Rethink Thinking Zimbabwean Tertiary Education in the Fourth Industrial Revolution: The Case of a State University

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Abstract

Disruptive technologies such as robotics, artificial intelligence, nanoscience, and blockchain technologies characterize what is referred to as the Fourth Industrial Revolution (4IR). This revolution came after the first, second, and third industrial revolutions (1IR, 2IR and 3IR) whose main contributions were steam engines, electricity, and internet-connected computer processing respectively. Due to its unique exponential speed, breadth, and impact on systems, the Fourth Industrial Revolution is changing the way people work and live and is threatening to make many jobs, skills, and education redundant, antiquated, and defunct now and soon. In view of the foregoing, it is not surprising that, like its predecessors, the Fourth Industrial Revolution technologies are making skills currently being taught to Zimbabwean students and those held by professionals in the industry archaic and thus making many workers redundant in today and tomorrow's industry. Now, with authorities such as Gleason (2018) stating that from as early as the first industrial revolution, education and society have been transforming themselves to suit the dictates of the industrial revolutions, this study sought to assess the degree to which state universities are prepared to adopt 4IR technologies to keep its graduates suitable for the workplace of tomorrow. It also sought to understand major drivers for adoption and to understand the nature of the relationship between industry and the university. A philosophy of pragmatism was used and both qualitative and quantitative methods were used. Questionnaires and interviews were used as the tools for data collection. Descriptive statistics and thematic narrative discussions were used to analyze the data. It was found out that save for basic computer skills taught at most universities in Zimbabwe, very little, if any, has been done to implement the adoption of 4IR technologies such as Artificial Intelligence (AI), Robotics, Machine Learning (ML), and Blockchain technology in the curricula. The study also established that university lecturers at state universities have no contracts with the industry's instructional designers in key technologies that can capacitate them and facilitate training thereof in the the deployment of relevant 4IR technology in their teaching. It was also found out that adoption of 4IR technologies can narrow the gap between the rich and the poor students, increase access to learning materials, and make university education cheaper and accessible. The study concluded that if Zimbabwean universities continue to be driven by consumeristic factors to adopt technology, there is bound to be little innovation and industrialization that would spur-causing drought in the innovation hubs and in international patent filings. It was recommended that practical implementation of the adopted technologies in the curricula should be adequately monitored at all levels to enable universities to produce students who are fit for the 4IR workplace.

Keywords: Fourth Industrial Revolution technology, Tertiary Education, Artificial Intelligence (AI), Robotics, Machine Learning (ML), and Blockchain technology

1. Introduction

The fourth industrial revolution also known as 4IR and Industry 4.0 is a revolution that is fast changing the way people live, do business, and work. It is characterized by disruptive technologies such as robotics, artificial intelligence, nanoscience, and blockchain technologies which makes the revolution unique in terms of exponential speed, breadth, and impact on systems (Schwab, 2016).The fourth industrial revolution was preceded by the first, second, and third industrial revolutions which were characterized by steam engines, electricity, and internet-connected computer processing respectively (Gleason, 2018b).

Gleanson (2018) stated that history has shown economists that an industrial revolution is usually followed by inevitable changes in society and higher education as witnessed in the first, second, and third industrial revolutions. For example, the second industrial revolution saw the establishment of universities such as Stanford University, the university of Southern California, and Chicago university to satisfy the need for training of the industrial classes (Gleason, 2018b). The third industrial revolution made tertiary education respond to it through the establishment of a multiplicity of campuses linked together by internet connectivity. (Schwab, 2016) stated that what differentiates the fourth industrial revolution from the third industrial revolution is the velocity, scope, and systems impact. 4IR's speed (velocity) is more exponential than linear. Scope-wise, 4IR is more disrupting in every industry and country and its impact is far reaching-reaching all systems of life (Schwab, 2016).

The Zimbabwean National Development Strategy 1 Programmes and Projects Investment Plan, unveiled in 2021, pointed out that to digitalize the Zimbabwean economy and adapt to 4IR technologies, the government is planning to have increased research, development, and innovation throughput by way of building innovation hubs and industrial parks to the tune of US$9 534 884 in 2022 (Ministry of Finance and Economic Development, 2021). Additionally, eLearning ICT labs are going to be established whilst training of teachers in all government schools also simultaneously took place. The government also plans to deploy 250 shared

towers across the country and facilitate the automation of application systems to support government operations. The total budget for that is pegged at US$37 740 759 in 2022 (Ministry of Finance and Economic Development, 2021). However, despite these seemingly grand plans, what is not clear now is the extent to which the tertiary institutions in Zimbabwe have adopted 4IR.

Institutions of higher education train for the global industries and organizations and given that institutions of higher education, in the face of an industrial revolution, thus have to produce what is relevant to the industry in skills set lest their graduates were worthless and unemployable (Dai & Vasarhelyi, 2016). The World Bank (2016), estimates that about 66.6 % of the jobs that we have today are susceptible to being made redundant due to technology disruption in the developing world. This then stands to reason that, in response to the rapid changes being brought about by Industry 4.0, the tertiary education curriculum has to be re-engineered, redesigned, and revised to suit the requirements of the new 4IR workplace (Dai & Vasarhelyi, 2016). UN (2021) stated that due to high levels of underemployment and vulnerable employment, many Zimbabwean young people are resorting to less productive subsistence activities and are getting engaged in the formal economy.

Presented with the fact that the fourth industrial revolution is going to change the way people work and live, making many jobs redundant, and knowing that tertiary education and society at large have always been transforming themselves to conform to the dictates of preceding industrial revolutions, the researcher was prompted to assess the state of preparedness of the Zimbabwean state universities to adopt the 4IR technologies. The preparation to adopt the technologies and the alignment of curricula to these 4IR technologies is vital in ensuring that the young educated people are not made redundant (Masinde & Soux, 2020)

The problem at hand now is that the Zimbabwean population already has a great number of youths who are either underemployed, unemployed, or are in vulnerable employment, yet here now we hear that the Industry 4.0 technologies was make the skills currently held and currently trained to the youth, antiquated and effete. Now, with authorities such as Gleason (2018) stating that from as early as the first industrial revolution, education and society have been transforming themselves to suit the dictates of the industrial revolutions, this study seeks to assess the degree to which tertiary institutions in Zimbabwe are prepared to adopt 4IR technologies so as to make their graduates suitable for the workplace of tomorrow. Several studies of a similar nature were carried out by authors such as Masinde & Soux (2020), Gleason (2018), and (Deloitte, 2018) among others, but the researcher is yet to see one that deals with Zimbabwean tertiary institutions' preparedness to embrace 4IR technologies to mould graduates relevant for the 4IR workplace in the future.

1.1 Problem Statement

The Fourth Industrial Revolution technologies are making skills currently being taught to Zimbabwean students and those held by professionals in the industry archaic and thus making many workers redundant in today and tomorrow's industry. Now, with authorities such as Gleason (2018) stating that from as early as the first industrial revolution, education and society have been transforming themselves to suit the dictates of the industrial revolutions, this study sought to assess the degree to which state universities are prepared to adopt 4IR technologies to keep its graduates suitable for the workplace of tomorrow.

1.2 Research Objectives/Aims

- To assess the extent to which universities in Zimbabwe have adopted 4IR technologies.
- To identify drivers for the adoption of 4IR technologies by universities in Zimbabwe.
- To evaluate the nature of the relationship that exists between industry and tertiary institutions in Zimbabwe with regards to 4IR key technology teaching and deployment.
- To find out the 4IR skills that tertiary institutions in Zimbabwe are imparting through their curricula

to prepare students for the new 4IR workplace.

- To assess whether the adoption of 4IR technologies in Zimbabwean tertiary institutions would not increase the gap between the rich students and poor students in terms of access and quality of education.

2. Literature review

Theoretical Literature Review

Several change theories can apply also apply to changes in higher education (Kezar et al., 2018). These theories are discussed hereunder briefly:

2.1 Institutional Theory

This theory is concerned with external forces that pressurize an organization to change the way it does its things or business. These could be political, economic, and or social and technological changes (Kezar et al., 2018). Given the higher and tertiary education setup, these forces would be emanating from outside the campuses. For example, in Zimbabwe, the government's Education 5.0 policy caused universities to change their courses and programs to align them with the government directives. This theory is important in understanding the changes required of universities as a result of external pressure (changes brought about by the Fourth Industrial Revolution)(Narrative, 2020)

2.2 Network Theory

The theory states that people, including institutions, are moulded to think in a certain way and to eventually change by their social circles- those whom they know and spend the most time with. In essence, the interactions of a university with its sister universities and colleges usually lead to the interacting universities ending up implementing the same policies and changing curricula toward a certain way of thinking (Kezar et al., 2018). This theory holds water when we think of various fora attended by various universities such as conventions, workshops, and conferences where there is socialization and mingling, sharing ideas and

learning from each other- influencing behavior afterward.

2.3 Empirical Literature Review

Deloitte (2018) sought to find out how the global youth could be given education, skills, and training that would make them useful to fill in the vacancies that companies are already finding problems in filling owing to a lack of skilled personnel. They concluded that it was imperative for a joint operation of the government, business community, and other important stakeholders to come up with strategies that design education curricula in tandem with public policy and workers' development programs to equip youth for the industry. Masinde & Soux (2020) carried out a study on how to transform South African universities of technology given the 4IR. The authors recognized the need for universities to be transformed in tandem with Industry 4.0 but expressed concern over the possibility of having such transformations increasing the inequalities between the poor and the rich students. A bibliometric analysis of research was used and they found out that universities in South Africa were yet to transform themselves in line with 4IR.

Gleason (2018) who carried out a study on the nexus between 4IR and higher education concluded that the most significant impacts of 4IR on our society were realized after many decades, as was the case with the first three industrial revolutions. The author, however, noted that, unlike the earlier industrial revolutions, the speed with which the 4IR is developing calls for drastic revamping, reengineering, and redesigning of the higher education curriculum. Gleason concluded that curriculum transformation in higher education should be guided by the need to teach emerging technologies such as Artificial Intelligence, robotics, the Internet of Things, blockchain digital technology, and so on. The result was the production of students who are capable of developing new products, applications, and services in a manner that is considerate of the impact on the society and environment, - and for that to happen, a more interactive approach to pedagogy should be adopted. Menon & Castrillón (2019) sought to reimagine curricula in the Fourth Industrial Revolution and they concluded that a flexible curriculum was the most ideal for the dynamic and great challenges of the 4IR.

The authors observed that new programs needed to be developed and that there was still a mismatch between changes in teaching technologies and supporting policies thereof.

Using an online desktop analysis method, Zyl et al., (2021) looked at the influence and usefulness of increased use of 4IR technologies in South African higher education institutions. The authors observed that the mass production of students characterizing the current South African education system is no longer in sync with the current demands of industry, especially given the fact that the outdated curricula being used cannot support the 21st-century skills demands. Krafft et al., (2020) studied the opportunities and challenges to the South African education sector about the 4IR. A desktop study method was used to carry out the study. The study found out that the South African education sector had a lot of challenges as far as adapting to 4IR was concerned. Lack of appropriate teaching skills, finance, and infrastructure shortages hampered efforts to adapt to 4IR.

2.4 Extent of Adoption of 4IR by Universities in Southern Africa

Southern African universities realised the inevitability of transforming higher education in tandem with dictates of 4IR technologies. In fact, many universities in South Africa, for example, have been rushing with the tide in as far as 4IR adoption is concerned. A good example is the Central University of technology, Free state (CUT) that in 2016 adopted a new motto or slogan, “Reimagining CUT: The Year of Innovation and Entrepreneurship”(Masinde & Soux, 2020). However, the same authors revealed that as juxtaposed to the rest of the world, African universities are still very behind in terms of adopting 4IR technologies.

2.5 Extent of Adoption of 4IR by Universities in Zimbabwe

Ministry of Higher and Tertiary Education, Science and Technology Development (2018) indicated in its higher education plan, that it sought to establish Innovation Hubs and Industrial Technology Parks in order to provide enabling environment for academia, private sector and government to adopt, adapt, transfer and commercialize technology vital for all sectors of the economy. In fact, the ministry stressed that there was a great difference between the economic and technological climate of the past years and that of today going

forward.

The Education 5.0 heritage based philosophy shall ensure that Zimbabwe develops an outward-facing and engaged higher and tertiary education, science and technology system, with strong links to industry, community and the global economy (Ministry of Higher and Tertiary Education, Science and Technology Development, 2018).

The above is pointing to the fact that it is not until 2018 that the nation as a whole thought it necessary to change the higher education system in tandem with the 4IR trends. Before 2018, the lecturers focused on teaching, research and community service, but in 2018 the Zimbabwean government resolved to adopt two more missions, that is, innovation and industrialization with a view to equip graduates with innovative skills that engender development of the society-through application scientific and technological knowledge. In actuality, the government felt that a coordinated effort at national level was the surest way of making this great shift a reality (Ministry of Higher and Tertiary Education, Science and Technology Development, 2018).

A more vivid picture of the level of adoption of 4IR technologies by universities and companies in Zimbabwe could be painted by the number of patents that the country's universities together with the companies managed to file as juxtaposed to other countries in the world. Kanhukamwe et al., (2020) stated that Zimbabwe as a country really trailed behind many countries with as little as one patent per year whilst other countries such as China, Japan and USA were filing the patents in thousands per year from 2014 to 2018. This is clear evidence of the appalling levels that we are at as a country as graphically represented below:

2.6 Drivers of Adoption of 4IR Technologies in Universities

The main driver of 4IR in higher education is the realization that 4IR is reality to contend with, and not just a passing fad. However, Abrahams (2010) pointed out that priorities and risk appetites of different organizations determine the rate at which those organizations adopt technology. Thus, we have innovators, early adopters, early majority, late majority and laggards.

According to Abrahams (2010) innovators are few (2%) and they want highest performance available, they

are risk takers and want to be best informed and profitable organizations. The early adopters also want to be leaders, want to be more profitable and want new solutions, but they generally want to see it done before they can adopt. The early majority want to lead in their fields, but they can only adopt proven and tried technologies proven many times. On the other hand, the late adopters do not want to be left far behind and do not want to be troubled by glitches, so they would buy when technology is now ubiquitous. The laggards are more reluctant to adopt technology and will only adopt it when it is no longer avoidable to adopt. They are afraid of the new solutions more than anyone.

2.7 Effect of Adoption of 4IR on the gap between the rich and the poor students

Masinde & Soux (2020)argued that there is still a lot of inequalities in the South African public universities which is characterized by discrimination, marginalisation and systemic exclusion- this regardless of the fact that independence was attained more than 20 years ago. In their study they argued that the technologies of the 4IR can be utilized to away with man-made barriers to access to university education by South African students and to the success thereof. They argued that the principle of acceptance, mutual respect and social inclusivity would aid in true transformation of the South African higher education -to close the gap between the rich and the segregated poor.

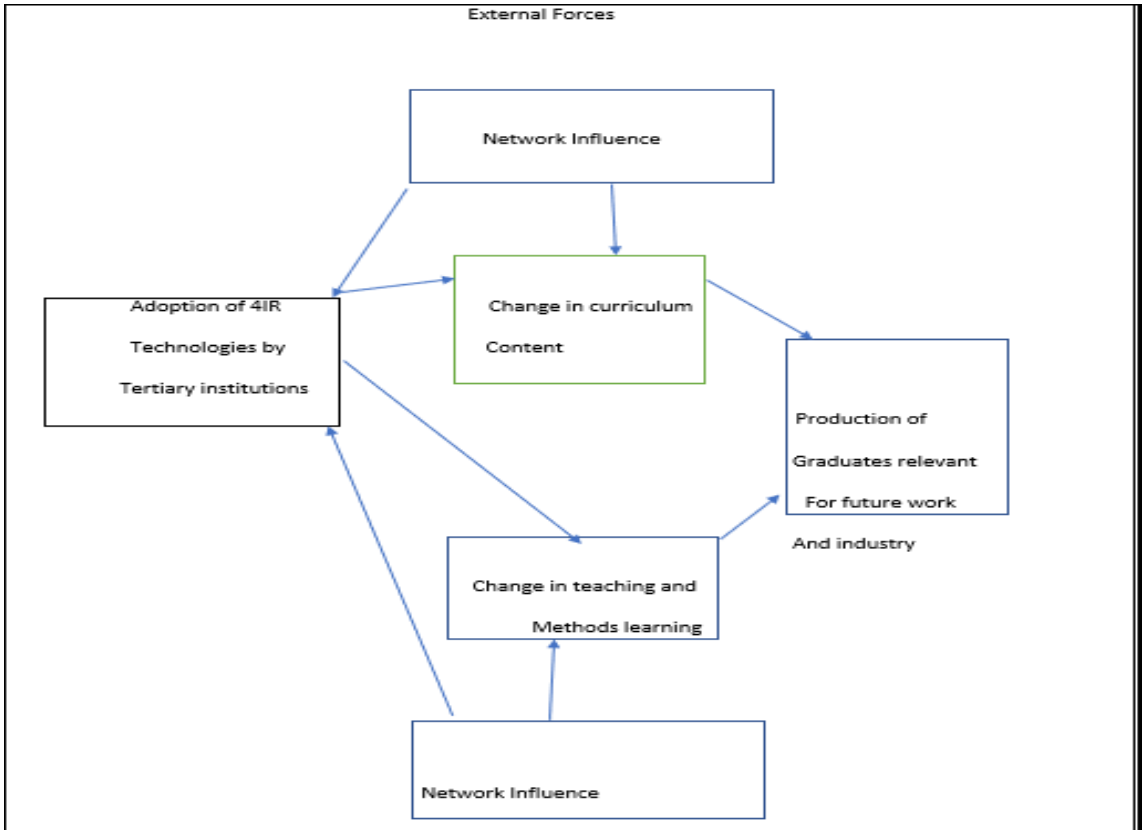
Masinde & Soux (2020) noted that it is mostly the young and ill-resourced universities of technology (UoTs) that have 90% of students being black and poor. On the other hand the traditional seasoned and well-resourced universities do not have many black students. Masinde & Soux (2020) however, saw an opportunity in the status quo. To them, if 4IR technologies are adopted in the young universities of technology (UoTs) where the majority of the students are marginalised poor black people, this could help to close the gap between the rich and the poor students in terms of access to quality higher education and success of the students. In fact, they said, “4IR can be used to remove artificial barriers to access and success of university students in South Africa”

2.8 Conceptual Framework

From the reviewed literature and the theories considered, the study came up with a conceptual framework outlined hereunder. The framework shows that the adoption of fourth industrial revolution technologies by tertiary institutions is influenced by networks of the institutions as well as the external forces as per the institutional theory and network theory.

The adoption of the 4IR technologies by these tertiary institutions would lead to both changes in curriculum content and a change in teaching and learning methods. The changes so effected would then lead to the production of students that are relevant for the jobs of tomorrow and future industry needs.

3. Figure 2.2: Conceptual Framework



Source: Researcher

3. Research methodology

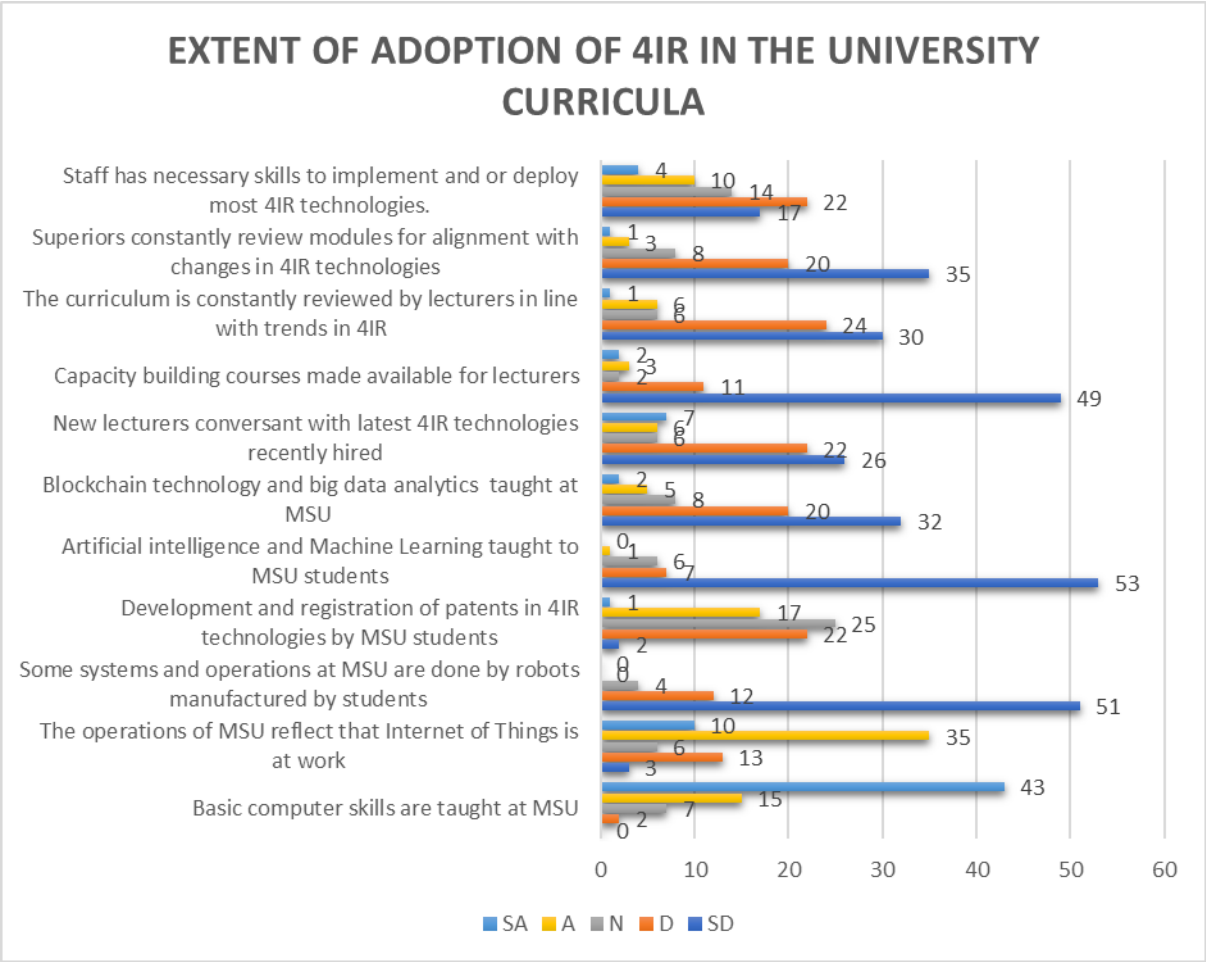
A descriptive research design was used for the study. Sileyew (2019) stated that this design has an advantage in that it allows the researcher to accumulate data from as many different respondents as possible. Loeb et al., (2017) argued that a descriptive research design fully describes a phenomenon whilst remaining simple as far as methods, data, presentation or concept are concerned. It also allows the incorporation of various approaches and perspectives. This design was therefore found to be good for this study which sought to gather the information that is both quantitative and qualitative (mixed methods) to answer the research questions. The design enables the answering of many questions about where what, who, to that extent, and when (Loeb et al., 2017)

4. Results and discussion

4.1 Extent of Adoption of 4IR in university curricula

Figure 4.1 below shows the extent of adoption of 4IR in university curricula

Figure 4.1: Extent of Adoption of 4IR Adoption in the state university curricula



Source: primary data from study questionnaire

Figure 2 above is showing that only one tenet that was measuring level of adoption- basic computer skills, are ubiquitously adopted and taught widely at the university. Specifically, of the 67 respondents, 43 respondents are strongly agreeing and 15 respondents are agreeing -87% generally agreeing).

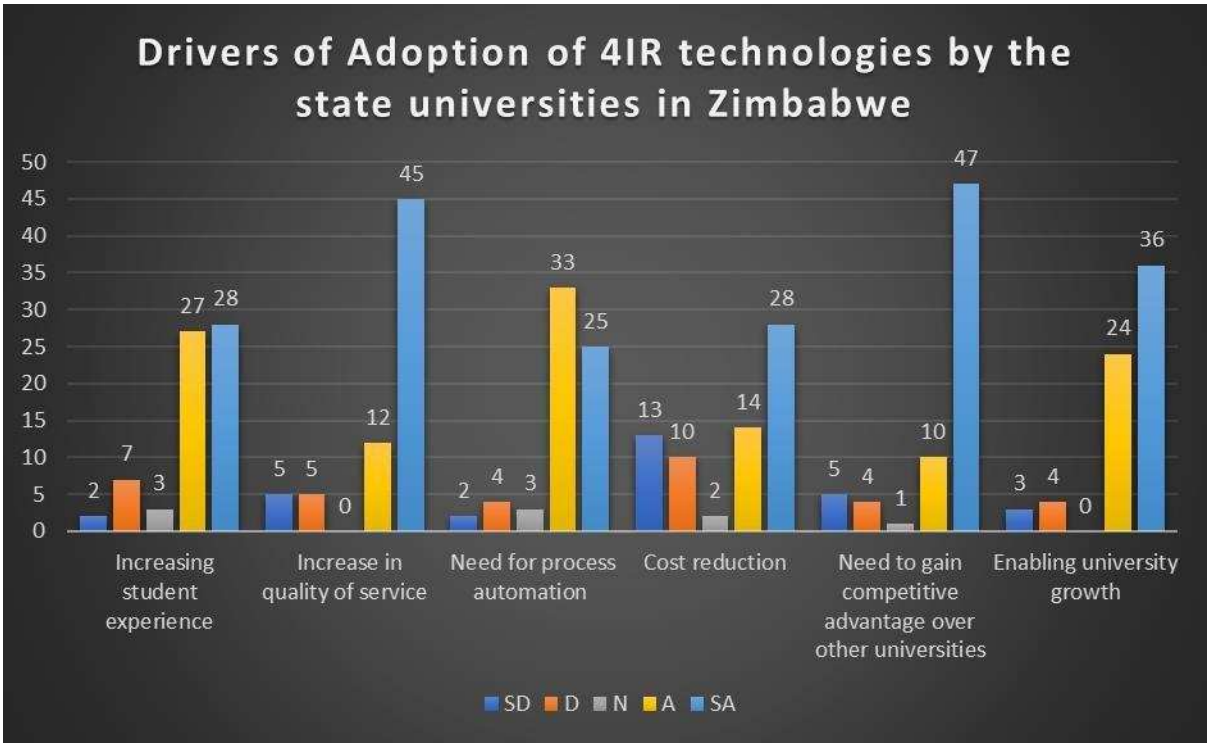
On the other hand, it is apparent that artificial intelligence, robotics and blockchain are yet to be adopted in the curricula at the university, with 53,51 and 32 of the 67 respondents strongly disagreeing respectively. The findings are in agreement with Masinde & Soux (2020) who revealed that as juxtaposed to the rest of the world, African universities are still very behind in terms of adopting 4IR technologies.

Again, the graph is also showing that lecturers are not adequately capacitated to deploy 4IR technologies- of the 67 respondents only 10 and 4 respondents agreed and strongly agreed respectively, that the lecturers are capable of implementing and deploying 4IR technologies. To buttress the fact that lecturers are not ready to implement and deploy 4IR technologies, 49 and 11of the 67 respondents strongly disagreed and disagreed respectively with the notion that capacity building courses were being availed to lecturers. These findings are in sync with Krafft et al., (2020 who found out that the South African education sector had a lot of challenges as far as adapting to 4IR was concerned with lack of appropriate teaching skills, finance, and infrastructure shortages hampering efforts to adapt to 4IR. This is also collaborated by data collected from interviews. In fact, the interviewees revealed that one factor that delays the adoption of 4IR technologies at universities is that the lecturers themselves are not conversant with these technologies- especially in light of the fact most of the professors and senior lecturers are not techno savvy, and might not deliberately cause curriculum change save for when compelled to do so as is the case with Education 5.0. It then stands to reason that meaningful curriculum change should be accompanied by government policy, implementation of which is adequately monitored.

The graph is also showing that the curricula is not being reviewed as constantly as it should be in tandem with changes of the 4IR. In fact, only 1 and 3 of the 67 respondents strongly agreed and agreed respectively with the notion that the curriculum is being changed constantly in tandem with 4IR changes. The foregoing, is in line with the conclusion made by Zyl et al., (2021) who observed that the mass production of students characterizing the current South African education system is no longer in sync with the current demands of industry, especially given the fact that the outdated curricula being used cannot support the 21st-century skills demands.

4.2 Drivers of 4IR Adoption by the state universities

Figure 4.2: Drivers of 4IR Adoption by the state universities



Source: primary data from study questionnaire

Figure 3 above is showing that the need to gain competitive advantage over other universities, the need to increase quality of service and the need to enable university growth are the three main drivers of adoption of 4IR technologies by the State University-with 47, 45 and 36 of the 67 respondents strongly agreeing respectively. Abrahams (2010 stated that the early majority in adopting technology want to lead in their fields, but they can only adopt proven and tried technologies -proven many times. This is typically what the university is doing in adopting 4IR technologies- it wants to gain competitive advantage over other universities (leading) and to be quality leaders, but it cannot be classified as an innovator, neither does it form part of the early adopters who take considerable risk.

The fact that the university is not driven by the quest to innovate make the findings to be supportive of what was revealed by Kanhukamwe et al., (2020) who stated that from 2014 to 2018, the Zimbabwean universities

and companies combined, only managed to do 7 (seven) international patent filings when counties such as China, Japan and USA were filing hundreds of thousand per year. In view of that, it is clear that the university and the country at large can at best be early adopters, not innovators-as the university, other universities and companies fail to innovate and internationally file patents.

4.3 Collaboration between Zimbabwean state universities and the Industry's Instructional Designers in Key Technologies

Table 4.1 Collaboration Between Zimbabwean state universities and Industry's Instructional Designers of Key Technologies:

State University contracts with industry's instructional designers in key technologies to facilitate training of academics in deployment of relevant technology in their teaching	**SD**	**D**	**N**	**A**	**SA**
a) I have witnessed instructional designers in key technologies being hired by the universities to facilitate training of academics in the deployment of relevant technology in their teaching	35	23	8	1	0
b) Lecturers are sponsored to attend latest technology exhibitions, launches and expos	33	28	4	1	1
c) Public lectures by designers of key technologies are arranged by the institution	37	29	1	0	0

Source: primary data from study questionnaire

Gathered data in table 3 is to a greater extent showing that university lecturers at Zimbabwean state universities have no contact with industry's instructional designers in key technologies that can capacitate them and facilitate training thereof in deployment of relevant technology in their teaching. More than three

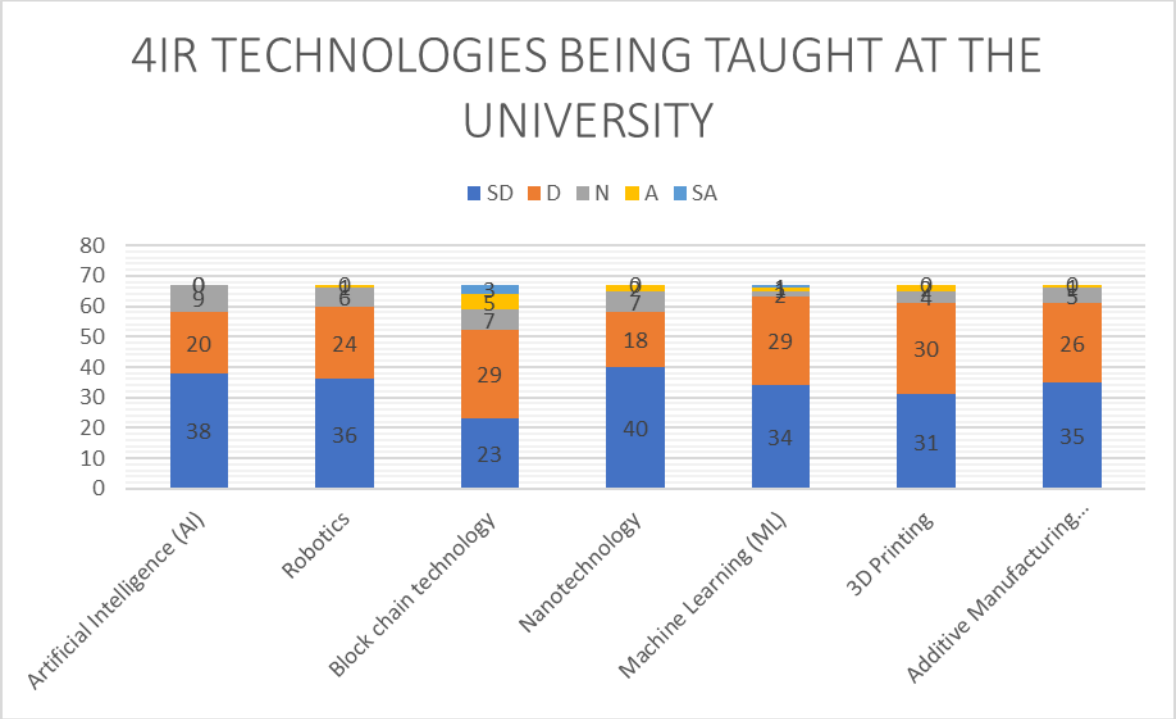
quarters of respondents in all cases (58, 61 and 66 respectively) gave the notion that lecturers are not trained in deployment of 4IR technologies and do not also get sponsored to attend latest technology exhibitions and expos. The finding is in agreement with what was revealed by Ministry of Higher and Tertiary Education, Science and Technology Development (2018)- that before 2018 , lecturers used to focus on three critical areas of teaching, research and community service. They were not expected to look at innovation and industrialization as is now demanded by the new Education 5.0. This therefore accounts for lack of programmes for capacity building of lecturers in the latest technology and also the absence of relations forged with industry's instructional designers in key technologies.

It is imperative to note that this finding is at variance with Deloitte (2018) who concluded that it was vital to institute collaborative efforts of the government, business community, and other important stakeholders to come up with strategies that design education curricula in tandem with public policy and workers' development programs to equip youth for the industry.

The innovation hubs that the government introduced at Zimbabwean universities through Education 5.0 should be the meeting place for innovators from the industry, academia and government, but information gathered by way of interviews pointed out that no much activity is taking place in those innovation hubs. In fact, it was even pointed out that proper operational structures and procedures for submitting an innovation proposal are not in place- with some departments not even having working innovation committees. This makes it impossible for industry specialists and instructional designers in key technology not to have a link with the academic staff- and this inevitably leads to the appalling revelation by Kanhukamwe et al., (2020)- only seven(7) international patent filings in six years for the whole country. In fact, the interviewees pointed out that there is really significant to point out which suggests that the innovation hubs are being fully utilized as expected.

4.4 Skills of the 4IR are being taught at Zimbabwean State Universities

Figure 4.3: Skills of 4IR being taught at Zimbabwean State Universities



Source: primary data from study questionnaire

Figure 4 above is showing that although the degree could differ, at least 75% of respondents were of the view that 4IR technologies such as artificial intelligence, robotics, blockchain technology, nanotechnology, machine learning, 3D Printing and Additive Manufacturing are yet to be taught to students at Zimbabwean state university. The revelation is in tandem with (Masinde & Soux, 2020) who stated that as juxtaposed to the rest of the world, African universities are still very behind in terms of adopting 4IR technologies. This then stands to reason that, in response to the rapid changes being brought about by Industry 4.0, the university education curricula is still to be re-engineered, redesigned, and revised to suit the requirements of the new 4IR workplace (Dai & Vasarhelyi, 2016). In light of the foregoing, Zimbabwean state universities are producing students that will not fit in tomorrow's workplace- with redundant, effete and moribund skills sets. The interviewees echoed the foregoing sentiments when they revealed that they do not specifically feel that the students being produced by the university will go and fit well in the 21st century workplace without an

understanding of the 4IR technologies. They pointed out that although the institution, in line with Education 5.0 directive, has been revising its programmes, very little has been implemented as yet and some of the lecturers are not really conversant with 4IR technologies and how they should be infused in the curricula as well as how to deploy them in their teaching. The interviews also revealed that except for work related learning visits there are no formal meetings or fora arranged for lecturers to meet with captains of the industry so that the academia is informed of what to include in the curricula.

4.5 Effect of adopting 4IR technologies on the gap between rich and poor students in terms of access and quality of education

Table 4.2: The effects of adoption of 4IR on the gap between rich students and poor students vis-a-vis access and quality of education

	SD	**D**	**N**	**A**	**SA**
The adoption of 4IR is widening the gap between the rich and poor students in terms of access and quality of education	24	28	2	6	7
The adoption of 4IR is in fact narrowing the gap between the rich and the poor students in terms of access and quality of education	5	5	4	21	32
Adoption of 4IR led to increase in students who can access learning materials	3	3	3	32	26
Adoption of 4IR made it cheaper to attend university	13	12	5	25	12
The adoption of 4IR made it possible for the university to increase enrolment	16	12	0	18	21

Table 4.2 above is showing that generally ¾ of the respondents are agreeing that adoption of 4IR technologies can narrow the gap between the rich and the poor students, increase access to learning materials, make university education cheaper and accessible.This finding is in line with the argument made by Masinde & Soux (2020) who stated that if 4IR technologies are adopted in the young universities of technology (UoTs) where the majority of the students are marginalised poor black people, this could help to close the gap

between the rich and the poor students in terms of access to quality higher education and success of the students.

4. Findings

5.1 Extent to which universities in Zimbabwe adopted the 4IR technologies with regards to changes made to the curricula.

Despite notable efforts by the government of Zimbabwe through its Ministry of Higher and Tertiary Education, Science and Technology Development to digitize the economy and spur innovation and industrialization by way of introducing Education 5.0 and; by way of establishing innovation hubs at universities, it was found out that save for basic computer skills taught at most universities in Zimbabwe, very little, if any, has been done to implement the adoption of 4IR technologies such Artificial Intelligence (AI), Robotics, Machine Learning (ML), and Blockchain technology in the curricula.

The delay in adoption of 4IR technologies in the university curricula was found to attributed to the fact that lecturers are not themselves technically capacitated and ready to deploy the technologies in their teaching. Again, the curricula are not revised and reviewed as frequently as it should in line with changes brought about by 4IR technologies. Thus, Zimbabwe like any other African country is still very behind in terms of Adopting 4IR technologies.

5.2 Drivers for the adoption of 4IR technologies by universities

Besides their mandate to innovate and industrialize, in as far as adoption of 4IR technologies is concerned, Zimbabwean universities such are more driven by other major factors such as the need to gain competitive advantage over other universities, the need to increase quality of service and the need to enable university growth. This could explain why they are not scoring high in innovations and international filing of patents as noted by Kanhukamwe et al., (2020). They adopt more as consumers only with little desire to innovate.

5.3 Contracts with industry's instructional designers in key technologies to facilitate training of academics in the deployment of relevant technology in their teaching?

The study established that university lecturers at Zimbabwean state universities have no contract with industry's instructional designers in key technologies that can capacitate them and facilitate training thereof in deployment of relevant 4IR technology in their teaching. More than three quarters of respondents in all cases gave the notion that lecturers are not trained in deployment of 4IR technologies and do not also get sponsored to attend latest technology exhibitions and expos. It was also found out that, given the background that before 2018, lecturers mainly focused only on teaching, research and community service, if nothing is done to technically capacitate them in deployment of latest technologies in their teaching, even the innovation hubs will become white elephants.

5.4 4IR skills that tertiary institutions are imparting through their curricula to prepare students for the new 4IR workplace

The study revealed that although the institution, in line, with Education 5.0 directive, has been revising its programmes, 4IR technologies such as Artificial Intelligence, Robotics, Blockchain technology, Nanotechnology, Machine Learning, 3D Printing and Additive Manufacturing are yet to be taught to students at Zimbabwean state universities- and in practice very little has been implemented to spur innovation and

industrialization through deployment of 4IR technologies in teaching. In fact, it was revealed that students currently being churned out of the university may be made redundant in the near future due lack of digital fluency and or literacy.

5.5 Effect of adopting 4IR technologies on the gap between rich and poor students in terms of access and quality of education

The study also showed that adoption of 4IR technologies can narrow the gap between the rich and the poor students, increase access to learning materials, make university education cheaper and accessible.

5.6 Conclusions

As long as lecturers are not technically capacitated to deploy 4IR technologies in their teaching, adoption of the 4IR technologies will be very delayed much to the negation of the governments' vision of seeing the universities leading in innovation and industrialization.

If Zimbabwean universities continue to be driven by consumeristic factors to adopt technology, there is bound to be little innovation and industrialization that they would spur-causing drought in the innovation hubs and in international patent filings.

As long as universities do not contract some of the instructional designers of key 4IR technologies to assist lecturers in the deployment of these technologies, Education 5.0 will delay in bearing fruits for the nation.

Again, if practical implementation of the adopted technologies in the curricula is not monitored, very little will be done in practice and the universities would continue to produce students not fit for the 4IR workplace.

5.7 Recommendations

- Lecturers should be technically capacitated to deploy 4IR technologies in their teaching, adoption of the 4IR technologies to speed up realization of the governments' vision of seeing the universities leading in innovation and industrialization
- Quest to be able to create better and new things (innovation) should be the major driver for adoption of 4IR technologies by Zimbabwean universities, if the country is to be innovative and industrialize as per Education 5.0.
- Universities should contract some instructional designers of key 4IR technologies to assist lecturers in the deployment of these technologies if Education 5.0 is going to be realised soon.
- Practical implementation of the adopted technologies in the curricula should be adequately monitored at all levels to enable universities to produce students who are fit for the 4IR workplace.

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