



PROMOTING SUSTAINABILITY IN NIGERIAN EDUCATION: A PRACTICAL STUDY ON REDUCING PAPER WASTE THROUGH ICT AND NEW MEDIA INNOVATIONS

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Abstract

This research explores the role of Information and Communication Technology (ICT) and new media in reducing paper waste in Nigerian higher institutions. As part of the specific objectives, the study evaluated the impact of ICT and new media on the administration, communication, record-keeping, and student's academic activities such as note-taking, assignments, assessments and preparation of study materials. Anchored on the Innovation Diffusion Theory (IDT), the study examines the initiatives taken to implement new technologies in the educational systems. Data was collected through surveys of staff members from four institutions, and a six-week self-experimentation with five students. Despite the availability of numerous digital tools, participants exhibited a high reliance on paper for various activities such as teaching and administrative tasks. During the self-experimentation phase, however, there was a notable reduction in the use of paper for assignments and study materials when digital tools were utilised. The study concludes that ICT and new media have the potential to reduce paper waste, but limited internet availability, digital literacy, high cost of devices, and unstable power supply present challenges to their maximisation. The study recommendations include strengthening digital infrastructure and literacy and developing supportive policies to accelerate the transition to a paperless education system in Nigeria.

Keywords: Sustainability, Paper waste, ICT, New media, Education

Introduction

There is a global emphasis on sustainability which indicates a need to mitigate impacts on the environment. In particular, there is a need to curb paper waste, as it contributes

to deforestation, pollution, and resource inefficiency (Circle Economy, 2023). McGarry (2024) cites a 2020 World Economic Forum report stating that paper and cardboard constitutes almost a quarter of the waste in the world and that it



constitutes a severe threat to the environment. In Nigeria, the education sector utilises a higher proportion of paper as compared to other sectors. This is because it is extensively used in the administration, record keeping, and in the preparation of educational materials (Adams, Rabiun & Ani, 2024).

Nigeria's urban centres including Lagos, Kano and Ogun State due to high concentration of educational institutions, generates over 2 million tonnes of waste per year with a large percentage of this being paper (Vanguard, 2021). The heavy reliance on paper in Nigeria's educational institutions contributes significantly to environmental degradation such as excessive paper waste and deforestation. As a solution to this problem, ICT and new media provide alternatives which can reduce paper usage and improve overall efficiency in educational processes. Tools like Google Sheets, emailing, and online learning platforms have the potential to replace current systems that utilise paper, thus reducing waste while improving functionality. Cloud computing, as noted by Kolawole and Oladokun (2024), has changed the storage and retrieval of educational content and administrative records and now makes it possible to maintain records digitally without using paper. With Google Drive and Microsoft OneDrive, storage is more convenient and available, and collaboration can be done electronically without paper.

Social media and new media technologies contribute greatly towards the reduction of

paper consumption. They encourage communication and learning to be done electronically (Blessed et al., 2023). Through social media sites like Facebook, Twitter, and WhatsApp, educational institutions, lecturers, and students can interact with one another digitally, thus eliminating the need for notices and notice board memos.

Moreover, Blessed et al. (2023) claims that social media, in addition to shaping policies, can also encourage the reduction of wasteful paper usage. Twitter, Instagram and Facebook have the ability to popularise the use of e-books, digital submissions, and other cloud-based tools. Such dialogues can change government policies and lead to institutional reforms directed toward sustainability in the educational system.

This study examines how ICT and new media can be utilised to reduce paper waste in Nigerian educational institutions in terms of administrative processes, communication, teaching, examination and student learning materials. It also explores the use of digital tools for teaching, administrative tasks, communication and student learning activities. The study aims to provide practical recommendations for creating a more sustainable and paperless education system in Nigeria which will serve policymakers, the Ministry of Education, the Ministry of Environment, management of educational institutions, lecturers, students and environmental health stakeholders, offering insights into how ICT and new media can drive both educational



and environmental reform for sustainability.

Statement of the Problem

The use of paper in Nigerian academic institutions for administrative purposes, record-keeping, note-taking, examinations and others has contributed greatly to paper waste accumulation and degradation of the environment. While the use of Information Communication Technologies (ICT) tools and new media offers promising solutions, many educational institutions still face challenges in effectively integrating these technologies. This continued reliance on paper contributes to environmental degradation, while slowing down the transition to a more sustainable, economical and efficient education system in Nigeria. Furthermore, there is a lack of cohesive policy and institutional efforts aimed at addressing the issue of paper waste in educational institutions in Nigeria. Therefore, the aim of this study is to examine how ICT tools and new media can play an integral role in fostering sustainability by reducing paper waste in Nigeria's education system.

Research Objectives

The main objective of this paper is to assess the impact of ICT and new media innovations in reducing paper waste in Nigerian educational institutions. Other specific objectives include:

to assess how ICT tools can reduce paper use in Nigerian educational institutions.

to evaluate the impact of new media in replacing paper for administrative processes and communication in Nigerian educational institutions.

to assess the reduction in paper waste from the use of ICT tools and new media in Nigerian educational settings.

to provide recommendations for promoting the adoption of ICT tools and new media in Nigerian educational institutions as sustainable alternatives to paper.

Sustainability and Environmental Impact in Education

The environmental effects of paper waste contribute to the greater challenges facing education sustainability today (Uzoma & Eudora, 2023; Kolawole & Oladokun, 2024). The consumption of paper in learning institutions contributes to environmental issues such as deforestation, pollution, and wastage of resources. Kyla (2023) estimates that paper and cardboard make up nearly 25% of waste across the globe, a large percentage of which stems from schools. In particular, nations like Nigeria have high paper consumption in educational institutions for administration of tasks such as lesson planning and assessments. Agboola et al. (2023) observed that large metropolitan areas like Lagos and Kano produce large amounts of trash in the form of paper. Pakam Tech (2024) declares that in Nigerian schools, paper waste constitutes an astonishing 30% of all waste, deteriorating the already bad waste management situation in the country. The heavy reliance on paper usage also



increases the operational costs for educational institutions, which are already strapped for resources.

Countries such as Finland, Canada, and even the UK are known to integrate digital tools in education and thereby have reduced the reliance on paper. The educational curriculum in Finland promotes the use of digital resources by having e-books alongside online learning systems, and this can serve as a viable option for Nigeria. With the adoption of digital technology and sustainability, a cheaper and greener education system can be created in Nigeria that accommodates the increasing number of students.

ICT in Education: Tools, Benefits, and Challenges

The use of ICT is expected to alleviate the reliance on paper (Asongu, Roux & Biekpe, 2017; Docusign, 2022). Platforms such as Google Classroom, Moodle, and Microsoft OneDrive promote the ease of digital learning, helping to move towards a paperless classroom environment. These tools aid collaboration while minimising the need for printing or physically sharing documents. Furthermore, cloud filing systems help to reduce the need for physical filing cabinets, which in turn diminishes administrative expenses, paper usage, and filing.

Barakabitze et al. (2019) claims that many teachers do not adequately train to apply ICT tools into teaching and hence remain digitally illiterate. Failure to use ICT in teaching stems from many challenges as the

Nigerian government needs to prioritise improving infrastructure and provide literate programmes for students and teachers. Moreover, the hurdle that most Nigerians face towards the adoption of ICT tools is limited access to the internet. According to the Nigerian Communications Commission, only 6 percent of schools are able to access the internet which impedes access to digital tools. The scarcity of wi-fi in rural areas poses another major obstacle. In addition, the affordability of numerous digital devices such as tablets, laptops, and smartphones are unreasonable in which most students and educators cannot meet.

New Media and Communication in Education

Obiora (2019) states that social media, webinars and blogs are examples of new media technologies that have altered communication in educational institutions in Nigeria. Information can be effortlessly shared or received on popular platforms like Twitter and Facebook. Teachers no longer have to rely on printed materials, as YouTube can now be used to teach or give students tutorial videos.

Nonetheless, the digital divide still poses a challenge. Oftentimes, rural areas do not provide reliable internet access or digital devices. Furthermore, students are often distracted by excessive usage of social media, which has an impact on focus. There should be policies in place to make sure social media is used for academic purposes, but unfortunately, the lack of social media literacy makes this difficult. Regardless of these barriers, new media has the ability to



reduce paper consumption and promote active learning. It is of utmost importance to place integrated policies in support of digital educational resources to facilitate the transition.

Paper Waste Management in Nigeria's Education Sector

The organizational structure of educational institutions in Nigeria regarding the management of paper waste is inadequate, as most schools do not have functional recycling or waste management systems in place (Blessed et al., 2023). The use of paper in administering school activities, assessing students, and teaching perpetuates the problem of waste generation. Paper waste contributes to the environmental problems in urban areas like Lagos and Kano. According to the NESREA report, the paper waste generated by schools is one of the predominant constituents of their waste. In addition to environmental consequences, the financial implications of paper waste are particularly burdensome for public schools that operate on limited budgets.

Aspects such as cost and efficiency can be improved by shifting to digital platforms. (Yale Sustainability, n.d; Vanguard, 2021.) Educational institutions can virtually store and share documents using cloud-based platforms like Google Drive, which promotes learning and reduces the consumption of paper. Although some schools have limited recycling programs, there is insufficient large-scale funding for waste management systems. Policies and infrastructure need to be holistic, and

cooperation between the educational system, the state, and private enterprises is fundamental to the development of ecological practices and efficient waste management systems in education.

Barriers to ICT and New Media Adoption in Nigerian Education

Several barriers hinder the widespread adoption of ICT and new media in Nigerian education, limiting the potential for reducing paper waste. These barriers include:

Internet Access Deficiency: A majority of schools do not have internet connectivity, especially in rural region, which is critical for the use of digital resources and tools for instruction and communication.

Digital Devices Pricing: The high cost of laptops, tablets, and smartphones hinders most institutions from availing the necessary resources to learners and tutors.

Social Media Mentoring: Blended learning integration social media and mentoring requires the educators and learners to have fundamental of using social media which is lacking in most.

Power Supply Problems: Use of modern teaching and learning resources is further complicated by the continuous interruptions to power supply, which cripples e-learning access and the functionality of other supporting technologies.

Learning Resistance: The intervention and use of new techniques for teaching and learning is accompanied by a host of



unlearning what most instructors and learners are accustomed which many tend to resist.

Despite these challenges, efforts by the ministry of education, government agencies and private institutions to promote ICT integration in education are underway. By addressing these barriers through investments in infrastructure, training, and policy development, Nigeria can make significant progress in reducing paper waste and promoting more sustainable educational practices.

Theoretical Framework

The study is anchored on the work of Rogers Everett on the Innovation Diffusion Theory (IDT)\, first introduced in his book “Diffusion of Innovations” published in 1962. IDT explains the spreading of new practices, technologies, or ideas within a population. Five stages are identified which include knowledge, persuasion, decision, implementation, and confirmation. Each of the stages has different categories of adopters which include: innovators, early adopters, majority early, majority late, and laggards. The varying degrees highlight the different speeds at which individuals and groups adopt technologies.

The use of IDT in this particular study is due to its potential in explaining how new media and ICT tools can be used to mitigate paper dependency in educational institutions in Nigerian educational institutions. The study however observed that perceived advantages, social influence, and infrastructure are important factors

influencing adoption of change and necessary for the application of IDT to be successful. It also identifies potential barriers, such as resistance to change, which can impact the successful integration of digital solutions in schools to reduce paper consumption.

Empirical Review

The application of Information and Communication Technology (ICT) in teaching and learning is important in promoting education sustainability through paper minimisation. Blessed et al. (2023) examined the role of social media in creating awareness among students and institutions’ sustainability practices in Nigeria towards paper waste awareness. Adams, Rabi, and Ani (2024) discussed green computing policies and proposed that ICT has the capability of minimising use of materials such as papers in educational activities. Barakabitze et al. (2019) assessed the role of ICT in the shift in the African education system, especially in the STEM disciplines, illustrating its promise in reducing paper usage, although there are some limitations such as insufficient infrastructure. Fagnani and Guimarães (2017) proposed a model of waste management in higher education that could be applied to promote sustainability in Nigerian universities. Obiora (2019) examined paper consumption patterns in Nigeria. His study highlighted the ecological consequences and the absence of ICT substitutes.

Even with these viewpoints, there is a gap in literature focusing on the impact of ICT



and new media on educational processes towards paper wastage minimisation in Nigeria, especially regarding policies and institutional frameworks. This research seeks to address the gaps by analysing the integration of ICT and new media into the Nigerian education system towards improving sustainability through the reduction of paper usage, providing suggestions for practical recommendations.

Methodology

The study utilised a mixed-method research approach, including self-experimentation, surveys, and a systematic literature review to validate the results. In the self-experimentation part, five students actively interacted with both paper and digital devices for six weeks and ended up providing their perceptions on the reduced paper consumption's sustainability impact.

The survey was completed by 100 staff members from the following selected institutions: Federal Polytechnic Ilaro, Moshood Abiola Polytechnic, Crescent University, and Federal College of Education Akoka. This close-ended online survey assessed the level of utilisation of the application of ICT and new media to the administrative and communicative functions of the institution.

Secondary data was collected through a systematic review of literature, focusing on relevant publications within the last ten years. The study further analysed literature regarding ICT and sustainability in education, specifically focusing on paper waste reduction in Nigeria. Relevant

sources were selected using the search terms “ICT in education,” “sustainability,” and “paper waste.” Descriptive statistics, including pie charts and tables were used to analyse data from the surveys and self-experimentation. The findings of the literature review were integrated thematically to provide a complete picture of the issue at hand.

Data presentation, Analysis and Discussion of Findings

Table I: Table: Overall Responses to the Impact of ICT and New Media in Replacing Paper for Administrative Processes and Communication and reducing paper usage in Educational Institutions.

Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Strongly Disagree (%)	Disagree (%)
ICT tools are regularly used for administrative purposes in my institution .	12	28	07	28	25
New media (e.g. social media, email, etc) are commonly	14	33	21	17	12



used for communication within the institution .					
Paper-based documents are still the primary method for administrative record-keeping.	8	29	19	26	18
Digital tools such as emails, cloud storage and online platforms are effectively used for teaching and learning purposes.	9	16	35	26	14
My institution has policies that encourage the use of digital platforms over paper-based	13	19	31	25	12

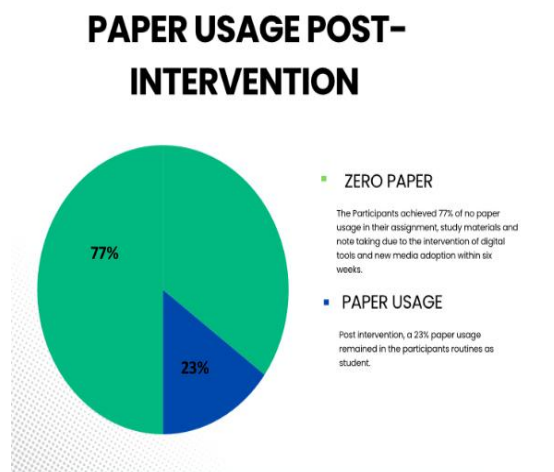
communication.					
New media has played a significant role in reducing paper usage in my institution .	7	21	33	24	15

Source : Authors

The findings from the survey highlight the high dependence on the use of paper within educational institutions in Nigeria, except for a slight use of ICT tools and new media. Only 40% of respondents agreed that ICT tools are utilised for administrative processes. This is directly contradictory to the 53% that disagreed implying there's still a dependence on the paper. In terms of communication, 50% said they use WhatsApp and other social media, however, 29% contradict this suggesting that a lot of communication is done via paper. For administrative record keeping, 37 % claimed that paper documents are the main method which shows the further dependence on the paper. The lack of effective use of digital tools in teaching was also evidenced by the fact that only 25% agreed with the statement and 40% disagreed. Furthermore, 32% believed that their institution encourages the use of digital platforms as opposed to paper which shows there are no policies in place to foster the embrace of digital tools. Finally, 28% felt that the use of new media has led to a

decrease in the use of papers demonstrating their minimal impact on the sustainability of educational institutions. These results point out the gaps needing attention which include the absence of appropriate digital infrastructure, insufficient integration of ICT tools, and policies aimed at moving educational institutions to paperless systems.

Figure 1: Pie Chart Showing Reduction in Paper Usage After 6-Week Adoption of Digital Tools by Students



Source: Authors

The adoption of digital tools in learning as opposed to the use of paper systems improved significantly after the 6-week self-experimentation study done with five students. These participants used to practice note-taking, access study materials and do assignments using paper. Within 6 weeks, they started shifting towards the use of digital tools like cloud storage, Google Docs, e-books, pdf and MS Word. The data shown in the pie charts above indicates that

there has been a considerable decline in the use of paper by almost 77% in the use of study materials, note-taking, and assignments. This reduction in the usage of paper signifies an improvement in the sustainable academic practices and less paper waste expands the reduction of environmental impacts and resource depletion.

Conclusion

Despite growing digital tool availability, the consumption of paper among educational institutions in Nigeria, specifically in administration, correspondence, record keeping and other student tasks remains unacceptably high. The survey indicates that there is still a great dependence on paper with minimal ICT application in administration and teaching. In contrast, the self-experimentation in this study demonstrated a 77% reduction in the usage of paper for assignments, study aids, and note taking arising from the use of digital tools. The barriers to the adoption of ICT include lack of access to the internet, expensive gadgets, irregular power supply, and weak policies. There is a need for investment in digital infrastructure alongside investments in digital literacy and enabling policies. While it is possible to significantly reduce the paper footprints of institutions by utilising ICT and new media, digital integration must become a core focus of institutions' operational and strategic frameworks to ensure sustainability.

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