

Does the use of library electronic resources promote environmental sustainability? Perceptions from staff and postgraduate students at the University of Embu, Kenya

DOI: [10.61735/61g7we26](https://doi.org/10.61735/61g7we26)

¹Antony Mwangi Maina*, ²Paul Maku Gichohi

²<https://orcid.org/0000-0003-1593-4642>

^{1,2}Kenya Methodist University

ABSTRACT

University libraries are expected to adopt environmentally friendly practices to promote sustainability. This is achieved by instituting energy-efficient measures such as embracing smart waste management, installing solar panels on the roof, having energy-efficient lighting systems, embarking on recycling programs, and embracing electronic resources, among others. However, print materials are still widely used, increasing their negative impacts on the environment through the use of chemicals, and cutting down of trees for paper processing.

The study aimed to investigate the perception of staff and students at the University of Embu on the role of e-resources use as a measure to promote environmental sustainability. The objectives include determining the use of e-resources at the University of Embu; assess library users' perception of the connection between electronic resources use and environmental sustainability and evaluate staff and students' perceptions regarding the effectiveness of e-resources use as a measure to promote environmental sustainability

The study used a survey research design, targeting 490 participants; comprising 468 postgraduate students, 14 library staff, and 8 management staff selected using simple random and convenience sampling techniques. Data collection involved the use of semi-structured questionnaires that were pretested to check their validity and reliability. SPSS was used to analyze quantitative data; where mean, percentage, and standard deviation were calculated. The qualitative data were analyzed using the thematic technique. The findings show that although the use of e-library by postgraduate students contributes significantly to reducing environmental footprint, the utilization of e-resources was average, with the participants having different perceptions regarding the effectiveness of the introduced measures. The study noted a need for university libraries to institute mechanisms for increasing the usage of e-resources in learning. The University of Embu should continue supporting the use of e-resources and embrace e-communication in the institution, which will reduce paperwork and ultimately minimize the carbon footprint, promoting environmental sustainability.

(Key words: Environmental sustainability, electronic resources, E-library, university library, Embu University, climate change.)

I. INTRODUCTION

Environmental sustainability refers to the act of maintaining natural resources without depleting them to ensure that future generations enjoy good health and well-being. The traditional libraries stored vital information on printed and handwritten learning materials (Zhou, 2021). The production and delivery of printed books increase degradation and increased air pollution (Makori & Mauti, 2016). However, electronic resources have revolutionized libraries' functioning, aiding in

conservation measures of natural resources, and contributing to environmental sustainability. By using e-resources, the demand for papers in libraries is reduced, resulting in fewer trees being cut for paper production (Mohapatra et al., 2023). As such, replacing the traditional approaches with the use of e-resources promotes the environment by minimizing the use of paper which is positively related to the number of trees cut to facilitate printing of documents and other learning materials.

* Corresponding Author: am.antonymwangi@gmail.com

University libraries are expected to play a role in promoting environmental sustainability by emphasizing on adoption of e-resources than print counterparts.”

A 2022 UNEP report presents climate change and global warming as serious threats to the planet. As a result, the UN adopted Sustainable Development Goals (SDGs) with the aim of enhancing environmental preservation and protection against degradation (UNEP, 2022). In this endeavor, the United States adopted online libraries and learning in universities which help to reduce environmental pollution and promote environmental sustainability (Plavia et al., 2018). Many other university libraries around the world followed suit and adopted electronic information resources (Merande et al., 2021).

Paper production is often associated with paper mill effluents and other pollutants that increase waste and gas emissions (Sharma et al., 2021). As such, using alternative options such as e-resources positively impacts environmental sustainability. Studies estimate that over 1 billion trees worth of paper are thrown away every year in the U.S. alone (EPA, 2022). Globally, paper waste accounts for around 26% of solid municipal waste, with millions of tons ending up in landfills (World Bank, 2019) The practice of relying heavily on physical paper and printed materials increases pollution through the high amount of paper waste and harms environmental sustainability by reducing the number of trees in the global ecosystem. Deshwal et al. (2019) and Shaytura et al. (2020) indicate that digital technology for example use of laptops and tablets in accessing learning materials reduces paperwork associated with notebooks. The university libraries are expected to play a role in promoting environmental sustainability by emphasizing on adoption of e-resources rather than print counterparts. According to Mohapatra et al. (2023), e-resources help reduce environmental pollution by being a part of the green library goal.

The primary way through which the approach achieves this is by reducing the number of trees or the amount of wood needed to be used as raw materials in paper production. In so doing, the adoption of e-resources in learning institutions enhances environmental conservation, positively impacting environmental sustainability. Other measures for reducing

environmental footprint include using energy-efficient lighting, adopting smart waste management, installing solar panels on roofs, and embracing recycling programs, among other measures (Rafique et al., 2020; Rafiq et al., 2021). The mention of measures like energy-efficient lighting, smart waste management, solar panels, and recycling programs highlights the various ways libraries can reduce their environmental footprint.

Kenya being one of the UN member state is committed to achieving Sustainable Development Goals, including using innovative tools in learning contexts (United Nations, 2022). Kenya prioritizes approaches that promote environmental conservation, including the need for local universities to subscribe to the Kenya Libraries Information Services Consortium (KLISC), which negotiates for cost-efficient access to electronic resources (Kimanga, 2018). The University of Embu (UoEM) uses an e-library offering access to electronic databases in all subject areas. Students can access e-resources outside the university's physical library center (University of Embu Library, 2016).

This Article investigates the perception of staff and students at the University of Embu on the role of e-resources use as a measure to promote environmental sustainability. Specifically, the article: Determine the use of e-resources at the University of Embu; Asses library users' perception of the connection between electronic resources use and environmental sustainability and evaluate staff and students' perceptions regarding the effectiveness of e-resources use as a measure to promote environmental sustainability

II. PROMOTING ENVIRONMENTAL SUSTAINABILITY IN LIBRARIES

The use of e-resources in libraries has gained significant attention in the recent past, enabling the facilities to digitize their services and improve the student's ability to access and use the resources. Among the leading factors facilitating the increasing adoption of the technologies is its impact on environmental sustainability. Studies conducted on the subject show that learning institutions embracing the use of e-resources in their operations play a vital role in enhancing environmental sustainability. According to Sawai and Chavan (2020), most learners and teachers prefer using e-resources in their studies due to the ease of accessing the materials and the lower cost associated with the process. By increasing the availability and use of e-resources, universities improve the education process by ensuring that the relevant stakeholders can easily get the materials needed for their education. However, the role of e-resources in improving

environmental management and sustainability has also been significant, resulting in the widespread support that the approach gets from students and educators in different learning institutions. Mahesh and Babu (2020) indicate that greening of libraries through the use of approaches such as introducing electronic resources seeks to enhance the internal and external environments by reducing pollution, energy consumption, and the use of hazardous materials. Thus, the increasing adoption and use of e-resources enables learning institutions to achieve a wide range of benefits with environmental sustainability being among the leading target impacts.

E-resources are associated with a wide range of benefits that promote their adoption in learning institutions. However, the adoption of existing resources and related technologies in learning institutions is still affected by technical factors, institutional-based factors, human factors, and fiscal factors among others (Haridasan & Firdaus, 2021). To Mitigate this challenge, the Kenya Libraries Information Consortium (KLISC) negotiates on behalf of local universities on joint purchases and sharing of resources (Mwaurah & Namande, 2018). In so doing, learners access unlimited information resources digitally, thus raising the possibility of impacting the environment's sustainability positively. However, the extent of the contribution of e-resources to environmental sustainability has not been addressed.

An ideal situation in environmental sustainability involves having systems of natural resources that are renewable without impacting negatively the life cycle of production and embarking on practices that reduce emissions (Oláh et al., 2020). University libraries are also expected to promote the use of e-resources due to their positive impacts on environmental sustainability (Abdulahi, 2017). Notably, various strategies have been proposed for addressing climate change challenges, although the efforts have not yielded much fruit (Lessler, 2022). This is attributed partly to the refusal to move away from traditional practices, for example, the overreliance on print resources. According to Aydemir and Özsoy (2020), using printed products such as books, magazines, pamphlets, and leaflets promotes environmental degradation considering that they promote the extinction of natural resources such as trees. This poses a challenge and presents a convincing need to explore how e-resources can be part of the solution in learning institutions. This justified the need for the current study to determine how e-learning resources at UoEM contribute to environmental conservation.

III. THEORETICAL FRAMEWORK

The adoption of E-resources in library institutions is intended to improve the learning process. Their usage corroborates well with Green Library Theory proposed by Ephraim (2003) which requires stakeholders to have a conscious awareness of the environment when administering library resources and services (Garner et al., 2021). The role of green libraries is to reduce the potential negative impacts of library operations on the environment. Libraries achieve this by prioritizing elements such as environmental awareness, community support and environmental friendliness (Hauke et al., 2021). Based on the theory, libraries' operations can positively impact the environment by promoting the use of environmentally friendly operations, vital in enhancing sustainability. With printing being among the leading contributors of pollution in learning institutions, embracing green alternatives such as the use of e-resources increases the facilities' ability to enhance environmental sustainability.

IV. RESULTS AND DISCUSSION

Response rate

Out of the 214 postgraduate students that took part in the survey, the majority were female 126 (58.9%) and males were 88 (41.1%). In terms of age, the highest number were in the 21-30 years bracket 100 (46.7%), followed by over 30 years 86 (40.2%), and 0-20 years 28 (13.1%) which had a mean age of 2.27 and a standard deviation of 0.679. Regarding educational level, most participants had a master's degree 168 (78.5%) and 46 (21.5%) had a Ph.D. As for the library staff, the majority were Assistant Librarians 12 (85.7%), with 1 (7.1%) System Librarian and 1 (7.1%) Librarian. Their work experience ranged from 5-10 years for 8 (57.1%) staff members, followed by 0-2 years for 4 (28.6%), and 3-5 years for 2 (14.3%). The management team participants included Registrars 2 (25%), Director of Board of Postgraduates 1 (12.5%), Odel Director 1 (12.5%), Director of Research and Extension 1 (12.5%), and Chairs of Departments 3 (37.5%). All 8 (100%) members of the management team had worked at the institution for more than five years.

Using Electronic Resources at the University of Embu Library

Embu University library provides various services to students, researchers, and educators. The university heavily relies on electronic resources, which learners can access within and outside the facilities. Since electronic resources' use in the institution varies amongst the students, the study had to determine how much students rely on the resources by evaluating the students'

experience in using the electronic resources. The results are presented in Table 1 below

Table 1: Students' experience in using the University of Embu Library's Electronic Resources

Statements	Mean	Std. Deviation
<i>Frequency of use of electronic resources in the library</i>	1.69	.949
<i>I have good experience using the institution's e-resources</i>	3.09	1.044
<i>I am satisfied with the e-resources/collections provided by the university</i>	2.28	.895
<i>I use varieties of e-resources</i>	1.72	.848

Table 1 results share information on the use of electronic resources in Embu University's library. The results show that students frequently use e-resources in the institution's library as indicated by the mean of 1.69, and standard deviation of 0.949. Additionally, most of the students consider the e-resources to be delivered in ways that provide them with good learning experience. The finding is reflected through the students' response to the second statement regarding their experience with their institution's resources, in which case most of the participants indicated that they have good experience. The score on experience in using the institution's E-resources had a mean of (3.09) and a standard deviation of 1.044. Satisfaction level had a low mean (2.28) and standard deviation (.895). Few participants use the resources frequently as shown by the mean (1.69) and standard deviation (.949).

The responses on the use of e-resources have a mean of 1.72 indicating that a small number of students use similar e-resources hence the difference in the student's experiences on the use of the resources. The findings are consistent with those of Kavithanjali (2019), who indicated that the practice faces various challenges that affect their adoption. The information concurs with Bannasar-Veny et al. (2020), indicating that most university students have different lifestyles, a factor that influences their behavior. Therefore, the adoption of e-resources in the libraries varies amongst the students, affecting the impact of their learning practices on the environment.

Furthermore, 119 (56%) of the participants indicated that they frequently use e-learning materials in their studies, with 107 (50%) of the participants attributing the practice to environmental conservation. According to Castro and

Gomez (2020), using technology tools in education enables people to develop innovative solutions to some of the primary issues they face in their respective societies. Thus, the student's use of the e-resources provides them with a wide range of benefits, amongst them knowledge on climate change and environmental sustainability. The same is reflected by the indication by 109 (50.9%) of the participants that they believe e-learning is vital in environmental conservation. As a result, continued use of e-resources promotes a change in the learners' behavior, making them more likely to adopt practices that promote the environmental sustainability. Thus, the shift towards the use of e-resources functions as a way for the institution to create awareness to the users on the use of cleaner options, increasing the students' knowledge of the benefits of using e-resources.

According to Sanganyado and Nkomo (2018), a lack of resources coupled with negative student and teacher perceptions have hampered the provision of e-learning services in most learning institutions across Africa. The same is reflected by the results, since the participants identify many participants consider the process to be inefficient. Although 83 (38.8%) of the participants are very satisfied with the e-resources and 45 (21%) being satisfied with the practice, the use of e-learning materials still faces many challenges. Notably, 57 (26.6%) are sometimes unable to access it, with 84 (39.3%) stating that the materials sometimes lack relevant information. Kavithanjali (2019) agrees by indicating that millions of people from various regions are still experiencing challenges in accessing e-resources. For this reason, increasing the use of electronic resources will enable University of Embu to provide quality education, increase access to learning materials, and indirectly impacts environmental sustainability.

Library staff's evaluation of the connection between electronic resource use and environmental sustainability

Data collected from the library staff focused on their knowledge of the introduced measures to promote environmental sustainability and their perception of the

practice's impacts on the environment. Table 2 provides the library staff's evaluation of the connection between electronic resource use and environmental sustainability at the University of Embu.

Table 2: Library staff's evaluation of the connection between Electronic Resources use and environmental sustainability

STATEMENTS	MEAN	STD. DEVIATION
<i>I consider e-resources in the library to contribute to sustainability.</i>	4.7143	.40260
<i>I often encourage students to use e-resources for learning and research.</i>	1.86	.363
<i>I perceive students to have sufficient knowledge of the contribution of e-resources to environmental conservation.</i>	3.43	1.222
<i>Students' use of e-resources is limited by various factors.</i>	4.1190	.22100
<i>The university has introduced various strategies to enhance students' use of e-resources and ultimately making the library greener.</i>	4.4000	.41510
<i>Library staff requires different skills to contribute towards making the library environment sustainable.</i>	2.21	1.188
<i>The library has introduced various mechanisms to encourage the use of e-resources.</i>	2.86	1.351

The results in Table 2 represent the library's staff evaluation of their reliance on electronic resources at Embu University. Based on the results, most library staffs believe that the use of e-resources positively impacts the environment. The perception is based on their experience on the use of e-resources and its impacts on the university's environment. The results reflect this by having a mean of 4.7143, with the participants believing that their skills have contributed to facilitating the impacts. The results reflect the findings of Sutton and Collinge (2018), who indicate that librarians' skills are vital in promoting e-resources use. Based on the results, library staff agrees that the institution promotes the use of electronic resources as a way of promoting environmental sustainability, especially through reduction of print materials which cause pollution and waste. The positive attitude towards the use of e-resources is reflected by the high mean (2.86) and standard deviation (1.1351) of the library staff's responses on the question regarding the mechanisms to encourage use of e-resources.

The results are supported by a study by Alam et al. (2021), finding that most academic institutions globally

have heavily invested in e-learning, replacing the traditional use of classrooms in the teaching process. The change is undertaken at the same time with the increasing call for promoting green practices, including on the use of learning resources to promote environmental sustainability (Garner, 2021). The positive relationship between the two processes shows that institutions such as Embu University that prioritize the use of electronic resources are influenced by the practice's impacts on environmental sustainability.

The foregoing results show that the University of Embu has significantly invested in e-learning, ensuring that the university's library provides services to all students in need. Also, show that 191 (89.3%) of the students possess ICT skills, which are vital in facilitating the learning process. According to Ionescu et al. (2020), learning outcomes are associated with online network connectivity through the high exchange of information facilitated by the process. As such, the benefits of using e-resources in the library on the environment are unintended, with the institution's primary goal being to improve service delivery. In this case, the universities embrace e-learning

to exploit the network connectivity and enable the students to access the information, resulting to the use of e-resources, and ultimately a reduction of using paperwork and traditional libraries which are likely to promote pollution (Albertyn, 2020). Therefore, the positive impact of e-resources in the learning institutions is an indirect effect of the intended goals, which focus on increasing the access of learning materials by the students.

The results also indicate that the university has introduced various measures promoting the use of e-resources in the library. Additionally, the librarians' response on existence of mechanisms in the facilities to promote the use of e-resources had a relatively higher mean (2.86), showing the institution's commitment to ensure that the use of the resources increases over time. According to Riva et al. (2022), most people especially millennials are becoming more aware of the impacts of their consumption activities on their environment. The same case applies to the University of Embu, since the results show an increasing awareness amongst the librarians' commitment to increase the use of e-resources for the benefit of the environment.

About, 11 (75%) of library staff members indicated that the library prints less than half of the materials that it used to print, improving both energy consumption and the amount of paper used. The reduction in energy consumption is achieved through a reduction in the amount of paper printed in the institution and the fuel used in physical movement of students and teachers in accessing physical libraries. The processes also positively impacts carbon footprint since they reduce the use of paper handouts and printed materials, replacing them with electronic materials that positively impact the environment.

The students supported the first statement, with 75 (35%) sharing neutral sentiments, 86 (40%) indicating to a great extent and 53 (25%) indicating to a greater extent. However, most students agreed that paper production and use increases pollution, an indication of their knowledge of the positive relationship between e-resources and environmental sustainability. According to Salloum (2019), colleges and universities have increased efforts to create awareness on pollution, a factor that has influenced the students' knowledge about their environment.

About 7 (90%) of the participants from the management team indicated that the university has introduced reliable policies that enhance the use of e-resources by students and teachers in the situation, with only 1 (10%) participant sharing neutral sentiments regarding the practice. The responses were similar the those relating to

creation of awareness, such that all 8 (100%) participants stated that they consider the university's efforts in promoting awareness among internal and external stakeholders to be effective. According to Amjad et al. (2021), organizational policies and creation of awareness play a pivotal role in enhancing environmental sustainability. Thus, the positive responses may be associated with the University of Embu's efforts and success in promoting change within the institution to enhance environmental protection. In so doing, the management team members consider the use of e-resources to be facilitated by the practices, significantly impacting environmental management in the university

Library Staff and Students' perception of the adequacy of e-resources use as a measure to promote Environmental Sustainability

Results collected from the students show that they consider the use of electronic resources to promote environmental sustainability is unreliable in enabling the university achieve its set goals and objectives. In this case, the responses on students' use of electronic resources had a mean score of 1.72, reflecting variability in students' experiences regarding the use and effectiveness of the materials. According to Bennisar-Veny et al. (2020) students' experiences and preferences of electronic resources are impacted by various factors. As a result, their perceptions regarding the effectiveness of the resources as a measure to promote environmental sustainability vary, hence the mixed reactions. Although some students consider the measures to be effective, others are still hesitant to use the materials due to their perception that the materials are unreliable in positively impacting the environment.

Conversely, results from the library staff members show their confidence in the reliability of the measures in promoting environmental sustainability. The results indicate that the library staff members know the strategies that are effective in enhancing students' use of the e-resources provided by the university library (mean=2.86). Most institutions are making the concept of sustainability a priority by increasing their staff members' awareness of the process (Aftab et al., 2023). The staff members' knowledge of the positive impact associated with a greener library increases their willingness to increase the provision and use of e-resources, a factor that promotes the institution's success in promoting environmental sustainability. Based on the results, most of the participants identified similar strategies, represented by the high mean of 4.4. The common environment that library staffs work influences their perceptions regarding the concept of sustainability, hence the similarity in the shared strategies.

The library staff members also indicated that e-resources play a vital role in environmental sustainability (mean=4.7143, standard deviation=.40260 respectively). As a result, the study shows that the University of Embu Library though containing various electronic resources that positively impact environmental sustainability is yet to fully enjoy the benefits of the practice on the environment. The finding in this section shows that although the use of electronic resources is associated with environmental sustainability, some participants consider it to have minimal positive impact. The perception may be attributed to the presence of other factors that promote pollution and poor environmental management, making it difficult for the use of e-resources to have a positive impact on the environment.

About 150 (70%) of the postgraduates indicated that the use of e-resources improves waste management to a great extent, with 21 (10%) indicating that the practice impacts the process to a very great extent by reducing pollution resulting from a reduction in the number of papers used within the institution. On the reduction of paperwork, 96 (45%) of the postgraduates attributed the process to have impacted the reduction to a great extent, with 32 (15%), stating that the practice has to very great extent reduced paperwork in the institution. Conversely, only 21 (10%) of the participants indicated that the university library to a great extent uses e-resources to manage waste. However, 107 (50%) rated the process as being to a very small extent, with an additional 64 (30%) stating that it is to a smaller extent. Only 21(10%) of the participants associated e-resources with waste management. According to Moruwawon (2020), the use of e-resources in most institution is also intended to improve library services. As such, the research results may be a reflection of the university's adoption of e-resources to be due to other reasons besides waste management.

Data collected from the school's management team shows that the administration's adoption of e-resources is influenced by the positive impacts of the practice on the institution's environment. 6 (75%) of the management team members indicated that the practice has to a great extent improved waste management in the school, with the remaining 2 (15%) sharing neutral sentiments regarding the practice. The response may be due to the positive impacts of e-resources, including reduction of paper use and ultimately human impacts on the environment.

However, the management team shared contrasting views regarding the impact of the practice on environmental sustainability costs. In this case, 4 (50%) of the participants indicated that they believe the promotion of e-resources has reduced the costs, with the remaining 4

(50%) indicating that the approach is costly than dealing with the paper waste associated with the use of traditional learning approaches. Although e-resources have various positive impacts on learning institutions, they are coupled with additional costs that may affect the university's operations (Joshua & King, 2020). Such costs may influence the participants' experience of the approach, considering it to have varied impacts on the university's sustainability.

V. CONCLUSION

Although the institution's primary goal is not promoting environmental sustainability, the findings present the use of e-resources as positively impacting the process. The positive impacts of e-resources on the dissemination of learning information promote the use of the materials at the University of Embu, resulting in environmental sustainability. The practice improves service delivery and reduces consumption of nonrenewable resources, air pollution, and waste production, thus contributing to environmental sustainability. The university has introduced measures to ensure environmental sustainability, including paperwork reduction, improving online connectivity, hiring skilled library staff, increasing calls for environmental sustainability, and introducing policies supporting environmental sustainability. The limited use of e-resources at the University of Embu curbs the institution's success in ensuring environmental sustainability, resulting to mixed perceptions from the students and management members regarding the effectiveness of the measures in promoting environmental sustainability. Library staff members have positive attitudes regarding the measures, presenting them as being effective in enhancing environmental sustainability.

VI. RECOMMENDATIONS

University libraries should institute mechanisms to increase usage of e-resources in learning and support the use of e-resources in learning, reducing paperwork in the institution and ultimately minimize carbon footprint in the environment. The university should also establish the department of environment to identify areas that need improvement, facilitate collaborative engagement between relevant stakeholders, introduce goals and objectives on environmental sustainability, and determine ways to improve stakeholders' perceptions on the use of e-resources. The study introduces new scientific knowledge on promotion of environmental sustainability and calls for future researchers to determine ways through which they can increase the use of e-resources in university libraries to directly impact environmental sustainability.

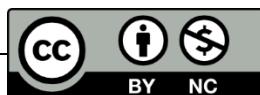
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