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Leveraging academic-industry partnerships for inclusive virtual learning

Abstract

The COVID-19 pandemic has caused serious disruptions to higher education institutions across the globe, prompting even the ill-prepared ones to embrace virtual teaching and learning approaches. Academic-industry partnerships remain an under-utilised and under-researched mutually beneficial way of strengthening organisational performance. This study used the case of Zimbabwe to fill the gap in the literature by exploring the types and extent of cooperation between academic institutions and industry towards inclusive virtual learning in public and private universities during the COVID-19 pandemic. The study used electronic questionnaires and virtual interviews to collect data from a sample of 100 university staff and executives in industry. The findings revealed major challenges concerning infrastructure, facilities, high cost of data and intermittent power cuts. At present, particularly in public universities, academic-industry synergies were focused on internet and data provision. However, no support was made available for infrastructure and related facilities. The study recommended the need for strong academic-industry partnerships towards funding infrastructure and facilities to enhance virtual teaching and learning.

Keywords: *Academic-industry partnerships, virtual teaching and learning, ICT infrastructure and facilities, COVID-19, Zimbabwe.*

1. Introduction

The quest for quality, accessible and affordable higher education has continued to intensify even in the face of the COVID-19 pandemic. In order to ensure that teaching and learning continued with minimum disruptions, universities shifted from face-to-face to online teaching and learning approaches, thus exerting pressure on already resource constrained universities (Lee & Lundemo, 2021). Despite education being a basic need for every citizen, the COVID-19 pandemic changed the landscape favouring those with adequate information and communication technology (ICT) affordances and disadvantaging those from poor backgrounds (Jachna, 2021). The state of ICT infrastructure and facilities in higher education institutions, especially in most third world countries where governments have struggled to subsidise education, is dire (Bray, 1999). Literature reveals that more than 82% of African students

did not have access to the internet in sub-Saharan Africa, thus, frustrating the realisation of inclusive and equitable quality education during the COVID-19 pandemic (Nakweya, 2021). However, in most developed countries, learners have access to the internet and digital devices at an early age in their homes, thus making it much easier to embrace online learning (Livingstone *et al*., 2011). Academic-industry collaboration systems are significantly different between developed and developing countries (Wijesinghe, Hansson & Peiris, 2018).

Virtual modes of study rely on the use of ICT online systems and devices. In order for online teaching and learning to be successful, universities must put in place the necessary policies, infrastructure (e.g. computer hardware and software), facilities (e.g. electricity, internet services) and strategies (Chanyagorn & Kungwannarongkun, 2011). Lecturers and students also require devices such as laptops, tablets, smartphones and earphones to be able to participate in virtual learning (Darko-Adjei, 2019). Albeit to varying extents, the universities across the globe that have gone virtual still face challenges regarding the availability of ICT infrastructure, facilities and financing, thus depriving students equal access to quality education (Mgaiwa & Poncian, 2016).

ICT preparedness on the part of the institution, lecturers and students is very low in African universities (Pillay & Erasmus, 2017) including Zimbabwe (Zvavahera & Masimba, 2019). Most institutions have put in place policies for lecturers and students to "bring their own device" through a BYOD policy and support those without through a purchase your own device initiative for use in teaching and learning. However, although these devices are almost ubiquitous across the globe, appropriate devices with the right specifications are generally out of reach due to the high costs (Chitanana, 2012). These challenges have been further exacerbated by the widespread and whole-hearted adoption of virtual teaching and learning by universities in response to the COVID-19 pandemic as a way of observing physical distancing requirements.

Research has shown that academic-industry partnerships play a key role in creating synergies that provide additional resources to support universities and to promote innovation and technology transfer (Guimon, 2013). These mutually beneficial partnerships are premised on the interchange between the academic, innovation and research capacities of universities and the resource endowments of industry (Rasiah & Chandran, 2009). There is limited literature on studies that provide a comprehensive picture of how higher education institutions (HEIs) have developed, strengthened and managed synergetic partnerships with industry at national level to rollout inclusive online learning in the COVID-19 era. This study used the case of Zimbabwe to investigate the status, initiatives, support and challenges regarding academic-industry partnerships to enhance virtual teaching and learning in public and private universities to create equitable, affordable, inclusive and quality education during the COVID-19 pandemic and proposes further areas of cooperation during and post-COVID-19.

The specific objectives of the study were:

- to understand the extent to which public and private universities were prepared for ICT and online teaching and learning in Zimbabwe during the COVID-19 pandemic;

- to evaluate academic-industry partnerships aimed at enhancing virtual teaching and learning during COVID-19; and

- to propose further areas of cooperation with industry during and post-COVID-19.

The article is structured as follows: Section 2 provides a synopsis of academia-industry partnerships in higher education institutions in Africa and in Zimbabwe as guided by existing literature indicating the paucity of literature in this important field; Section 3 outlines the methodology of the study; Section 4 presents the findings and discussion of the study in accordance with the research questions; Section 5 presents recommendations on areas for further cooperation. Finally, Section 6 provides the conclusions of the study and implications for future research.

2. Academia–partnerships in African higher education institutions

The inclusive, equitable and sustainable implementation of online learning by African universities can be enhanced by collaborations between universities and industry. A scoping study of academic-industry partnerships in Nigeria by Ssebuwufu, Ludwick and Beland (2012) revealed that although great potential exists in this area, only a few higher education institutions have reaped significant gains through academic-industry partnerships. Egypt and South Africa are examples of African countries that have strong academic-industry partnerships (Odeleye, 2012). Partnerships have the capacity to uplift the quality of higher education and collaborations in the pertaining environment (Boye & Mannan, 2014; Odeleye, 2012). The concept of academic-industry partnerships in higher education is not new (Mishra & Krishna, 2014). It refers to mutual agreements between academia and industry motivated by several factors inclusive of research, innovation, capacity development for staff and students, infrastructure, sharing expertise and financial support. This study focused on partnerships in internet facilities, ICT and energy infrastructure and other online learning affordances. These are critical for virtual teaching and learning during the COVID-19 pandemic. In this study, ICT infrastructure refers to networks, devices, protocols and processes that are related to information technology or the telecommunications field to enable communication. Related to ICT, infrastructure is energy infrastructure that refers to alternative (off-grid) sources of power such as solar, generators, power banks and invertors among others. Finally, industry refers to private business organisations that provide ICT infrastructure and related facilities (Egoeze, Akman & Colomo-Palacios, 2014).

Barriers to forging successful academic-industry partnerships include the absence of agency to broker partnerships, for instance lack of government commitment; lack of awareness on the value of these partnerships on the part of universities and industry; limited mutually beneficial opportunities and conflicting policies and regulations and philosophies. Policy implementation frameworks in the areas of cooperation, funding, support, communication and conflict resolution strategies should underpin effective and sustainable academic-industry partnerships (Awasthy, *et al*, 2018; Seke, 2020).

In an exemplary show of agency at continental level, the Association of African Universities (AAU) in partnership with eLearnAfricaLMS launched AAU-eLearnAfricaLMS to provide affordable data to students and academics during the COVID-19 pandemic in African universities (Kigotho, 2021). This was in response to the request by African universities through the AAU for digital and energy infrastructure, affordable high-speed internet access, smart devices and data for academics and students to maximise virtual learning during the COVID-19 period. In order to complement the AAU efforts towards enhancing virtual teaching and learning, African governments are urged to play their role by creating a conducive environment to promote the same cause.

2.1 The state of academic-industry partnerships in Zimbabwe

Academic-industry partnerships in Zimbabwe date back to the pre-independence era when the first university was established in 1955 (Nyemba *et al.,* 2018). Although these persisted in the post-independence era, they lacked national and institutional frameworks to effectively implement and monitor them. Maposa and Munanga (2021) argue that this was so because a blanket model would not be suitable for every industry since these have unique characteristics and challenges that require different approaches and models.

The persistent economic decline that bedevilled Zimbabwe since the late 1990s had a profound impact on the infrastructural, service delivery, material, human and financial well-being of universities. It is against this background that universities, faced with a plethora of challenges because of dwindling funding, infrastructure, facilities, equipment and human resource shortages, increasingly turned to industry for partnerships and support to help stem the worsening situation (Mbizvo, 2011; Mpofu, Chimhenga & Mafa, 2013). Even though this resulted in some partnerships (Mashininga, 2018), some researchers (Chiyangwa, 2014; Zinyama, & Nhema, 2015) noted that these were limited by:

- slow pace of reforms and creditworthiness of the country's public sector utilities upon which many private infrastructure investments depend;
- shortage of well-structured investment and improvement opportunities;
- absence of a regulatory framework; and
- the perception of Zimbabwe as a high-risk country due to inconsistencies in policy implementation.

Although incentives for academic-industry partnerships abound in Zimbabwe, the depressed macroeconomic environment made a weak case as industry performance was declining. However, even under these conditions, academic-industry partnerships are reported to have worked well in the areas of universal health care in Zimbabwe (Chikwawawa & Bvirindi, 2019) and the same could be replicated in institutions of higher education. This study aimed to explore academic-industry partnerships with respect to support for virtual teaching and learning.

2.2 Conceptual framework

The conceptual framework that was developed to guide the research scaffolding, data collection and framing of the findings is illustrated in Figure 1 below. The framework conceptualises how a situational analysis using interrelated independent, dependent and moderating variables can be critical in achieving acceptable levels of online preparedness towards inclusive virtual learning. An example of the interrelatedness of the variables is the importance of infrastructure, policy guidelines and financial resources among other dependent factors that negate the level of preparedness by institutions of higher education. This is because of limited support from governments (independent variable) to invest in ICT infrastructure and facilities (Seke, 2020). Lack of legal frameworks (independent variable) to guide the implementation of academic-industry partnerships (moderating variable) is also a major concern.

The independent factors that affect preparedness for virtual teaching and learning at the institutional, lecturer and learner levels were analysed using the PESTLE model. This model is common for organisational environmental analysis. PESTLE is an acronym for political, economic, social, technological, legal and environmental factors that when categorised,

understood and analysed, can be used to effectively predict the future performance of an organisation (Ansah *et al.,* 2016, Stoyanova & Harizanova, 2017). The independent variables that influence ICT preparedness, as analysed by the PESTLE technique, are summarised in the following section.

The factors considered under political include peace and stability; government commitment; leadership capability; policies and regulations and processes regarding ICTs; funding support to universities. Economic factors relate to issues of Gross Domestic Product; income levels; economic growth and stability; inflation rates; employment rates; government expenditure; loan repayments; cost of internet; allocation of funds for ICT and education. Social factors include demographics; ICT literacy rates; ICT and mobile penetration rates; culture and beliefs; digital users' behaviours and public trust. The technological factors include the contribution of technology to the quality and quantity of available infrastructure; technology development; internet access; e-learning and ICT applications in education; security and privacy. Legal factors include regulation on cyber security and privacy; legal framework for promoting and supporting virtual learning. Environmental factors refer to policies of government on climate change; eco-friendly technology; pollution and energy efficiency.

The dependent variables refer to the institution, lecturer and learner preparedness and include Infrastructure (hardware and software); policies; strategies; financial resources; digital literacy; staff and learner support; workload; teaching, learning and assessment; research and dissemination.

The moderating variable is academic-industry partnerships that has the potential to improve the level of online preparedness during and post-COVID-19 in institutions of higher education by creating an enabling environment with requisite resources (Alsoud & Harasis, 2021).
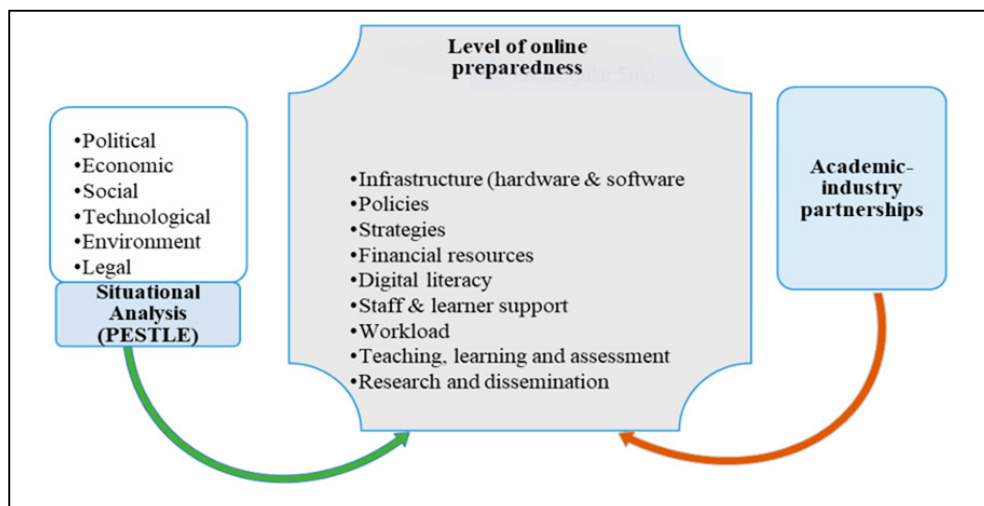

Figure 1: Conceptual framework on the environmental context of virtual teaching and learning preparedness

3. Methodology

A mixed descriptive and exploratory research design was used to collect data from private and public universities in Zimbabwe. Deriving from the conceptual model, and in compliance with COVID-19 lockdown regulations, the study used electronic questionnaires to collect data from a sample of university management and staff. The electronic questionnaire included closed and open-ended questions. The closed questions required participants to select one or more suitable responses from the range provided with an option to insert other unlisted responses into the free-form space provided. For open-ended questions, the participants were required to insert responses into the free-form text boxes provided. Virtual interviews were conducted with industry management, ICT Directors, Registrars and Deans. This study explored the types and extent of cooperation between academic institutions and industry towards inclusive virtual learning in public and private universities during the COVID-19 pandemic.

All 20 registered public and private universities participated in the study. A sample of 5 participants per university was considered adequate for the purposes of the study. ICT Directors, Registrars, Deans, Quality Assurance Directors and academic staff were the main targets due to the importance of their roles in managing partnerships, ICTs and teaching and learning. Email invitations were sent to 100 potential participants providing them with a link (survey URL) to the online questionnaire using Survey Monkey – an online data collection tool. The brief questionnaire required an average of eight minutes to complete. The survey was distributed in May 2021 and was open for three weeks after the initial distribution, during which an email reminder was sent to participants on day 15. Ethical approval to conduct the study was sought from the institution of the principal researcher. In addition, the questionnaire and interviews observed ethical and data protection protocols.

The personalised email invites, the reminders and the provision of a survey URL helped the study achieve a response rate of 61% (61 participants), made up of 50% participants from private universities and another 50% from public universities. The response rate of 61% for online surveys was higher than from similar studies, suggesting the high levels of digital literacy within the higher education sector. The equal distribution of participants from public and private universities enabled the researchers to make a comprehensive analysis of the situation in both categories of universities.

After the data were analysed to understand the emerging industry partners, the required ethical clearance processes were undertaken with the relevant offices before interviews with representatives of the companies were arranged and undertaken. Twenty virtual interviews were undertaken using the Zoom platform and lasted for 20 minutes. Consent was obtained to record the interviews for further transcription and analysis.

4. Findings and discussion

The findings were presented in accordance with the conceptual framework developed for the study. The first part sought to understand how the independent (PESTLE) and the dependent variables shaped the extent to which public and private universities were prepared for online teaching and learning during the COVID-19 pandemic. In the second part, an analysis of the moderating variable, academic-industry partnerships to enhance virtual teaching and learning during COVID-19 was undertaken. The last segment of the findings presents the recommendations regarding further areas of academic-industry cooperation during and post-COVID-19.

4.1 PESTLE analysis

The participants provided information on PESTLE when they were completing the questionnaire that the researchers synthesised and analysed.

4.1.1 Political

It was noted that the Government of Zimbabwe had in place regulations that permitted online education, thus providing universities with opportunities to go virtual. However, there was a lack of meaningful direct investment by the Government towards ICT infrastructure and according to Bray (1999), this was found to be the case in most African countries.

4.1.2 Socio-economic

The poor performance of the economy made it difficult for institutions, lecturers and learners to get financial assistance for ICT resources from industry and the government. A substantial capital outlay needed to be provided upfront to enable online learning. Universities required ICT infrastructure while lecturers and students needed access to affordable software, broadband internet connections and electronic devices inclusive of laptops, tablets and smartphones. Sustainable transformation and growth of the global economy requires serious investment in human capital (Mpofu *et al.,* 2013).

4.1.3 Technological

The key technological challenges to virtual teaching and learning were internet connectivity, power outages and limited internet infrastructure. Associated or dependent technologies are required for e-learning to be effective, examples being hardware, software and broadband internet connections or Wi-Fi. Fortunately, these technologies are increasingly available around the globe to enable the ubiquitous uptake of e-learning.

4.1.5 Legal

The Zimbabwe Council for Higher Education (ZIMCHE), the regulatory body for quality assurance, monitors virtual teaching and learning in all institutions of higher learning. Quality Assurance Directors in universities assist the ZIMCHE on compliance issues.

4.1.6 Environment

The shift to virtual teaching and learning may result in a decrease in the use of paper that could be a great opportunity towards a green environment. However, as highlighted in literature and the findings of this study, it was apparent that the country was far from realising the benefits of a green environment.

4.2 Level of preparedness for online learning by institutions

This section presents and discusses issues related to levels of preparedness for online teaching and learning by institutions.

4.2.1 Infrastructure facilities, devices and data

The participants were cognisant that the success of online learning is premised on the availability of requisite ICT and energy infrastructure, facilities, devices and data. They presented a range of challenges faced by their universities in that respect. Figure 2 illustrates the challenges being faced by public and private universities in implementing virtual teaching

and learning in Zimbabwe. The challenges included internet connectivity and devices (73.9%); infrastructure and bandwidth (65.2%); high cost of data and power outages (56.5%).
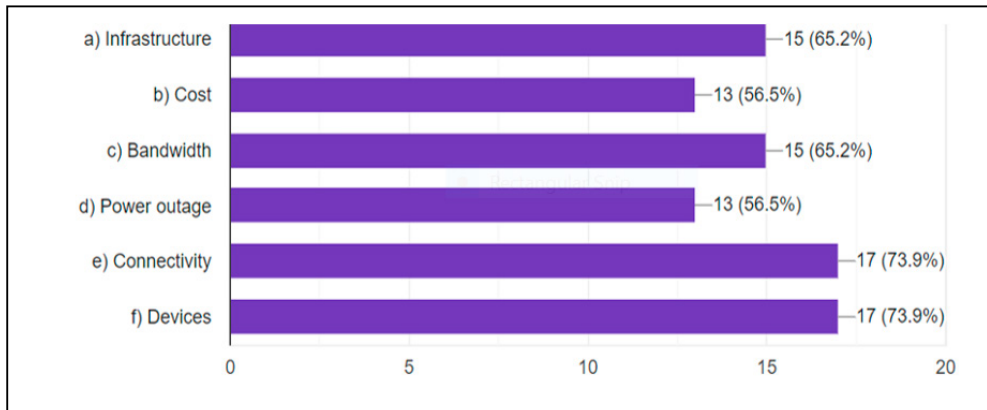

Figure 2: COVID-19 related challenges faced by universities in Zimbabwe

Only the few university staff and students who stayed on university campuses were able to utilise university facilities and the rest who had to stay home during lockdown struggled to get the requisite devices, connectivity and data. Virtual interviews with deans revealed that the cost of data bundles was an impediment for students and academic staff. It was noted that very few universities were able to support their staff and students in this regard. These findings concur with the findings by Zvavahera and Masimba (2019) who reported that most Zimbabwean universities lacked basic ICT infrastructure and facilities, and this affected the quality of their delivery. This finding can be generalised beyond Zimbabwe since Nakweya (2021) found that more than 82% of African students did not have access to internet in sub-Saharan Africa.

The disciplines that were mostly affected are shown in Figure 3. Commerce/business was the most affected discipline (69.9%), followed by information technology (60.9%), science and engineering (47.8%), education (43.5%), life sciences (30.3%) and arts, humanities and social sciences (26.1%). Even though commerce/business was the most affected discipline, it was clear that every discipline had its share of challenges. The reason commerce and information technology ranked highly could be explained by the fact that every university was offering degree programmes in these disciplines with fewer universities offering sciences/engineering and health sciences.
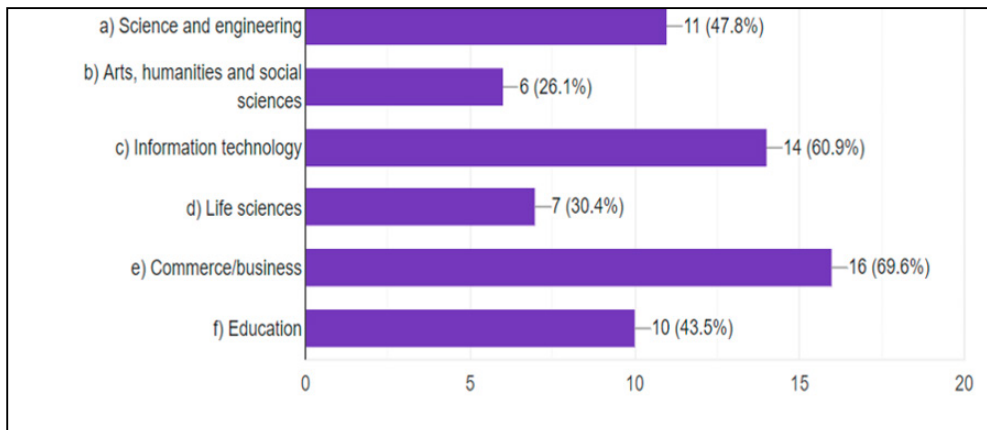
Figure 3: Disciplines worst affected by the pandemic

4.2.2 Teaching, learning and examination

Virtual interviews with ICT Directors, Registrars and Deans revealed that academics and students who preferred face-to-face interaction were not ready for a shift from the traditional approach to the virtual which they viewed as more detached andragogical teaching and learning. It was further highlighted that students and staff struggled to strike a balance between home and work responsibilities in a depressed economy characterised by power outages and high costs of goods and services. Virtual interviews with Deans revealed that the online approach increased workload for staff and students, through lecture preparations as well as continuous student assessments. It was noted that failure to access the physical library, meant students and staff had to spend most of their time glued to their computers leading to increased costs of data that was already out of reach for students and staff. One ICT Director had this to say: *"Students and staff are facing challenges in navigating the e-resources since it is first experience for some of them and they lack the skill and expertise to navigate the information super highway".*

From the electronic questionnaire responses, it was noted that academics had to follow-up on students who could not utilise e-learning platforms, further increasing their workload by delivering lectures in multiple forms to foster an equitable learning environment. Teaching staff also needed to pre-record lectures and this doubled their work, since the same had to be delivered to students synchronously with some resorting to acquiring their own recording hardware and software as the universities did not have a budget for these requirements. This included the time that was spent assisting students on various online platforms such as chat forums, WhatsApp groups, video conferencing and emails. A lack of supportive environments of working from home was also highlighted, since there was no proper office setup leading to disruptions. In view of these dynamics, different ways and modes had to be devised to support student queries. With reference to the conceptual framework, social life of staff could be negatively affected as they would end up having less time with their families and friends.

One of the challenging areas of virtual teaching and learning related to student term evaluation in the form of final examinations. Only 20% of the universities indicated that exams were conducted online whilst 80% indicated that their institutions conducted examinations physically. Virtual interviews with Deans further revealed that for examinations that were conducted physically, social distancing was observed in line with the World Health

Organization guidelines and protocols for gatherings, including the distribution of personal protective equipment (PPEs) for staff and students. For those who indicated that exams were administered online, students had to provide their own data and academics were supported with data by their institutions. In some universities, it was reported that only ICT related exams were administered online. Zoom interviews with internet service providers (ISPs) revealed that they were facing viability challenges because of the poor performance of the economy that was further worsened by the COVID-19 pandemic, where businesses were required to follow strict COVID-19 protocols. The same challenges were confirmed by Kigotho (2021) who noted that lack of support by governments and industry across most parts of world was affecting online learning initiatives.

The fact that 80% of the participants indicated that their institutions conducted exams physically, showed lack of preparedness thereby compromising on the quality of education and human capital development which is critical for the development of the global economy. Twenty per cent (20%) of the respondents that were able to conduct examinations online reported that they were supported by industry which invested heavily in ICTs to make virtual teaching, learning and assessment a reality. It has become apparent that the pandemic has resulted in most universities being stressed since they lack capacity to transition to virtual teaching and learning as policies and contingency plans were not drafted and executed to address the key issues within universities from the onset of the pandemic in March 2020 to the present. Alsoud and Harasis (2021) concur with the findings of this study that policies and legal frameworks are critical for sustainable academic-industry partnerships. What has become apparent is that the new normal of doing business virtually will continue as digitisation of economies and governments has taken centre stage (Seke, 2020).

Responses obtained through electronic questionnaires revealed that students were expected to undertake industrial attachment also known as an internship or work-related learning during their course of study. It was noted that the strict COVID-19 containment measures including total shutdown for those not engaged in essential services reduced attachment opportunities for students. Another challenge could be that most businesses had introduced remote working thereby compromising on the most needed practical experience by student interns. Internship is by nature dependent on interns' ability to work shadowing the experts who were now working from home. Students could be forced to defer their studies because they are unable to fulfil this requirement. In this regard, industry could assist by creating environments where student interns could work from home under close supervision. Developing work-related simulations for interns could assist them being attached remotely. This can be made possible through assistance from industry supporting virtual teaching and learning in institutions of higher learning. Since the pandemic is a global concern, almost every country and organisation has been affected.

4.2.3 Research and dissemination

There was consensus from the participants that data collection for research purposes was limited because of the inability to travel due to lockdown restrictions. They further indicated that they were now relying on secondary data collection through desktop research. Virtual interviews with Deans revealed that even though online research was cheaper, limited availability and access to internet due to the high cost of data and power outages was compounding the problem. It was noted that observation could not be substituted where it was required, and non-verbal cues could be impossible to deduce with poor video and poor internet connectivity.

All the respondents concurred that the prevalent forms of primary data collection were being performed via virtual platforms mostly using online interviews and surveys. Academics noted that online research could not fully work in all areas of study and examples given were in health sciences and engineering, unless good simulations were developed and provided. Even though research was now being conducted virtually, the cost of data was found to be out of reach for students and staff.

A finding from the electronic questionnaires revealed that even though COVID-19 had a negative influence on physical research initiatives, online engagements continued. It was further noted that even though face-to-face interactions remained important, this could not be the best option because of COVID-19 restrictions. Local, regional and international travel restrictions weighed in on face-to-face interactions. However, virtual engagements were appreciated by universities because of their cost-effectiveness. The pandemic created opportunities for everyone since all staff could attend conferences and seminars in the comfort of their homes. There was consensus among the participants that stable and affordable internet as well as uninterrupted electricity supply were prerequisites for realising quality virtual education in the face of the COVID-19 pandemic and into the future. One of the Deans had this to say: "*Industry should support the new normal as a way of corporate social responsibility (CSR). Our institutions do not have the capacity to be fully online*".

All the participants concurred through online responses that research grants in most areas from cooperating industry partners had dwindled since the beginning of the COVID-19 pandemic except those targeting the containment of the pandemic. Virtual interviews with Deans revealed that the implementation of the existing grants was being affected by lockdown restrictions since some of them were administered in the field which was inaccessible due to travel restrictions and bans. Some of the academics indicated that they had not received grants during this period mainly because there was a huge shift to encourage virtualisation of most research-based events including conferences and respondent interactions.

It was noted that producing effective simulations was expensive and industry support could be more helpful. One ICT Director had this to say: "We *encourage Industry and universities to develop simulations that can replace physical presentations, systems and processes*". This could be an opportunity for industry and academia to forge strong research partnerships to solve current and future challenges associated with pandemics. In view of the challenges highlighted, it is critical for universities to engage industry to invest and support in the areas of ICTs and power generation since electricity and ICTs were viewed as the key drivers to virtual teaching and learning. Even though there was evidence that some organisations were assisting universities with free and subsidised data, the level of support was not adequate considering the obtaining environment that had seen an exponential growth in the demand for the internet and internet-based services. Support from industry and the government towards financial and infrastructural investment in modern technologies such as virtual reality simulators or studios that allow for a realistic life experience could go a long way in addressing most of the issues raised in this study.

4.3 Academic–industry partnerships

On the level of collaborations and partnerships, 56% of the respondents indicated that there was a shift towards online engagements because of COVID-19. Eighteen per cent (18%) of the respondents indicated that there was no change in the way collaborations were being handled, whilst 14% indicated that collaborations had declined because of COVID-19. Finally,

12% of the respondents indicated that they were not sure of what was happening since they were not involved in any form of collaborations or partnerships and this category of respondents could have been non-teaching staff.

Twenty-seven per cent (27%) of the respondents indicated that they had received support from internet service providers such as TelOne and Econet. It was revealed that initiatives such as the buy a device scheme, computer purchase schemes and computer lab time were also made available even before the onset of the pandemic. This was in addition to the ongoing Presidential Computer Scheme, which is a government initiative towards computerising universities and schools around the country. Some ICT Directors pointed out that internet services from TelOne and Econet enabled institutions to assist their students with affordable data bundles. In some cases, students were made to pay for subsidised bulk data bundles together with their tuition fees. One per cent (1%) of the participants indicated that internet grants were made available to students whilst 17% indicated that students and lecturers were using WhatsApp since it was regarded as the cheapest social platform for sharing information. Fifty-five per cent (55%) of the participants indicated that students were not getting any form of support and if they did, they were not aware of such support.

The Government of Zimbabwe, through the Ministry of Higher and Tertiary Education, Science and Technology Development (MHTESTD), facilitated academic-industry partnerships with a leading pan-African telecoms group, Liquid Telecom to establish free Wi-Fi delivered across its high-speed fibre network. This initiative, aimed at assisting students to bridge the digital divide, was part of Liquid Telecom's CSR. The initiative established free Wi-Fi zones, named Edu-Zones, in areas where students congregate, for example dining halls, student residences, study areas and sports fields. It was noted that Edu-Zones were established at 10 state universities and one private university (Nyemba *et al.,* 2021). However, negotiations to expand infrastructure and facilities in all universities were ongoing as was reported by the participant interviewed from Liquid Telecom who indicated,

> *Our Company, the largest ISP in Zimbabwe, established Edu-Zones as a long-term initiative to connect universities and other education institutions so that they could save money on internet data costs. The initiative had so far benefitted staff and students from 48 education institutions in Zimbabwe. These institutions benefited from high speed, reliable internet connectivity resulting in better grades and future career opportunities.*

Although Edu-Zones were seemingly a Liquid Telecom's CSR initiative, participants at universities indicated that in return, the beneficiaries of the initiative (i.e. the institutions) were supposed to purchase data from the organisation resulting in a win-win relationship. The Edu-Zone initiative exemplifies how academic-industry partnerships can help develop virtual teaching and learning in universities and to spur Africa's Fourth Industrial Revolution (Boye & Mannan, 2014). However, because of the lockdown and work from home arrangements, and other COVID-19 regulations, this initiative was only able to help the few students who remained on campus.

Virtual interviews with Registrars and ICT Directors also revealed that the Zimbabwe Research and Education Network's (ZIMREN) efforts to provide universities with cheap data were to be realised in August 2021. To this effect, the Post and Telecommunications Regulatory Authority (POTRAZ) had given ZIMREN a free license to enable the joint provision of internet connectivity and distribution. POTRAZ had also assigned the three ISPs in Zimbabwe (TelOne, Econet, and Telecel) with free frequencies during the COVID-19 pandemic to increase their

capacity to provide data to higher education institutions. Given that ZIMREN lacked network infrastructure to act as an internet service provider and supply bandwidth to universities, it had planned to do this through consolidated bandwidth supply from TelOne which currently supplies 75% of the universities' bandwidth. ZIMREN undertook the requisite tender processes on behalf of all the universities to the Procurement Regulatory Authority of Zimbabwe. Such noble initiatives have the capacity to improve the levels of preparedness for online learning in institutions of higher learning across the globe (Rasiah & Chandran, 2009).

As far back as 2014, the Zimbabwe Universities Vice Chancellors Association (ZUVCA), a consortium of universities in Zimbabwe, in partnership with UbuntuNet Alliance had established ZIMREN, a National Research Network (NREN), to provide cheap data particularly for research purposes (Chisita & Rusero, 2016). ZIMREN was to utilise its collective bargaining power to lobby for and coordinate the development of national network infrastructures and to negotiate improved and cheaper bandwidth. ZIMREN would achieve this through facilitating inter-institutional connectivity in partnership with UbuntuNet Alliance, the regional research education network (RREN) in Eastern and Southern Africa (Chisita & Rusero, 2016). These initiatives by industry in Zimbabwe can be replicated in other countries that have similar challenges.

Virtual interviews with state universities Registrars revealed that the government provided grants to public universities to manufacture sanitisers, masks and other personal protective equipment (PPEs). The universities collaborated with relevant ministries to roll out the production and distribution of sanitisers. A Registrar from a private university revealed that the General Board of Higher Education in the United States of America financially supported their institution to conduct research on Zumbane (Lippia javanica) and produced "cough drop sweets" that are perceived to suppress COVID-19 induced coughing. The same board also supported students and staff with data bundles in the first wave of the pandemic. Funding to capacitate staff and staff with online teaching and learning skills was also made available.

It was encouraging to note that universities were receiving some form of support even though it was inadequate considering the number of students and staff who needed this form of assistance. In light of this glaring exposure, targeted investment towards ICT infrastructure and facilities in universities could assist. It was sad to note that some members of staff were conducting teaching and learning business using the WhatsApp platform which in its current form, cannot be an effective method of teaching and learning as it does not offer a 360° platform for teaching and learning and is inadequate for courses where demonstrations and pragmatism take centre stage.

In view of the findings, people with networking and managerial skills necessary to attract industry partners could only broker sustainable academic-industry partnerships. Furthermore, interest and commitment leading to the partnership by industry is critical as was also reported in the contexts of Japan, the United Kingdom and the United States of America by Rahm, Kirkland and Bozeman (2013). As reported in this study and other contexts as well, it is clear that policy makers who stimulate academic-industry partnerships, promote global economic growth (Dill & Van Vught, 2010).

5. Recommendations

Attending to issues in the conceptual framework, (Figure 1) could assist in addressing most of the concerns raised in this study. The conceptual framework together with the findings of

this study can be applied beyond Zimbabwe through inference. The study noted that a lack of ICT infrastructure and facilities, the high cost of data, devices and power outages were the major impediments in efforts aimed towards the adoption of virtual learning and teaching in Zimbabwean universities. The lack of prerequisite infrastructure and facilities show the extent to which institutions were ill-prepared for virtual teaching and learning. Industry-academic partnerships should strongly consider investing in ICT infrastructure and facilities across the country so that even those in rural areas can benefit. A lack of internet connectivity could lead to unequal access to education affecting those who come from poor backgrounds and rural areas. This was noted to be a challenge not peculiar to Zimbabwe. Availability of uninterrupted internet will also allow students to have examinations and other learning related activities virtually. Academic-industry partnerships should make cheaper internet and data available so that students and staff can connect from anywhere across the globe. Industry, with support from the government, should come up with subsidised computer schemes for students and university staff so that virtual teaching and learning becomes a reality in the prevailing COVID-19 environment.

Even though there were ongoing industry-university partnerships in the areas of ICT and facilities development, the level of participation by industry was lower than expected considering the urgency to fully embrace virtual teaching and learning because of COVID-19. In the spirit of making virtual learning a reality across the globe, governments and industry should also consider supporting partnerships similar to those proposed by ZIMREN and ZUVCA so that universities and other educational institutions and students are provided with subsidised data. Industry should complement the already ongoing computerisation programme by the government by providing cheaper devices to staff and students so that equal access to quality education is achieved in the obtaining environment. Finally, there is also a need to capacitate students and staff with computer skills to allow a quick transition to virtual teaching and learning.

Apart from the above recommendations, industry should complement government's efforts by generating electricity. The intervention by industry in power generation will go a long way in alleviating power cuts that have since become a perennial problem affecting the smooth running of universities and industry. Developing ICT infrastructure and facilities with no backing of power will not assist universities in achieving the desired outcomes. There is also a need for the government to establish a supportive legal framework to operationalise the existing partnerships. Industry needs to invest in research so that new initiatives and innovations become a reality. Connecting student interns to industry through simulations could also go a long way in assisting interns who are finding it difficult to get attachment because of COVID-19.

6. Conclusions

The study noted that the critical analysis and application of PESTLE is vital for fostering strong academic-industry partnerships in addressing most of the issues raised in this study. Most of the students and staff were finding it difficult to cope with the new normal of virtual teaching and learning due to a lack of capacity and preparedness by their institutions. This was a result of a lack of support from industry and the government. Working from home was difficult for some, as they could not balance work with family demands leading to emotional challenges. Students were concerned about access to networks, intermittent power cuts and the high cost of data. The little support by industry was attributed to the poor performance

of the economy, which was further compounded by COVID-19 restrictions on the operations of industry. However, it can be concluded that equipped with supportive brokers or agency, industry-academic partnerships have the capacity to improve the state of ICT infrastructure and facilities in universities towards virtual learning. A shared vision by all key stakeholders could go a long way in uplifting ICT standards in Zimbabwean universities and beyond thereby creating a learning community that exists virtually with shared resources, access to materials and near real life virtualised environments that foster equitable, accessible and affordable education even beyond COVID-19.

The study contributed to knowledge on leveraging academic-industry partnerships to enhance the quality of virtual teaching and learning during and post-COVID-19. The existing literature on this topic is based mostly on perspectives from academics and excludes the perspectives from industry, as was the case in this study. Future research should further focus on including the perspectives of informants from those organisations that do not have existing partnerships with universities in order to capture their views on academic- industry partnerships.

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