through three industrial revolutions and is now in a fourth (Schwb, 2016:7). Yet, throughout the industrial revolutions, the universities have remained essentially unchanged since the first true university was established in Bologna, Italy in 1088. This point was captured very well in an address at Harvard University by Clark Kerr, the President Emeritus of the University of California (Kerr, 2001:115):

About eighty-five institutions in the Western world established by 1520 still exist in recognizable form, with similar functions and unbroken histories, including the Catholic church, the Parliaments of the Isle of Man, of Ireland, and of Great Britain, several Swiss cantons, and seventy universities. Kings that rule, feudal lords with vassals, and guilds with monopolies are all gone. These seventy universities, however, are still in the same locations with some of the same buildings, with professors and students doing much the same things, and with governance carried on in much the same way.

The technological changes driving the Fourth Industrial Revolution (FIR) represent, however, perhaps for the first time, a paradigm shift in the challenges facing universities. In the words of Prof Klaus Schwab, the Founder, and Executive Chairman of the World Economic Forum (Schwab, 2006:1) had this to say,

We stand at the birth of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything human kind has experienced before. We do not yet know how it will unfold, but one thing is clear. The response to it must be integrated and comprehensive,

involving all stakeholders of the global policy, from the public and private sectors to academia and civil society.

How should universities respond to the technological challenges of the FIR? Although universities have hitherto been very static institutions, the disruptions of the FIR would require universities to borrow a leaf from Charles Darwin if they are to cope with the FIR successfully. For, on the survival in the face of change, Charles Darwin was as follows,

It is not the strongest of the species that survive, nor the most intelligent, but the ones most responsive to change (O'Toole, 2013:1):

The paper is organized as follows: Section 1 is an introduction that underscores the fact that, for the first time in one thousand years of its existence, the university will have to make major changes for it to survive, compete, and prosper in the Fourth Industrial Revolution (FIR). Section 2 gives a brief description of the FIR, its attributes, its drivers and its anticipated impact on universities. Section 3 describes the concept of University 4.0 and its attributes. Section 4 identifies the initial steps, which Mzumbe University has to take if it intends to transform itself into a University 4.0 model and Section 5 suggests a strategic planning approach to realize that transformation. Concluding remarks and references complete the paper.

2.0 THE FOURTH INDUSTRIAL REVOLUTION

The industrial development of the world has spanned three industrial revolutions and is now in the fourth. The *First Industrial Revolution* had its origins in Europe in the late 18th century, and involved the invention of the steam engine and mechanical production driven by water and steam (Schwab, 2016:2).

The *Second Industrial Revolution* began at the end of the 19th century. It was characterized by mass production in factories driven by the use of electrical power, division of labour, the advent of the assembly line, and the invention of the landline telephone system (Schwab, 2016:7).

The *Third Industrial Revolution* emerged in the 1950s. It is also known as the *digital revolution* and it represented a shift from mechanical power and analogue electronics to digital electronics and technologies which were made possible by digital electronics devices, computers, mobile cellular telephones, and the Internet (Schwab, 2016:7).

According to Schwab, the *Fourth Industrial Revolution* (FIR) began at the turn of this century based on the advent of cyber-physical systems. This is being driven by the convergence of technologies in the physical, digital, and biological domains. Furthermore, all these technological drivers are underpinned by the exploitation of the power of digitization and that of networking using information and communication technologies (ICTs) (Schwab, 2016:7).

The factors of production, which businesses would exploit in the FIR, are data, time and capital-raising ability rather than the ones of classical economics- land, capital, and labour. Exploitation of LASIC (**L**ow margin, **A**sset light, **S**calable, **I**nnovative, **C**ompliance-easy) principles would be crucial for the creation of sustainable businesses in the FIR while remaining faithful to the social objectives of increasing income and reducing wealth inequality (Chuen, 2015:3).

2.1 Physical and Digital Domain Technology Drivers of the FIR

In the physical domain, the major technological trends driving the FIR are many (Schwab, 2016:13). The ones relevant to Mzumbe University at its current level of development are block chain technology and additive manufacturing (3D Printing).

In the digital domain, the main technologies driving the FIR which would be of interest to Mzumbe University are the Internet of Things (IoT) utilizing, simple, cheap, and smart sensors in either block chains or in technology-enabled digital platforms (which are the basis of a *sharing economy*). Others are Artificial Intelligence/Machine Learning, Cloud Computing, Big Data Analytics, or a convergence of various permutations between these technologies (Schwab, 2016:18):

The technology drivers in the biological domain are at the early stages of influencing businesses in the developed world and would therefore not be of an immediate interest to Mzumbe University (Schwab, 2018:21).

2.2 Impact of the Fourth Industrial Revolution on Institutions

The Fourth Industrial Revolution (FIR) would influence institutions in three ways. First, It would motivate institutions to shift their emphasis from classical factors of production (land, labour, and capital) to new ones (data, time, and capital-raising ability) (Chuen, 2015:3). Second, it would place on institutions the obligation of providing to consumers new services, which arise from digitization and the leveraging of the convergence of the technologies of the FIR and thirdly, at its maturity, the FIR would put the consumer at the centre of its service offerings by ensuring that the services provided were personalized and customized.

At the maturity of the Fourth Industrial Revolution, the economy would be a consumer-centric economy (Schwab, 2016:53). Such an economy could be brought about by the seamless integration of consumers, *smart factories*, agile, digitized supply chains, broadband Internet, and the converged technologies of the FIR. In the case of manufacturing, the integration of all these entities would lead to the personalization and customization of product specification and design, product manufacturing and product delivery. This would necessitate a shift from the legacy business model of business-to-consumer (B2C) to a consumer-to-business (C2B) model (Fung Business Intelligence, 2017:11).

The smart factories of a C2B model would not maintain inventories and would provide digital platforms and Apps that would connect consumers to the factories, bypassing all intermediaries. The C2B model would also exploit big data analytics to ensure that it was optimally responsive to consumer needs and requirements.

The C2B business model would also be applicable to other businesses. Its application to universities is touched upon at Section 3.0 of this paper. The C2B business model could also be extended to the personalization and customization of the production of other products such as pharmaceutical products. With the agreement of regulatory authorities, there are no technological barriers as of today to prevent consumers from producing (using 3D Printers) pharmaceutical drugs in their residences (Pharma, 2018:3).

For education institutions, the impact of the FIR could be divided into two phases. In the short term, education institutions would be motivated to focus on the use of digitization and the leveraging of the technologies of the FIR in the provision of new services. In the long term, education institutions would be expected to transform themselves so that they become student-centric. Due to the uncertainty surrounding the evolution of the Fourth Industrial Revolution (Schwab, 2016:1), there would need to be a paradigm shift in strategic planning for the long-term transformation of universities.

3.0 UNIVERSITY 4.0

University education relevant to the Fourth Industrial Revolution (FIR) is sometimes referred to as *University 4.0*. The whole education system (from kindergarten to tertiary education) is then referred to as *Education 4.0*. Using this terminology, the education systems relevant to the Second and Third Industrial Revolutions are *Education 2.0* (massification of education with the teacher as knowledge provider and the student as a passive knowledge recipient) and *Education 3.0* (use of computers and the

Internet in teaching and learning), respectively (Jhingan, 2017:9). The current education system in Tanzania is largely Education 2.0 with some Education 3.0.

3.1 The Role of African Universities in the FIR

The Fourth Industrial Revolution (FIR) is already underway across the world (Schwab, 2016:1); although most people, including university academic staff in Tanzania, do not seem to have realized it! If internal forces do not make Tanzanian universities adopt and adapt to the FIR, external forces, mainly through international trade (which under the World Trade Organization includes trade in education products and services under the General Agreement on Trade in Services (GATS)) and the globalization-led to the shrinking of the political space in the international order, will.

The world of the 21st century is that of an information society in a knowledge economy, which is being created by FIR technologies. In such an economy (Lorin, 2005:2):

The only comparative advantage a company will enjoy will be its processes of innovation – combining market and technology know-how with the creative talents of knowledge workers... - and its ability to derive value from information.

Universities in the developed world have been recognized as creators of knowledge workers and, therefore, central players in the knowledge economy (David, 1997:3):

*...the university (is) not just a creator of knowledge, a trainer of young minds and a transmitter of culture, but (is) also a major agent of economic growth: the **knowledge factory**, as it were, at the centre of the knowledge economy (Emphasis mine).*

In developed countries, knowledge factories are spread out in educational institutions, governments, industry, and civil society organizations. In developing countries such as Tanzania, on the other hand, knowledge factories are confined almost exclusively to academia. The universities of the developing countries have, therefore, a unique and indispensable role to play in spearheading the adoption of the FIR in their countries in which the future development of knowledge economies in these countries would depend. This is especially relevant to Tanzania; for industrialization in the Fourth Industrial Revolution would most probably be a services-led industrialization.

As for the education sector, the role of the universities should be to take part in the transformation of national education systems to Education 4.0 and to take a leadership role in the transformation of the university sector to a University 4.0 model, which is relevant to Africa.

3.2 Attributes of University 4.0

The main characteristic of University 4.0 is that a student is put at the centre of the learning experience. This characteristic is the same as the general characteristic of Education 4.0 (Jhingan, 2017:31):

In Education 4.0, learning is connected to the learner, focused on the learner, demonstrated by the learner, and led by the learner. It is the learner who is responsible for defining the various dimensions of his education path – the what, where, when, how and why - while moving up the learning ladder.

The future of the Fourth Industrial Revolution is still fuzzy (Schwab, 2016:1) and, consequently, the future of Education 4.0 is uncertain. Therefore, we shall confine ourselves to a discussion of generalities about University 4.0. The discussion will, however, be structured in accordance with the fundamental functions of a university. Those fundamental functions are teaching (content, delivery, and student assessment), research, and service. In University 4.0, these are referred to as Teaching 4.0, Research

4.0, and Service 4.0. They, however, do not form the focus of this paper and, therefore, we shall only sketch them. More details are available elsewhere (Luhanga, 2018 and references contained therein).

Pending clearance on the uncertainties surrounding the evolution of the Fourth Industrial Revolution, we assume that the core mission of a university, which has remained essentially unchanged for the past 1000 years, would remain largely the same.

3.2.1 Teaching 4.0

The teaching and learning environment in University 4.0 would emphasize on the use of digitization and the leveraging of emerging technologies to yield a student-centric learning environment built on the personalization and customization of education services provided to the student. This type of learning environment would put the student at the core of the learning experience. This would have an impact and disrupt the modes of teaching and learning processes making most of the learning occurring either online or through using generalized blended teaching and learning. It would also disrupt contractual responsibilities of academic staff, accreditation processes, quality assurance processes, and certification processes. It would generate massive data on student performance, which through data analytics could be exploited to optimize the learning processes. It would also open up opportunities for the deployment of artificial intelligence, Massive Open Online Courses (MOOCs), Augmented Reality (AR), Virtual Reality (VR) and SMAC (Social, Mobile, Analytics, Cloud) technologies for the improvement and personalization of the learning processes (Jensenius, 2017:1; Jhingan, 2017:33; Kurshan, 2016:1; Selamat, 2017:32; Woolf, 2013:87)

3.2.2 Research 4.0

Research 4.0 is interdisciplinary and multidisciplinary research (Xing, 2017:2) although it could be extended to include other types of disciplinarity as defined in (Jensenius, 2017:1). However, this mode of research is not enabled by current organization structures of African universities. The academic discipline-based department is the basic and primary unit for carrying out an African university's mission. An organization structure of a university based on the academic department is not conducive to collaboration in any form of a disciplinarity.

Most of the development problems, which face Africa, are complex and novel, requiring innovative approaches and solutions to overcome them. These problems usually cannot be addressed by a single academic discipline. Collaboration of researchers or academics using one of the several types of disciplinarity is necessary for successfully solving such problems. The simplest of the disciplinarity to implement is the multidisciplinary approach. Even so, there are very few multidisciplinary groups or units in African universities. Groups or units embracing the other types of disciplinarity are non-existent.

In universities, whose organization structure is academic discipline-based departments, interdisciplinary or multidisciplinary research collaboration is organized as a *centre*. Typically, centres are formed to address a specific issue or problem and the centre ceases to exist once the objectives for setting it up have been met. Centres are key to carrying out cutting-edge innovative research.

Research 4.0 must also distinguish itself from current modes of research in African universities by being responsive to the true ethos of University 4.0 and, therefore, it must leverage digitization and other technologies driving the Fourth Industrial Revolution (FIR) in its focus on interdisciplinary and multidisciplinary research. One of the technologies of the FIR to be mobilized for research collaboration is Artificial intelligence, which could be employed to

- (i) Implement artificial intelligence (AI)-enabled collaboration.
- (ii) Use AI for information search, collection, organization and knowledge discovery to evolve new research directions.
- (iii) Effectively implement a quadruple helix innovation system.
- (iv) Implement *web collaboration* in research both in-country and internationally.
- (v) Implement open peer review.
- (vi) Exploit research opportunities arising from digitization and the convergence of the technologies driving the Fourth Industrial Revolution(Kurshan, 2016:1):

3.2.3 Service 4.0

Just as digitization has been exploited in the Fourth Industrial Revolution to disrupt traditional business models (Schwab, 2016:30), it should be possible for universities to provide disruptive digital solutions in the academic, research and service domains and offer them as Service 4.0. This could be accomplished by adopting the service-oriented architecture of Cloud Computing in which the “everything-as-a-service” (XaaS) paradigm offers services online and on-demand (Xing, 2017:3).

In Service 4.0, the service function of a university would be transformed into a platform-based paradigm obtained by leveraging the technologies, which are driving the Fourth Industrial Revolution (FIR). Universities would thus use platform-centric services as engines of innovation for transformation of their service architectures. How this could be accomplished in practice is open for research.

In a platform-based model, the service functions of a university would be digitized and modelled as either *University-as-a-Platform (UaaP)* or *University-as-a-Service (UaaS)* (Xing, 2017:3). The later concept is derived from the concept of *Education-as-a-Service (EaaS)* (Xing, 2017:3).

University-as-a-Platform (UaaP)

The UaaP service architecture gives universities an opportunity to transform their service models towards a digital platform service model. Key drivers of a UaaP model are, *inter alia* (Xing, 2017:2)to:

- (i) Deliver inter-, multi- and cross-disciplinary degree and non-degree programs (combining course facilitators from academia and industry).
- (ii) Offer generalized blended learning programs
- (iii) Offer MOOCs, preferably by horizontal integration of expertise at national level.
- (iv) Establish inter- and multi-disciplinary research programs, preferably by horizontal integration of expertise at national level.
- (v) Integrate, at national level some university administrative functions.

Universities, such as the University of Dar es Salaam, are already offering some analogue versions of UaaP. The Certificate Course in Law offered by the University of Dar es Salaam is a good example.

University-as-a-Service (UaaS)

The UaaS service architecture would offer university services online and on-demand to customers. It would also deliver student-centric services to its students. Key drivers of UaaS are, *inter alia* (Xing, 2017:4)to:

- (i) Offer customized, personalized learning anytime, anywhere
- (ii) Use digitization and modern technologies (MOOCs, SMAC, AR, VR, etc) to disrupt education delivery models and evolve models which are faster, learner-centric and affordable
- (iii) Evolve better lifelong and life wide learning strategies for a student of the 21st century

3.2.4 Governance

Prof Klaus Schwab, the Founder and Executive Chairman of the World Economic Forum, has proposed that *agile governance* be the appropriate governance model for the Fourth Industrial Revolution (WEF, 2018:6). Therefore, it is appropriate to propose *Agile University Governance* to be the governance model for University 4.0. University stakeholders need to come together to propose, deliberate, enact and enforce agile university governance which would use modern technologies to accelerate decision making in universities while ensuring that collegial decision making is modernized to fit the attributes of University 4.0. According to Selamat (2017:32), some of the issues to be considered under agile university governance include,

- (i) Degree of autonomy of institutions
- (ii) Self-accreditation or co-accreditation
- (iii) Open academic tenure ship (emulating contractual relationships in the *gig economy*)
- (iv) New structures of faculties and academic departments
- (v) Degree of self-financing for institutions
- (vi) Quality assurance and certification
- (vii) Building up and sustaining a digital university culture
- (viii) Modalities for the setting of student fees
- (ix) Employment contracts for academic staff and their remuneration

Agile university governance could only be underpinned by university management that is less risk averse in order to be responsive to the disruptive changes inherent in the Fourth Industrial Revolution.

3.2.5 Mzumbe University 4.0

The term *Mzumbe University 4.0 (MU 4.0)* is being used to represent a Mzumbe University which has acquired all the major attributes of the University 4.0 model and is operating as one such university. It would be unrealistic to expect Mzumbe University to have acquired, in the short term, most of the attributes of University 4.0. This is mainly because the transformation of the university into Mzumbe University 4.0 would be all encompassing requiring major transformations in infrastructure, human capital (in quality and quantity of academic, administrative, and technical staff), technologies for teaching, learning and administration, linkages and internationalization, interdisciplinary and multidisciplinary research profiles, service architecture, and the like. These transformations would require ownership by the university community of huge investments in financial resources, an enabling legal and regulatory environment, and support and blessings of the government. The transformation into Mzumbe University 4.0 should be considered therefore, as a long-term venture.

Looking at the transformation into Mzumbe University 4.0 as a long-term endeavour has an added advantage in that, in the long term, the uncertainties surrounding the evolution of the Fourth Industrial Revolution would have cleared up. This would make it possible to define clearly the attributes of Mzumbe University 4.0.

The Fourth Industrial Revolution (FIR) is already underway. The lesson from Charles Darwin which was quoted earlier means that the adaptation to the FIR by Mzumbe University should start now, the uncertainties on the evolution of the FIR notwithstanding. In Section 5.0, we propose a methodology, which Mzumbe University could adopt for strategic planning under uncertainty. While such planning is underway, Mzumbe University could start implementing initial steps towards becoming Mzumbe University 4.0.

4.0 INITIAL STEPS TOWARDS MZUMBE UNIVERSITY

Africa literally stood by as some parts of the world improved and moved on as industrial revolutions came and went. Thus, new services, which were being enjoyed by people in the various industrial revolutions, were not available in Africa. Since the Fourth Industrial Revolution (FIR) is already under way, Africa cannot afford to repeat the mistakes of the past. Africa has to get involved in the FIR. For Mzumbe University, the involvement could consist of taking some initial steps as detailed below. These initial steps are meant to make Mzumbe University acknowledge that the FIR manifests itself in Tanzania through the digitization of her economy.

4.1 Scanning the Environment

The region of interest should be the whole of East Africa. The member states of the East African Community have signed the Common Market Protocol that contains provisions on the free movement of labour. Therefore, Mzumbe University should prepare its graduates so that they are employable anywhere in East Africa. This should be the least to be expected of Mzumbe University from its membership to the East African Community Common Higher Education Area (EACCHEA) whose – one of its goals is the fostering of student mobility in the region. The university should, in collaboration with other universities in Tanzania step up its game in the operationalization of the EACCHEA to ensure that the interests of Tanzania are protected.

4.1.1 Block chain Technology in the EAC

The East African Community countries of Burundi, Kenya, South Sudan, Tanzania, and Uganda are at the early stages of introducing block chain technology (the technology that underpinned the use of the *bitcoin* cryptocurrency) into the region. So far, block chain technology activities in the region have involved

- (i) Formation of block chain associations in Kenya, Tanzania and Uganda.
- (ii) Holding of in-country workshops on block chain technology.
- (iii) Rolling out the use of block chain technology in the banking sector in Uganda.
- (iv) Establishment of a block chain-based land registry in Rwanda. This is the first phase of a larger project on the application of block chain technology in Rwanda.
- (v) Kenya has set up a task force to study the benefits and challenges of block chain technology. Kenya is mooting the establishment of a block chain-based land registry and the enactment of laws on trading in crypto currencies and on alternative uses of block chain technology.
- (vi) Between April 1, 2018 and June 30, 2018, 16 articles on either cryptocurrencies or block chain technology appeared in *The Guardian* (Tanzania) newspaper – an average of more than one article per week (Luhanga, 2018:11):.

The use cases of block chain technology show that it is already being used in insurance, finance, banking, and healthcare - all professions whose future workers are receiving education and training in Mzumbe University. Even the big four global accounting firms – KPMG, Deloitte, PriceWaterhouseCoopers and Ernst & Young – have set up in-house research and development units on block chain technology to establish how the technology would fit into their businesses (Casey, 2018:1).

4.1.2 Financial Technology (FinTech)

The Guardian (Tanzania) newspaper of July 31, 2018 quoted the Controller and Auditor General (CAG), as stating that when Tanzania was appointed to be a member of the United Nations Board of Auditors (UNBoA) in 2013 most Tanzania auditors lacked skills in auditing of electronic financial statements. By taking advantage of its membership in the UNBoA, the CAG's office had managed to up skill 200 of its auditors in the auditing of electronic financial statements by the time Tanzania's tenure on the UNBoA ended in 2018. This is a clear indication that the CAG's office is convinced that Tanzanian auditors need to be skilled in the auditing of electronic financial statements.

In digital economy, businesses rely more on *opex* rather than on *capex* (Schwab, 2016:28). The deployment of financial technology in this paradigm would exploit Cloud Computing. It would be prudent, therefore, for Mzumbe University to start academic activities (teaching, research, and service) in Cloud Computing.

It should also be noted that some professions as we know them today stand to be disrupted by artificial intelligence (AI) and machine learning. One of those professions is accounting and bookkeeping (Palmer, 2017:2). Some tasks performed by accountants today would be taken over by AI algorithms.

Finally, we note that accountants and auditors in Tanzania might soon be required to be skilled in the preparation and auditing of XBRL (extensible Business Reporting Language)-based structured digital financial reports. This is because regulators in some developed countries, such as the Securities and Exchange Commission of the U.S. and Her Majesty's Revenue and Customs in the United Kingdom, have, from about a decade ago, been requiring companies to use this reporting format (Hoffman, 2017:2; XBRL, 2013:1). The advantage of this new reporting format is that it is machine-readable.

4.1.3 Data Analytics

The importance of consumer data in businesses cannot be overemphasized. Already the Financial Sector Deepening Trust (FSDT) of Tanzania has teamed up with the NMB Bank PLC and Resolute Insurance to enable the two institutions use data analytics to deliver more personalized services to their customers. FSDT has advertised itself as being capable of assisting financial and insurance institutions establish data analytics ecosystems. What are the lessons for Mzumbe University?

4.1.4 Cyber security

Financial institutions are attractive targets to cyber attacks especially because of their role in intermediating financial transactions. Opportunities for cyber attacks have, generally been exacerbated by the shortage of people with cyber security knowledge and skills. This lack of expertise in cyber security has manifested itself in the lack of strategic plans on the protection of those institutions against cyber attacks in most institutions. A properly designed strategic plan for financial institutions would customize for each institution the integration of cyber security services from in-house capacity, from outsourcing capacity (obtained from Managed Security Service Providers) and from the usage of Security-as-a-Service platforms (provided by a Virtual Security Operations Centre) (Comtact, 2018).

4.1.5 A Synthesis

We focus on the short to medium term and extrapolate from the *tipping points* of the World Economic Forum (WEF) (Schwab, 2016:28) to identify technologies which might impact businesses in Tanzania in that time frame. The selected tipping points – moments when specific technological shifts hit the mainstream society – are shown in Table 1.

Table 1: Tipping Points Expected to Occur By 2025

90% of people having unlimited and free (advertising supported) storage
1 trillion sensors connected to the Internet
80% of people with a digital presence on the Internet
The first 3D printed car in production
The first government to replace its census with big data sources
5% of consumer products printed in 3D
90% of the population using smartphones
30% of corporate audits performed by Artificial Intelligence
Tax collected by a government for the first time via block chain
Over 50% of Internet traffic to homes for appliances and devices
Globally more trips/journeys via car sharing than in private cars
10% of global GDP stored on block chain technology
The first Artificial Intelligence machine on a corporate board of directors

Source: Adapted from Schwabm, 2016:28

In summary, the selected tipping points shown above and the scanning of the environment lead to a conclusion that, the initial steps which Mzumbe University could take if it wished to evolve towards Mzumbe University 4.0 are:

- (i) Imparting of knowledge, conducting research and providing services in business related aspects of block chain technology.
- (ii) Imparting knowledge, conducting research and providing services in financial technology (FinTech) and regulatory technology (RegTech).
- (iii) Conducting research and providing services in new business models arising from the use of 3D Printing.
- (iv) Imparting knowledge, conducting research and providing services in (big) data analytics and cyber security.
- (v) Imparting of knowledge, conducting research, and providing services in Cloud Computing.
- (vi) Imparting knowledge, provision of services and conducting interdisciplinary research in converged technologies (e.g. block chain technology and IoT, FinTech and Cloud Computing, etc).

Work in areas covered by the last three items has already spawned, and will continue to spawn many new innovative business models (Luhanga, 2018 and references contained therein). The work under item (iii) could lead to the diversification of small-scale industrialization strategy for Tanzania. This could be from one, which focuses on industrialization by utilizing technologies of the Second and Third Industrial Revolutions – which is the forte of the Small Industries Development Organization (SIDO) - to one, which also includes industrialization by small-scale industries, which utilize 3D Printing and other technologies of the Fourth Industrial Revolution (e.g. nanotechnology).

4.2 Pathways towards Mzumbe University 4.0

What initial steps should Mzumbe University take if it wishes to transform itself into Mzumbe University 4.0? The initial steps are proposed to be the ones, which are responsive to Section 4.1.5 as follows.

(a) Staff Development

Mzumbe University could identify young academic staff to be earmarked for specialization in block chain technology. Internal capacity building on block chain technology could begin by having the earmarked staff start learning, at the expense of the university, from online courses and MOOCs.

The staff development needs of block chain technology, and of other disciplines in financial technology (FinTech) and cyber law, which are covered later in this paper, could be made a part of the university's staff development program.

(b) Block chain Cloud Services

Oracle, IBM, Amazon Web Services, and Microsoft are offering Cloud-based block chain services (BaaS, 2018:1). Mzumbe University computer code developers could deploy the Ethereum block chain technology and the Linux Foundation's Hyperledger Fabric (Peck, 2017:29). More knowledgeable and ambitious Mzumbe University computer code developers could adopt more innovative approaches to the development of smart contracts.

Mzumbe University could also launch research projects on the use of block chain technology in poverty eradication schemes, extending the work which has been reported elsewhere (Comben, 2018:3).

(c) Mainstreaming Science and Technology into Mzumbe University

The establishment of academic activities within Mzumbe University as proposed in Section 4.1.5 would be easily affected by increased mainstreaming of science and technology within the university through a modification of its organization structure. It is proposed that this be done through the establishment of the Department of Financial Technology and the Department of Information Technology Law (Cyberlaw). Why these two departments?

The core technologies that are transforming and disrupting the financial ecosystem are blockchain technology, big data analytics, cloud computing and artificial intelligence underpinned by digitalization and networking using information and communication technologies. The legal and regulatory environment must also be conducive to the transformation of the financial ecosystem. All these subjects belong to the academic disciplines of FinTech and Cyberlaw and hence the proposal for the establishment of academic departments which would host these disciplines.

Specifically, the formation of the Department of Financial Technology is being proposed for the following reasons:

- (i) The staff earmarked for up skilling in FinTech and block chain technology would need this department as their base (Luhanga, 2018:11).
- (ii) FinTech is already a buzzword in the local media in Tanzania, with news appearing periodically of private companies, especially Financial Sector Deepening Trust (FSDT), offering training and research services in FinTech. If FinTech activities of private companies appear in the local media but FinTech academic offerings (i.e. teaching, research and service) are absent at Tanzania's leading university of business and management sciences then, even the proverbial *man in the street* might wonder "Why?" Would Mzumbe University have a credible answer to the question? Does Mzumbe University know the gaps in training programs and research services in FinTech, which are being filled by FSDT?
- (iii) The legal and regulatory environment has to be transformed to make them conducive to the transformation of the financial ecosystem in Tanzania. This effort would be aided by the establishment of academic programs in FinTech regulation and *regulatory technology (RegTech)*.
- (iv) This would be the home for academic activities (i.e. teaching, research, and service) in Cloud Computing and of similar activities on the convergence of FinTech and Cloud Computing, block chaintechnology, the Internet of Thing, and other converged FIR technologies.
- (v) Data analytics and cyber security are important in business, in local and central government and in healthcare. Literacy in data analytics and cyber security is, therefore,

important to all professionals intending to work in these areas. Since future professionals in these fields are produced at Mzumbe University, then literacy in data analytics and cyber security could be imparted to students by having the Department of Financial Technology offers, initially, Masters with Data Analytics/Cyber security degree. for future students, consider making data analytics a core course in all undergraduate degree programs offered by Mzumbe University.

- (vi) In one application of FinTech – mobile phone-based money transfer – Tanzania is one of the world's leaders. An estimated 52 percent of Tanzania's population uses exclusively mobile money as a financial service compared to an estimated 2 percent who have a traditional bank account (Tanzania Invest, 2018). Thus, mobile money has improved the efficiency of the economy in Tanzania and facilitated financial inclusion.

The establishment of the Department of Information Technology Law (Cyber law) is being proposed for the following reasons:

- (i) The lack of an academic unit in Tanzania specializing in cyber law has left a vacuum. This has made Tanzania lag behind in the domestication of cyber laws and in the regulations enacted elsewhere in the world (e.g. the General Data Protection Regulation of the European Union and European Economic Area, which came into force on May 25, 2018). Tanzania also lags behind in taking a leading role in enacting laws and regulations, which would protect *inter alia*, the digital consumer in Tanzania. The digital consumers would also need legal protection and legal remedies from the misuse of technologies of the FIR (e.g. misuse of facial recognition technology) or from security breaches arising from the misuse of the technologies (e.g. 3D printing of weapons)
- (ii) New and novel legal issues emerging from the digital technology-led disruptions to the economy need to be identified, researched and addressed. The novel and complex legal issues being raised may be exemplified by a simple example on how the deployment of 3D printing technology could impact the legal and regulatory frameworks supporting the production, distribution, and use of goods and services (Schwab, 2018:146):

...if products are 3D printed locally by a 3D printing shop or by an individual consumer, who bears the liability for product defects: the supplier of the digital template for the product, the supplier of the 3D printer or the person who does the 3D printing, then What intellectual property regimes should govern the ownership and cross-border transmission of the data needed to 3D print a product? How should value added tax and tariff systems adapt?

- (iii) There need to be at least one unit in Tanzania with the responsibility of redressing the quantity and quality of local cyber law experts and conducting research and offering scholarly advisory services in cyber law. For example, current topical questions on freedom of expression and privacy on the Internet need to be addressed from a Tanzanian legal perspective.
- (iv) Regulatory issues of a sharing economy (Schwab, 2016:32) need to be addressed. A sharing economy is a decentralized business model, perfectly matched to the attributes of block chain technology. Are there legal impediments to using block chain technology to offer true peer-to-peer sharing economy models in Tanzania? Who legally owns the data in sharing economy models under implementation in Tanzania? How are those who capture value from consumer data expected to share that value with consumers? Does Tanzania need standards for using and protecting consumer data? Should these standards be national or should Tanzania collaborate with other East African Community member countries to evolve regional standards? Are there lessons for Tanzania from the General

Data Protection Regulation (GDPR), which started being implemented in the European Union on May 25, 2018 (GDPR, 2018:1)?

- (v) The introduction of block chain technology into Tanzania is imminent. The legal regime in Tanzania is, at present, not enabling for block chain technologies. If Tanzania is to benefit from these technologies, she needs to establish a suitable legal and regulatory framework. In order to be enabling to block chain technology, the laws and regulations need to recognize digital signatures that underpin the use of smart contracts and dispute settlement mechanisms for the disputes arising from the use of smart contracts and digital signatures ought to be established. Research needs to be carried out to identify either new laws or amendments to the existing laws and regulations in order to create an enabling environment for block chain technologies, especially Ethereum block chains.
- (vi) Many legal questions regarding smart contracts need answers from a Tanzanian legal perspective. The integration of Ethereum block chain technology, the Internet of Things, and artificial intelligence also raises many questions on smart contracts including their enforcement across multiple legal jurisdictions. The *modus operandi* and legal liabilities of the relationship between lawyers, their clients, and computer programmers who write the digital agreements has to be properly worked out (Raskin, 2017).

Under the current Mzumbe University dispensation, the home for the Department of Financial Technology could be the School of Business, with the University using its staff development program to ensure that academic staffs in the department have the expertise in the applications of FinTech and the development of FinTech Apps. The Department of Information Technology Law could be hosted in the Faculty of Law. However, the essence of scholarship in the Fourth Industrial Revolution is interdisciplinarity and multidisciplinary. In this case, the intersection of Mzumbe University academic activities in the technological, legal, business and management fields is essential. Under this paradigm, as discussed in Section 3.2.2 of this paper, Mzumbe University could start by organizing some of the current academic staff into multidisciplinary research centres in FinTech and Cyber law and later, upon maturity, convert the centres into academic discipline-based departments in the new disciplines of FinTech and Cyberlaw.

The names of the departments, which have been proposed, are mere suggestions. Names could be obtained by following the tradition of universities in the Commonwealth of adopting names, which have been used by other members of the Association of Commonwealth Universities.

(d) Public Seminars

The frequency with which articles on block chain technology are appearing in the local media in Tanzania clearly shows that block chain technology is a subject whose appeal extends to the public as a whole. Mzumbe University staff who become skilled in block chain technology could be encouraged to hold public seminars in Dar es Salaam on the topic.

Mzumbe University staffs who build capacity in data analytics and data security could be encouraged to hold targeted seminars to educate organizations on the benefits of applying data analytics or of having adequate data security protection mechanisms to their businesses. This could open opportunities to Mzumbe University staff of offering consultancy services in data analytics and data security.

5.0 UNIVERSITY STRATEGIC PLANNING WITH FORESIGHT

Strategic planning in universities in Tanzania began in 1994 at the University of Dar es Salaam (UDSM, 1994). From 1994 to date, strategic planning in universities in Tanzania has been carried out with some degree of certainty as to what the next five years of the planning horizon would bring. The fundamental parameters underpinning university strategic planning were assumed unlikely to change at a rapid rate and, hence, the future was assumed to emerge from the present in an essentially predictable, linear, and manageable way. It was assumed, in other words, that universities could manage their way to their visions.

The Fourth Industrial Revolution (FIR) is evolving at an exponential rate (Schwab, 2016:1) and thus the assumptions underpinning legacy university strategic planning models, which assume that the internal and external environments to universities change at a very slow pace are irrelevant to the planning of universities of the FIR.

The fuzziness surrounding the evolution of the FIR, the rapid changes inherent in the FIR and the attributes of University 4.0 imply that the environment of the University of the FIR would be complex and uncertain. Uncertainty and complexity are, therefore, key parameters under which planners of University 4.0 would work. These planners could not afford to adopt a business-as-usual approach and apply legacy university strategic planning models because traditional strategic planning cannot produce strategies that deal with complexity, uncertainty, and rapid changes of the internal and external environments of universities (Conway, 2005:2).

To effectively deal with an uncertain future of University 4.0, it is essential to understand the future and see how the uncertainty could be handled while remaining faithful to the fundamental, universal mission of the university. Understanding the future and using it to enrich strategic planning would make the University of the FIR futures-oriented, using future options to underpin strategic planning. In this model of strategic planning, *Foresight* is used to systematically develop and maintain a shared vision of the future (Conway, 2005:3).

In Foresight, scenario planning is at the core of the methodology. The imaginative thinking arising from the scenario planning processes of Foresight, feeds into the strategic thinking and strategic planning of the University (Munck, 2009:34). The strategic plan, which is the output of such a process, takes into account all plausible scenarios thus future-proofing the strategic plan and, hence, better preparing universities for the uncertainties of the FIR (Munck, 2009:34).

A Foresight exercise is carried out through consultations in a Foresight Group whose members are carefully chosen based on their capacity for independent thinking. The Foresight Group consultations are moderated by a person with specialist skills in moderation of a Foresight Group (Munck, 2009:34).

Mzumbe University is a university of business and management sciences. As such, some of the *gurus* of strategic planning in Tanzania should be found in Mzumbe University. Would Mzumbe University introduce into Tanzania the methodology of strategic planning using Foresight (for universities)?

6.0 CONCLUSION

The Fourth Industrial Revolution is already underway around the world (Schwab, 2016:6). This industrial revolution is driven by a core of technologies, block chain technology being one of them. The technologies driving the Fourth Industrial Revolution are disruptive of business models in the economy in general (Schwab, 2016:28) and have the high potential of being disruptive of academic, research, service and administrative processes in universities (Selamat, 2017:32).

The future of the university in Tanzania must be shaped to ensure that it plays a major role in defining the development of Tanzania in the Fourth Industrial Revolution. For Mzumbe University, the initial

steps for an evolution towards a university relevant for the Fourth Industrial Revolution have been proposed. In transforming itself into Mzumbe University 4.0, Mzumbe University would be playing the traditional role of universities as test beds for innovation and educators and trainers of future generations; in this case, future generations with the right knowledge and skills for the Fourth Industrial Revolution.

This paper has posed a question to Mzumbe University. The university is challenged to provide an answer to such a question. Moreover, Mzumbe University has a vision of becoming a centre of *excellence* in management and allied sciences. Nevertheless, can Mzumbe University attain that vision in a digital economy, with the true meaning of the word *excellence* without acknowledging that the Fourth Industrial Revolution is already under way and that it is manifesting itself in Tanzania through the digitization of the country's economy?

References

- BaaS (2018), "Tech Giants- IBM, Amazon & Microsoft now offer Blockchain as a Service (BaaS)", April 17. Accessed at <http://www.financialreporting.com> on August 23, 2017.
- Casey, M. J. and P. Vigna (2018), "Opinion: Blockchain will make today's accountants (and many Wall Street jobs) obsolete", February 28. Accessed at <http://www.marketwatch.com> on April 19, 2018.
- Chuen, D. L. K. (2015), "Emergence of FinTech and the LASIC Principles". *Journal of Financial Perspectives*, vol. 3, no 3, pp 1-26, December.
- Coindesk (2018), "How Does Cloud Mining Bitcoin Work?" July 4. Accessed at <http://www.coindesk.com> on March 31, 2018.
- Comstac (2018), "Pros and cons of outsourcing Cybersecurity – In-house, MSSP, or Virtual SOC", November 22. Accessed at <http://www.comstac.co.uk> on December 10, 2018.
- Conway, M. (2005), "Strategic Planning Revisited: A Futures Perspective", World Futures Society Annual Conference.
- Craig, R. (2014), "Education-as-a-Service: 5 ways higher ed must adapt to a changing market", May 11. Accessed at <http://www.venturebeast.com> on July 5, 2018.
- David, J. P. (1997), "Inside the knowledge factory", *The Economist*, October 2.
- Faggella, D. (2017), "Examples of Artificial Intelligence in Education", September 1. Accessed at <http://www.techemergence.com> on July 9, 2018.
- Fung Business Intelligence (2017), "Customization: A reality under the Fourth Industrial Revolution", Business Innovation in China, Fung Business Intelligence, January.
- GDPR (2018), *General Data Protection Regulation*, May 25. Accessed at <http://www.gdpr.info.eu> on June 1, 2019.
- Gil, P. (2018), "A Beginner's Guide to Cryptocurrency Mining", June 8. Accessed at <http://www.lifewire.com> on December 8, 2018.
- Hao, K. (2018), "The secret lives of students who mine cryptocurrency in their dorm rooms", *Quartz Media LLC*, June 8.
- Hoffman, C. (2017), "Conceptual Overview of an XBRL-based Structured Digital Financial Report". Accessed at <http://www.xbristle.azurewebsites.net/> 2017/Intelligent Digital Financial Reporting/Part01 Chapter 2.1 ConceptualOverviewofDigitalFinancialReporting.pdf on May 4, 2018.
- Jensenius, A. R. (2017), "Disciplines: intra, cross, multi, inter, trans", December 12. Accessed at <http://www.orj.no/2012/03/12/disciplinarity-2/> on May 8, 2018.
- Jhingan, A. (2017), "Leapfrogging to Education 4.0: Student at the core". Ernst&Young.
- Kerr, C. (2001), *The Uses of the University*, Fifth Edition, Harvard University Press.
- Kurshan, B. (2016), "The Future of Artificial Intelligence in Education", March 10. Accessed at <http://www.forbes.com> on August 11, 2018.
- Lorin, J. J. (2005), "Knowledge economy". Accessed at <http://www.enterweb.org/know>. Htm on April 19, 2018.

- Luhanga, M. L. (2018), "Mzumbe University: Relevance of Blockchain Technology and Initial Steps Towards Mzumbe University 4.0", Unpublished Report, The Council, Mzumbe University, August 8.
- Munck, J. R. and G. McConnell (2009), "University Strategic Planning and the Foresight/Futures Approach", December. Accessed at <http://www.up.org.htm> on October 18, 2018.
- O'Toole, G. (2014), "It is Not the Strongest of the Species That Survive But the Most Adaptable", May 14. Accessed at <http://www.quoteinvestigator.com> on December 14, 2018.
- Palmer, S. (2017), "The 5 Jobs Robots Will Take First", February 28. Accessed at <https://www.shellypalmer.com/2017/02/28-jobs-robots-will-take-first/> on May 5, 2018.
- Pharma (2018), "The Future of 3D Printing Drugs in Pharmacies is Closer Than You Think", July 20. Accessed at <http://www.medicalfactories.com> on July 19, 2018.
- Peck, M. E. (2017), "Blockchains: How They Work and Why They'll Change The World", *IEEE Spectrum*, pp22-31, October.
- Raskin, M. (2017), "The Law and Legality of Smart Contracts", *Georgetown Law Technology Review*, pp 305-341.
- Schwab, Klaus (2006), "The Fourth Industrial Revolution: what it means, how to respond", World Economic Forum, Geneva, Switzerland, January 14.
- Schwab, Klaus (2016), *The Fourth Industrial Revolution*, World Economic Forum, Geneva, Switzerland.
- Schwab, Klaus (2018), *Preparing for the Fourth Industrial Revolution*, World Economic Forum, Geneva, Switzerland.
- Selamat, A. (2017), "Higher Education 4.0: Current Status and Readiness in Meeting the Fourth Industrial Revolution", August 22. Accessed at <http://www.mohe.gov.my> on October 17, 2017.
- Tanzania Invest (2016), "Tanzania Mobile Money". Accessed at <http://www.tanzaniainvest.com> on April 19, 2019.
- UDSM (1994), *Corporate Strategic Plan*, University of Dar es Salaam (UDSM).
- WEF (2017), *The Future of Jobs and Skills in Africa: Preparing the Region for the Fourth Industrial Revolution*, The World Economic Forum, May.
- WEF (2018), *Agile Governance: Reimagining Policy Making in the Fourth Industrial Revolution*, The World Economic Forum, October 11. Accessed at <http://www.wisekey.com> on May 23, 2018.
- Woolf, B., et al. (2013), "AI Grand Challenges in Education", *AI Magazine*, Vol. 34, no 4, pp 66-84, Winter.
- XBRL (2018), "XBRL", July 19. Accessed at <http://www.en.in.wikipedia.org> on November 7, 2018.
- Xing, Bo (2017), "Implications of the Fourth Industrial Age". Accessed at <http://www.arXiv.org> on November 22, 2018