A Resource-based Approach in the Implementation of E-learning in Selected Ugandan Public Universities

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Abstract

This study examined the influence of selected Ugandan public universities' tangible and intangible resources and capabilities on E-learning implementation. The study also explored the management of E-waste resulting from E-learning implementation. The study used the quantitative approach to examine the influence of resources and capabilities on E-learning implementation and the qualitative approach to explore management of E-waste resulting from E-learning implementation. Based on a cross-sectional design, data were collected from academic staff using a self-administered questionnaire and an interview guide from technical experts. The findings revealed that tangible resources and capabilities positively and significantly predicted E-learning implementation, but intangible resources positively but insignificantly predicted its implementation. It was also revealed that the management of E-waste was poor but can be effectively managed by selling them to recyclers or universities developing recycling capacity for recyclable E-waste and destroying the useless ones in an environmentally friendly manner. The study also showed the need to sensitize students and staff about proper E-waste disposal. It was concluded that tangible resources for universities' capabilities are crucial for E-learning implementation and low intangible resources hinder E-learning implementation. The recommendations of the study are that university managers should put in place sufficient tangible resources to facilitate E-learning implementation; make an effort to improve their E-learning capabilities; and also enhance their intangible resources. It was recommended that universities should collect E-waste for commercial purposes, develop the capacity to recycle E-waste, ensure that their staff members follow the established policies for disposal of E-waste, and sensitise staff members and students about proper E-waste management.

Keywords: Capabilities, E-learning, E-waste, Intangible, Tangible

Introduction

After December of 2019 when the Coronavirus Disease (COVID)-2019 was identified in Wuhan, China, it quickly spread to various parts of the world and became a global pandemic (Lai et al., 2020). Lockdowns as mechanisms for curtailing its fast spread to protect people were declared by

different countries. On March 18, 2020, the government of Uganda also declared a lockdown that included closure of institutions of learning such as universities (Mugizi et al., 2021). This necessitated the need for E-learning as there was no hope that the pandemic would go away soon. Therefore, the reality of the unanticipated COVID-2019 was the implementation of E-learning by universities because of the shutdown of university campuses due to the lockdowns. Nonetheless, the challenge was that universities were not prepared and are still grappling to successfully implement E-learning. In Ugandan public universities, the shift to E-learning was haphazard because most of them had not previously given it paramount consideration. Still, like in other developing countries, the teaching staff in most Ugandan universities lacked E-learning delivery competences (Rapanta et al., 2020). Furthermore, besides most students in the universities having a negative attitude toward E-learning, a major challenge to incorporating E-learning into the mainstream curriculum of Ugandan universities was that instructors were stuck to teacher-centred pedagogies. Therefore, there was a narrow scope for the application of the E-learning opportunities that modern technology provides (Tumwesige, 2020).

Nonetheless, based on the existing organizational assets that were tangible such as computer laboratories, Internet and libraries, the intangible ones including technical know-how, learning culture and relationship with the stakeholders together with capabilities that were internal knowledge and competencies which most universities had, universities had the potential to effectively implement E-learning. Therefore, based on the resource-based approach, which explains the different types of organizational resources that enhance organizational performance, this research investigated how the resources Ugandan public universities possessed could be used to implement technology-based learning during the COVID-2019 emergency and beyond. The approach was derived from the Resource-Based Theory (RBT). The central proposition of the theory is that if an organization is to achieve successful performance, it must be able to absorb and use its key resources (Kraaijenbrink et al., 2010). Available resources can be used to exploit opportunities and even neutralize threats such as COVID-2019 lockdowns in an organization's environment. Thus, the strategy of an organization should be how to exploit the bundle of resources at its disposal. This study examined how universities could exploit their existing tangible and intangible resources and their capabilities to effectively implement E-learning.

The research was limited to Kyambogo University and Makerere University, the two largest universities in Uganda. This was because while these universities had assets in terms of tangible and intangible resources and capabilities necessary for implementing E-learning, they were unable to effectively provide education during the COVID-2019 pandemic lockdowns (Mugula & Momanyi, 2021). On the one hand, the two universities provided limited platforms for teaching students, yet they had pre-existing online programs that were the open distance education learning (ODEL) for Kyambogo University and distance education in some programs in different colleges and schools for Makerere University (Mugizi & Nagasha, 2023). On the other hand, the universities lacked infrastructure for appropriate E-waste management, specific policies for E-waste, and frameworks for end-of-life (EoL), thereby posing a danger to the environment as a result of increased use of online equipment. Hence, while the universities had resources for implementing E-learning during the COVID-2019 period and beyond, they were inadequately prepared. This made it necessary to examine whether if using the resource-based approach, universities can effectively implement E-learning and develop capabilities to protect the environment from E-waste.

Theoretical Framework

Effective E-learning implementation demands the possession of specific resources essential for its

use. E-learning resources can be examined guided by the Resource Based Theory (RBT). RBT is a framework that proffers that the sustainable success of any project depends on the internal resources of an organization and the organization's capabilities in using those resources to ensure successful performance (Holdford, 2018). RBT was originated by Penrose (1959) and propagated by its advocates such as Barney (1986). The central proposition of RBT is that if an organization is to achieve successful performance, it should have the capacity to absorb and use its key resources (Kraaijenbrink et al., 2010). Available resources can be used to exploit opportunities and even neutralize threats such as COVID-2019 lockdown in the organization's environment. Therefore, the strategy of an organization should be about how to exploit the bundle of resources at its disposal. The organization in the extensive sense of the term should support the coordination and taking benefit of the potential of the resources at hand (Soloducho-Pelc & Sulich, 2020).

Resources according to RBT are organizational assets that are the tangible and intangible resources and capabilities (Ahmed et al., 2018). On the one hand, tangible resources are the physical resources that support continued competitive advantage (Holdford, 2018). On the other hand, intangible resources are elements that lead to the rise in the value of knowledge-based organizations (Oprean-Stan et al., 2020). Capabilities comprise invisible competencies in use in an organization marked by accumulated know-how (Othmana et al., 2015). Precisely, RBT reveals that the tangible and intangible resources and capabilities of organizations such as universities can be used to implement programs such as E-learning. Based on RBT, this study examined how universities could exploit their existing resources tangible, intangible and their capabilities to implement E-learning. The ensuing subsections explain these aspects apropos E-learning implementation and the nexus between E-learning and E-waste management.

Tangible Resources and E-learning Implementation

Tangibles are the physical resources of an organization such as buildings and equipment (van Weele et al., 2020). These resources have the potential to provide services. Tangible resources are strategic and establish a competitive advantage and have the potential to enhance service delivery (Jawed & Siddiqui, 2019). E-learning tangible resources include information and communications technology (ICT) teaching facilities, access to ICT facilities, and ICT implementation policies.

A number of studies (e.g., Arthur-Nyarko & Kariuki, 2019; Jawed & Siddiqui, 2019; Ouma, 2021) have been carried out on the significance of tangible resources in relation to E-learning implementation. Nonetheless, knowledge gaps emerge. For example, while a number of studies indicated that tangible resources significantly led to successful achievement of institutional goals such as E-learning implementation, scholars such as Arthur-Nyarko and Kariuki (2019) and Jawed and Siddiqui (2019) did not concur. This lack of an affirmative position on the value of tangible resources in successful E-learning implementation necessitated further investigations. Thus, this study tested the following hypothesis, H_1: Universities' tangible resources have a significant influence on E-learning implementation.

Intangible Resources and E-learning Implementation

Intangible resources are necessary attributes necessary to attain a competitive edge (Pires et al., 2021). They are non-physical assets including a bundle of structured knowledge, applications and attitudes of the organization that establish value for an organization (Lopes & Carvalho, 2021). These resources can also be internally generated to facilitate organizational effectiveness (Hasprová et al., 2018). Intangible resources include technical know-how, organizational structure, learning

culture, and relationship with the stakeholders (Ahmed et al., 2018; Sharma & Dharni, 2020). Scholars (Basantes-Andrade et al., 2020; Jawed & Siddiqui, 2019; Hatlevik & Hatlevik, 2018) have studied the influence of intangible resources on E-learning implementation.

Nevertheless, while most scholars revealed that various intangible resources were important for the implementation of projects such as E-learning, knowledge gaps emerged. For example, contrary to the other scholars, Jawed and Siddiqui (2019) reported that intangible resources had a negative and insignificant role. This suggested that the association between intangible resources and E-learning is not definite but depends on the context. This knowledge gap made it imperative for this study to further test the influence of intangible resources on E-learning implementation. Accordingly, the study tested this hypothesis, H_2: Universities' intangible resources have a significant influence on E-learning implementation.

Organizational Capabilities and E-learning Implementation

Capabilities describe the capacity of organizations to deploy resources using organizational processes (Huang & Li, 2017). Capabilities are the socially complex routines upon which organizations depend to turn inputs into outputs (El-Awad et al., 2017). Capabilities are essential in steering innovations and integrating acquisitions such as E-learning. They include processes such as experimentation, integration capability, and content management (Mugizi & Rwothumio, 2023). Studies (Daouk & Aldalaien, 2019; Mtebe & Raphael, 2018; Park et al., 2018; Teo et al., 2020) have examined the influence of various elements of organizational capabilities and implementation of E-learning. Nevertheless, none of the studies captured the Ugandan universities' context where E-learning implementation was a challenge.

In addition, knowledge gaps emerged with some studies producing results indicating that some capabilities were insignificant predictors of E-learning implementation. For instance, Daouk and Aldalaien (2019) and Park et al. (2018) revealed that experimentation insignificantly predicted E-learning implementation. Relatedly, Mtebe and Raphael (2018) reported the content quality an aspect of content management had an insignificant association with E-learning success. This knowledge gap suggested that the contribution of capabilities to E-learning implementation is not certain. Therefore, it was deemed imperative in the context of Ugandan universities to further test the ensuing hypothesis, H_3: Universities' capabilities have a significant influence E-learning implementation.

E-learning and E-waste Management

E-waste or electronic equipment waste or electronics end-of-life defines obsolete or unwanted components, sub-assemblies and consumables of information technology and other electronic appliances (Lu et al., 2015). When electronic appliances become useless, they become E-waste (Kumar & Sharma, 2015). E-waste includes a wide range of absolute appliances such as computers and their peripherals such as monitors, central processing units (CPUs), printers, keyboards, chargers, headphones, and batteries (Awasthi et al., 2018). Their improper disposal poses environmental deterioration and health risk challenges. For instance, landfilled computer garbage releases tainted leachates that eventually poison groundwater. Universities are called upon to pursue strategies that enhance E-waste management. Nonetheless, the challenge is that few universities globally have organized activities focused on the same (Ramzan et al., 2019).

In a study evaluating consumer E-waste recycling behaviours, Arain et al. (2020) revealed that increased access to free or affordable recycling and providing recycling incentives enhanced E-

waste recycling. Gomes et al. (2017) in a study at a University in Brazil revealed that E-waste segregation facilitates their management for future reuse and recycling. Also, establishing a waste pickers association in the process of segregation would boost E-waste management. At a university campus in Mexico, Ramzan et al. (2019) established that it was necessary to institutionalize electronic waste management, design policies for the same, adopt participative methodologies to develop synergies in waste management, and sensitize university community members about the hazardous nature of E-waste. In addition, it was also revealed that there was a need to commercialize recoverable materials. In their study done in China, Lu et al. (2015) demonstrated the need for a coordinated effort to put into place measures including creative policy designs, stringent enforcement of relevant regulations, a market-based strategy, cutting-edge E-waste treatment technologies, and a wide range of public participation mechanisms. Nevertheless, while studies revealed a number of approaches for managing E-waste, all the approaches were suggested from the context outside the developing countries of Africa where E-technology levels are low and, thus, its management is also low. Therefore, in the context of Uganda, a low developing nation in Africa, this study explored the following research question: What are the E-waste management strategies in Ugandan public universities?

Methodology

The study used the quantitative approach to carry out numerical analysis in order to draw inferences while the qualitative approach was employed to explore respondents' opinions. The cross-sectional research design was adopted because it enabled obtaining data on what was prevailing at the particular time since such studies search for data on what exists at a specific time (Asenahabi, 2019). The sample for the quantitative aspects of the study comprised 312 lecturers from a total number of 1883, comprising 451 from Kyambogo University and 1432 from Makerere University in 2022. The sample size was determined using the table for sample size determination by Krejcie and Morgan (1970). Simple random sampling was used to collect the data in order to ensure that the study participants were determined by chance, which gave academic staff members an opportunity to be involved in the study without bias. The sample for the qualitative aspects of the study included E-learning experts in the universities that were academic staff members and E-learning technicians selected based on expert sampling. Expert sampling involves collecting data from those who are known experts in the study area (Etikan & Bala, 2017). The sample for E-learning technicians was determined based on data saturation.

The data collection instrument for the quantitative data was a self-administered questionnaire. The indicators were anchored on a five-point Likert scale with 1 = Strongly Disagree, 2 = Disagree, 3 = Not Sure, 4 = Agree, and 5 = Strongly Agree which enabled the collection of ordinal data necessary for quantitative analysis. For the qualitative data, an interview guide with standardized open-ended questions for probing was used to collect data from five academic expert staff members, comprising two from Kyambogo University and three from Makerere University, and four E-learning technical staff members, comprising two from each university.

The data were analyzed using descriptive analysis in terms of means and partial least squares structural equation modelling (PLS-SEM) using Smart PLS-SEM helped us to develop a measurement model, thereby establishing validity and reliability and path models. The measurement models indicated the appropriateness of the measures, while the path models revealed how intangible resources of universities were associated with effective implementation of E-learning. Qualitative data were analysed by using content analysis, which enabled us to provide relevant explanations. The data were distilled into fewer words according to similar patterns and themes,

thereby helping us to delineate meaning for the presentation of the findings.

Resource-based Approach and E-learning Implementation Findings

This section entails the presentation, analysis, interpretation and discussion of the quantitative findings on the resource-based approach and E-learning implementation. The results include descriptive statistics in terms of means, measurement models, and structural equation models and path estimates discussed in the subsections that follow.

Measurement Models

The study produced descriptive results, specifically the means to illustrate how academic staff members rated universities' E-learning resources and the effectiveness of E-learning implementation. Measurement models seeking to determine if the data were suitable for structural equation modelling were also developed. The measurement models included validity tests measured by average variance extracted (AVE) and heterotrait-monotrait (HTMT) ratio correlations as well as reliability measures, namely Cronbach's alpha [α] and composite reliability [CR]. The value inflation factor (VIF) was also computed to detect the presence or absence of *collinearity*: i.e. correlation between predictor/independent variables such that they express a linear relationship in a regression model. This was the basis for determining whether the independent variables were suitable for structural equation modelling. Tables 2 and 3 entail the results of the measurement models.

Table 1: Descriptive Statistics, Means and Heterotrait-Monotrait Ratio (HTMT) for E-learning Resources of Universities

Measures	Means	AVE	ELI	SCI	SSI	STI
ELI	3.55	1.000				
SCI	3.42	0.692	0.869			
SSI	3.54	0.550	0.758	0.502		
SSI	3.68	0.526	0.869	0.640	0.517	
Measures	Means	AVE	IR	TR	UC	UER
IR	3.03	0.519				
TR	3.18	0.515	0.800			
UC	3.62	0.507	0.532	0.560		
RBA	3.28	1.000	0.865	0.896	0.805	

Key: ELI = E-learning implementation IR = Intangible resources, RBA = Resources-based approach, SCI = Student-content E-interaction, SSI = Student-student E-interaction, STI = Student-teacher E-interaction, TR = Tangible resources, UC = Universities capabilities, UER = Universities E-resources
Source: Self-generated by the Authors

The results in Table 1 show that generally, E-learning implementation was rated high (mean = 3.55) as the mean corresponded to "agree" or "strongly agree" based on the five-point Likert scale. Nonetheless, E-learning student-content E-interaction was rated moderate (mean = 3.42) since the mean was around three or "not sure," the results indicate that student-content E-interaction was considered moderate or fair. Nevertheless, student-student E-interaction (mean = 3.54) and student teacher E-interaction (mean = 3.68) were rated "high." Thus, whereas student-

content E-interaction was moderate, student-student E-interaction and student teacher E-interaction were high. Concerning universities E-learning resources, they are rated moderate (mean = 3.28). Intangible resources (mean = 3.03) and tangible resources (mean = 3.18) were also rated moderate while organizational capabilities (mean = 3.62) were rated high.

The AVE results assessing convergent validity revealed that each construct was a suitable measure of dependent (E-learning implementation) and independent (resource based approach) variables. This is because all the AVE values were higher than 0.5, the lower limit (Hair et al., 2021). Discriminant validity was also assessed using HTMT ratio correlations. The aim was to establish if the constructs for E-learning implementation and resource-based approach independently described them. The ratio correlations obtained were below the higher limit of 0.90, indicating that the three constructs independently described the variables (Purwanto & Sudargini, 2021). Therefore, the study constructs (measures) converged on the variables but were still independent. This means that the results obtained on the variables (refer to Table 1) were amenable to structural equation modelling.

Table 2: Construct Reliabilities and Collinearity Assessment

Measures	α	CR	VIF
E-learning implementation	1.000	1.000	—
Student-content e-interaction	0.850	0.899	1.508
Student-student e-interaction	0.792	0.858	1.293
Student-teacher e-interaction	0.819	0.869	1.522
Tangible resources	0.881	0.904	2.338
Intangible resources	0.948	0.953	2.317
Universities capabilities	0.929	0.939	1.437
Universities E-learning resources	1.000	1.000	—

Source: Self-generated by the Authors

Table 2 reveals that the data collected for the different constructs were reliable because the Cronbach's alpha (α) and composite reliability (CR) values were above the minimum level of 0.70. Besides Cronbach's alpha, composite reliability was done because the former is very sensitive due to its assumption that the traits of the indicators have to be similar across the population. This generally lowers reliability values; thus, the need for composite reliability which is liberal as it tolerates outer traits. This ensures that more indicators attain reliability (Hair et al., 2019).

The factor loadings in Figure 1 show that E-learning implementation was reduced to student-content E-interaction only but all the constructs of the independent variable loaded unto it. The constructs of student-student and student-teacher were left out of the model because they did not load unto it. The model shows that the three previously mentioned hypotheses (H_1, H_2, and H_3) vis-à-vis that tangible resources, intangible resources, and universities capabilities have a significant influence on E-learning implementation were tested. Table 3 entails structural equation model estimates.

The results in Figure 1 and Table 3 reveal that universities' E-learning resources namely tangible resources and universities capabilities, positively and significantly influenced E-learning implementation effectiveness. Nonetheless, intangible resources positively but insignificantly predicted E-learning implementation. The R^2 suggested that universities E-learning resources explained 36.2% of the variation in E-learning implementation. The adjusted R^2 indicated that the two universities' E-learning resources, namely tangible resources and universities capabilities, explained 35.6% of the variation. The coefficient of determination (R^2) suggested that 63.8% of the

variation in E-learning implementation was accounted for by factors other than capabilities. The results implied that H_1 and H_3 were accepted while H_2 was rejected. The Beta magnitudes suggest that tangible resources were the most significant predictor of E-learning implementation.

Structural Equation Model for Resource-based View Approach and E-learning Implementation

To establish the influence of universities' E-learning resources and E-learning implementation, a structural equation model was done. Figure 1 presents the model's findings.

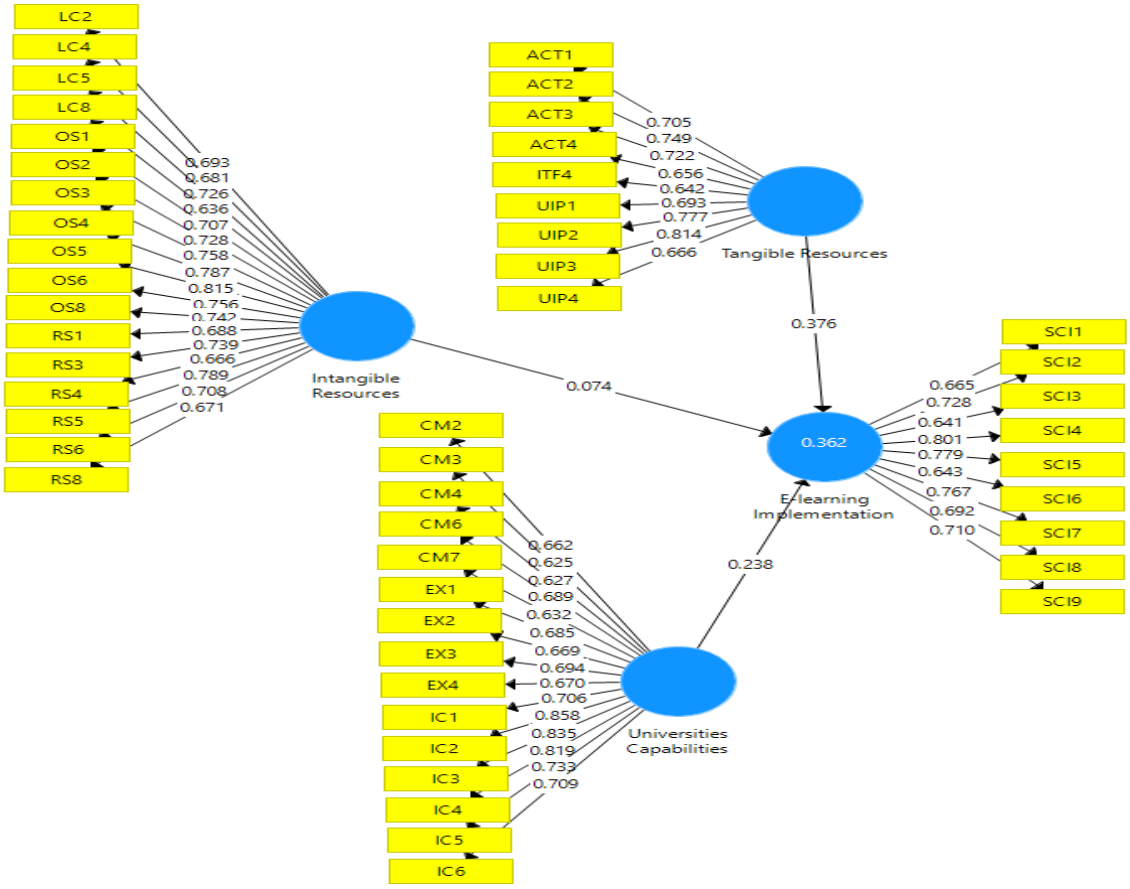

Figure 1: Structural Equation Model findings for Resource Based View Approach and E-learning Implementation
Source: Self-generated by the Authors

The finding to the effect that tangible resources positively and significantly influenced e learning implementation's effectiveness was consistent with that of Ouma (2021). With respect to the finding that intangible resources positively but insignificantly influenced E-learning implementation, it was contrary to the findings of Basantes-Andrade et al. (2020), but closely concurred with Jawed and Siddiqui (2019) who reported that intangible resources had a negative and insignificant role. Nonetheless, it should be noted that while the respondents rated E-learning implementation to be a bit high, intangible resources were rated moderate. Therefore, when

intangible resources are low, they insignificantly contribute to E-learning implementation effectiveness. Regarding the finding that universities' capabilities positively and significantly influenced E-learning implementation, it agreed with the findings of previous scholars such as Teo et al. (2020). This means that universities' capabilities are important for implementation of E-learning.

Table 3: Structural Equation Model Estimates for Universities' E-learning Resources and E-learning Implementation

Path Estimates	**β**	**Mean**	**STD**	**t**	**p**
Tangible Resources → E-learning Implementation	0.376	0.367	0.080	4.685	0.000
Intangible Resources → E-learning Implementation	0.074	0.085	0.078	0.945	0.345
Universities Capabilities → E-learning Implementation	0.238	0.247	0.059	4.069	0.000

$R^2 = 0.362$; Adjusted $R^2 = 0.356$

Source: Self-generated by the Authors

E-learning Waste Management Findings

This section is about E-waste management resulting from the implementation E-learning in universities. The findings are on E-waste resources, possibility of recycling and commercialization, the necessary policies, and rules and regulations for E-management and their enforcement. The results are also about how stakeholders in the universities can be involved in E-waste and sensitization necessary for enhancing organized E-waste management. Concerning E-waste resources resulting from E-learning resources, the respondents revealed that the waste included a variety of appliances. E-learning technical staff 2 stated the following: "E-waste resources we have in the university include absolute computer components especially monitors and central processing units (CPUs), uninterruptible power supply (UPS') electrical appliances, key boards and mouse, printers, printer cartridges and various cables and wires. The absolute computers are largely as a result of power surges which lead to their breakdown. The out of use UPS' are many because they breakdown very first" (personal interview, 2022).

All the other E-learning technical staff members generally pointed out that the E-waste resources resulting from E-learning were largely computer monitors, CPUs, UPS, printers, and printer cartridges. With respect to the possibility of their recycling and commercialization of E-waste, E-learning technical expert 1 revealed this:

> The possibility of recycling and commercialisation is high. Today in town there are a number of technicians turning computer monitors both curved and flat monitors into television sets (TVs). The high number of computer monitors in the various stores and offices can be sold for recycling which can bring income to the university. Still, some of the computers are not highly damaged but are replaced when new generation computers are acquired. These can be sold for repair and use by those who need them and the market is available (personal interview, 2022).

Consistent with the preceding perspective, E-learning technical expert 3 stated the following:

> E-waste resources in this university such as monitors and CPUs can be recycled or

> sold. Monitors can be turned into TVs for sale to low income earners because this is a common in Kampala low earning areas especially in slums. Also, there is a company in Kampala involved buying and recycling redundant computer equipment. The university can sell these computers to such a company. The company refurbishes those computers that can be refurbished and sells them and offers other to charities and incinerates the useless materials (personal interview, 2022).

Furthermore, E-learning technical expert 4 remarked the point as follows:

> It is possible for the university working with the faculty of engineering to set a recycling plant where students can be trained in refurbishing old computers and turning them into other appliances such as TVs. The university also needs to build an incinerator for burning useless waste from the computers because appliances such as printer cartridges and wires are just thrown into the dustbins disposing them as other forms of cabbage which in future will cause environmental challenges in the country (personal interview, 2022).

The preceding views were also echoed by all the E-learning technical experts. They all indicated that the computers can be sold to those involved in recycling them or universities can develop their capacity to recycle and destroy the useless appliances in a manner that does not negatively affect the environment.

Regarding the necessary policies, rules and regulations for E-management and their enforcement, the technical E-learning experts gave related responses that indicated that there is a need for the formulation of policies and regulations guiding E-waste management. The respondents indicated that currently the operating practice is the procurement departments collecting the E-waste appliances after staff members with them made reports with effect to the same. Nevertheless, all of the E-learning technical experts indicated that they did not know what the procurement staff members did with the E-waste once they collected them from the different departments. Technical staff 1 said: "I am not aware of the e-management policy of this university. Computers and other accessories that are no longer in use are piled up in stores and in offices of those who were using them. Staff from the procurement department sometimes picks spare parts of heavy equipment such as generators when they are being taken for repair or for replacement and other old appliances are in stores and offices of staff" (personal interview, 2022). In agreement with the aforementioned, technical staff 4 stated this: "In this university, the Public Procurement and Disposal of Public Assets Act regulations is supposed to guide E-waste management but rarely is E-waste collected by the procurement department staff responsible. The responsible procurement staff collect appliances such as computers only when a report has been made to them to collect them but how the appliances are disposed after collecting them is knowledge privy to the procurement department" (personal interview, 2022). The views above suggest that there is need for a clear and effective policy for E-waste management because the Public Procurement and Disposal of Public Assets Act regulations in use are not effective in the handling of E-waste. Therefore, specific policies targeting E-waste are necessary to enable its effective disposal.

About how students and staff can be involved in E-waste and the sensitization necessary for enhancing organized E-waste management, the E-technical expert staff revealed that students can be trained in ethical disposal of appliances they no longer need. Nevertheless, the E-technical expert staff indicated that staff members of the universities needed to be sensitized about using the existing guidelines of disposal of assets because they were not observing them. Technical staff 2 said this:

> Students do not have a lot of waste because they have their personal gadgets which they handle and dispose at their convenience. The students need to be trained not throw anywhere the gadgets they are no longer using either by selling them to those who refurbish them or taking them to gazetted areas for disposal like those that may be set up by universities. However, staff of the universities need be sensitized about following the asset disposal guidelines of the university (personal interview, 2022).

In relation to the preceding aspect, technical staff 3 stated that "Students should be sensitized on how to ethically dispose their obsolete gadgets ethically either by selling them to recyclers or taking them to places specified for disposing them off. For staff, they must be sensitized about the policies of the universities pertaining how E-waste materials are supposed to be disposed (personal interview, 2022).

The foregoinmg views show that students and staff should be sensitized about proper disposal of E-waste. This is because there was a lack of knowledge among them on how to dispose the waste and staff members did not follow stipulated procedures on how to dispose the gadgets. Overall, the responses revealed that the management of E-waste was poor but can be effectively managed by selling them to recyclers or universities developing recycling capacity for recyclable E-wastes and destroying the useless ones in an environmentally friendly manner. In addition, it was revealed that there is a need to sensitize students and staff members about proper E-waste disposal.

The finding that E-waste resources resulting from E-learning were largely computer monitors, CPUs, UPS, printers, and printer cartridges was consistent with the finding of previous scholars. Awasthi et al. (2018) indicated that with respect to E-learning, waste included a variety of obsolete appliances such as computers and their accessories like monitors, CPUs, printers, keyboards, chargers, headphones, and batteries, among others. With respect to selling E-waste to those involved in recycling or universities developing their capacity to recycle and destroy the useless appliances, this supports the findings of previous scholars. For instance, Nuwematsiko et al. (2021) reported that selling E-waste to repair shops was the common disposal option. Relatedly, Ramzan et al. (2019) indicated that there is a need for the commercialization of recoverable materials that can be sold in the local recycling market such as motherboards, copper wire, and scrap in general recovery. In the same vein, Lu et al. (2015) concurred that there is a need for an integrated effort of E-waste management, including a market-based approach involving establishing an effective E-waste collection system for commercial purposes or selling to recyclers. This means that E-waste can be collected for commercial purposes.

With respect to the finding that universities should enhance their capacity to recycle and destroy the useless appliances in a manner that does not negatively affect the environment, this is in agreement of previous scholars. For instance, Arain et al. (2020) revealed that there is increasing access to free or low-cost recycling. Relatedly, Awasthi et al. (2018) indicated that there is a need to adopt environmentally sound technology for recycling in order to facilitate proper management of E-waste. This means that it is possible for universities to venture into recycling of E-waste. Regarding the finding that there is a need for a clear and effective policy for E-waste management, this was consistent with the findings of previous scholars. For instance, Zeng et al. (2017) reported that there should be regulation or policy for E-waste management. Relatedly, Lu et al. (2015) revealed that for effective E-waste management, there is a need for policies guiding the same. This means that institutions such as universities should develop policies guiding E-waste management for effective management.

The finding that there should be sensitization of students and staff about proper disposal of

E-waste agrees with the findings of other scholars. For instance, Nuwematsiko et al. (2021) indicated that there is a need for special attention toward sensitization about E-waste handling practices before disposal and final disposal options available. Also, Prasad et al. (2021) established that it is necessary to organize collaborative campaigns to sensitize users to recognize their responsibility in the system and promote environmental consciousness among the users. Relatedly, Ramzan et al. (2019) established that there is a need for adopting participative methodologies to establish synergies in waste management and sensitizing university community members about the hazardous nature of E-waste. This means that for effective E-waste management, there is a need for sensitizing of the parties involved.

Conclusions and Recommendations

The discussion of the quantitative findings led to the conclusion that tangible resources are crucial for E-learning implementation in universities. These tangible resources include ICT teaching facilities that are accessible, a university ICT policy, and libraries E-resources. Furthermore, universities' capabilities are essential for E-learning implementation. This is through experimentation with E-learning resources, integrating E-learning in teaching, and developing E-learning content that lead to E-learning's successful implementation. Furthermore, low intangible resources hinder E-learning implementation. Therefore, low E-learning technical know-how, learning culture, relations with stakeholders, and a weak organizational structure impede E-learning implementation.

It was further concluded that E-waste management involves collecting the E-waste for commercial purposes to sell it to those involved in refurbishing or recycling. This is because there are different entities involved in the purchase of E-appliances that can be refurbished or recycled. Also, it is possible to develop the capacity to recycle E-waste because it is within the means of the universities since cheaper recycling alternatives are available. In addition, universities need policies for guiding E-waste management for its effectiveness. This is because members in the universities' staff were not following the established policies for disposal of E-waste. Moreover, there is a need to sensitize the different stakeholders in the universities such as staff and students about proper E-waste management.

This study therefore recommends that university managers should put in place sufficient tangible resources to facilitate E-learning implementation in universities. This should include ensuring that there are sufficient ICT teaching facilities that are accessible, establishing a university ICT policy, and having library E-resources. Also, university managers should enhance their intangible resources. This should include technical know-how of staff members in using E-learning, enhancing the learning culture of staff membes, and establishing relations with stakeholders. In addition, university managers should make efforts to enhance their E-learning capabilities. This should involve universities ensuring that their staff members have experimented with E-learning resources, integrated E-learning in their teaching, and developed E-learning content.

Furthermore, universities should ensure that there is the collection of E-waste for commercial purposes, as different entities are involved in the purchase of E-appliances that can be refurbished or recycled. Universities should also develop the capacity to recycle E-waste because it is within the means of the universities as cheaper recycling alternatives are available. In addition, universities need to develop policies guiding E-waste management for effectiveness. This will help to ensure that staff members follow the established policies for disposal of E-waste. Finally, universities need to sensitize their stakeholders such as staff members and students about proper E-waste management.

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