Driving Education 5.0 through Green Boardrooms: Evaluating the Adoption and Impact of Advanced Technologies in Zimbabwean Higher Education Institutions

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***Abstract*—This study explored the integration of advanced technologies in education and their potential in creating sustainable and eco-friendly practices. Evidence from research revealed a determined shift towards "green governance" among sampled institutions, with main drivers being moving towards convergence of "environmental sustainability", "Education 5.0" policy, and a necessity for institutional efficiency in the digital world. Extant literature revealed that green boardrooms support progressive solutions to minimize environmental impact while intensifying collaboration, productivity, and decision-making. In our study, the main technologies explored included cloud computing, blockchain, AI & Big Data, and Internet of Things. Unlike prior studies, which mainly focused on the adoption of advanced digital technology in the learning environment, our study explored the level of adoption of advanced digital technologies in Higher Education Institutions to promote green boardrooms. We applied an exploratory approach with a pragmatic paradigm and utilized a mixed-method design. The major challenge identified in our study was the deployment gap that prevailed, where there was high paper reduction, but more power-intensive hardware remained. Qualitative insights identified the high cost of technology and infrastructure, a human capital skills gap, and poor connectivity to neutralize the efficiency gains of digital tools. Ultimately, the study confirmed that green governance in Zimbabwean Higher Education Institutions is currently more paperless than sustainable.**

Keywords: **Green Boardrooms, Education 5.0, Environmental footprint, Digital Transformation, Sustainability**

I. INTRODUCTION

A. Background

Corporate sustainability is the major thrust in today's business. The modern Boardroom symbolizes corporate power and decision-making. The world is struggling with challenges of climate change, environmental degradation and social divide. Higher Education Institutions need to establish their position in this struggle. According to [1], "green Boardrooms generally refer to the integration of environmental, social, and governance (ESG) considerations into the core decision-making processes of a company's board of directors". In the context of education 5.0, a green boardroom can be redefined not just as a physical space but as a digital ecosystem designed to minimize the carbon footprint of institutional governance through paperless workflows and virtual oversight [2]. Green boardrooms outline a shift in the way corporates think about their impact on the planet. This concept highlights that business success is not only about financial returns but embracing a broader perspective that considers people, planet and prosperity.

Digitalization is a worldwide trend that incorporates the integration of advanced ICTs to change the way corporates operate and bring about value, transforming every internal process and client engagement. The changes are not just merely technology adoption but also include cultural change, embracing innovation, adopting new business models and new skills development. To stay competitive, there is a need for accepting digitalization, improving efficiency and enhancing client interaction in today's digital world.

Education 5.0 is a Zimbabwean national policy framework that shifts the purpose of Higher Education Institutions to include innovation and industrialization [3]. It was designed to help Zimbabwe's Vision 2030 of becoming an upper-middle-class economy. The policy mandates that Higher Education Institutions modernize their own internal systems to lead by example. A green boardroom is a direct application of modernized governance. In higher education institutions, digital technologies are increasingly changing how information is accessed, delivered, and managed. Customized learning experiences, easy access to resources, and new and better ways of engaging students are some of the advantages they offer in education. In administration, technologies offer streamlined processes, better communication, and enhanced efficiency.

B. Problem Statement

Recent global trends point to the adoption of advanced digital technologies to promote green boardrooms by reducing paper consumption, travel, and energy use. In Zimbabwe, higher education institutions face huge challenges in adopting digital transformation despite the recognized benefits, such as increased efficiency and sustainability. Government initiatives such as education 5.0 and the national ICT policy 2022-2027 promote digital transformation, but there are significant gaps between policy goals and practical implementation within institutions. The major challenges that stall the implementation and adoption of digitalization in these institutions are the inadequacies of infrastructure, limited financial resources, and a visible digital literacy gap among administrators and board members

[4]. Resistance to change and a lack of awareness of digital transformation's full potential hinder green boardroom practices. These challenges prevent institutions from fully leveraging digital transformation for improved governance, reduced environmental footprint, and enhanced sustainability, ultimately limiting their contribution to broader national development goals related to a green and digitally inclusive economy.

C. Research objectives

The paper's main objective is to explore the extent to which advanced digital technologies are being adopted to promote green boardrooms in higher education institutions in Zimbabwe.

To achieve the main objective, the study addressed the following specific objectives: To

- Identify the technologies being used in educational institutions in Zimbabwe.
- evaluate the level of adoption of advanced technologies in educational institutions' boardrooms.
- assess the perceived benefits and challenges of adopting advanced technologies for green practices
- propose recommendations for enhancing the adoption of advanced technologies for green boardrooms in educational institutions in Zimbabwe.

D. Significance of the study

This study explored the level of adoption of advanced digital technologies in promoting green boardroom practices in higher education institutions in Zimbabwe. The results of this study will inform policymakers, educators, and administrators of educational institutions in Zimbabwe on the benefits and challenges of adopting digital technologies in promoting sustainability and environmental responsibility. It also contributes to the achievement of Sustainable Development Goals (SDGs) in Zimbabwe. The study also raise awareness on environmental sustainability in educational institutions and advocates for the promotion of eco-friendly practices among staff and the community at large. It also provides insights into the opportunities and challenges of digital transformation in Educational Institutions in Zimbabwe, showing the potential benefits of technology in sustainability. There is growing research on digitalization and sustainability worldwide, but specific studies on green boardrooms in educational institutions in the Zimbabwean context are limited; thus, this study aims to fill this significant gap in the literature.

The study has the potential to benefit educational institutions in Zimbabwe, policy makers, board members and administrators, environmental sustainability advocates, digital technology providers, and implementers.

E. Scope and Limitations

The scope of the study focused on Higher Education Institutions in Zimbabwe, specifically in the Masvingo district. These consisted of teachers' colleges, polytechnics, and universities. The digital technologies that will be considered during the study are those that can be used in the boardrooms. The limitations of the study are data availability, sample size, and time constraints.

II. Literature Review

A. Green Boardrooms and Sustainability

Green Boardrooms are also called regenerative or eco-friendly Boardrooms that comprise of environmentally responsible practices and digital technologies to reduce environmental impact. Technical innovations have been determined as catalysts that promote SDGs [5] [6]. Advanced digital technology plays a pivotal role in fostering green Boardrooms. According to [7], "green Boardrooms generally refer to the integration of environmental, social and governance (ESG) considerations into the core decision-making processes of a company's board of directors". Green Boardrooms outlines a shift in the way corporates think about their impact on the planet. This concept highlights that business success is not only about financial returns but embracing a broader perspective that considers people, planet and prosperity. The principles and practices of green boardrooms include paperless meetings, virtual collaboration, using energy-efficient equipment, Artificial intelligence, machine learning, green data analytics, and the Internet of Things.

[8] Asserts that sustainability is the ability to protect or boost accessibility and condition of treasured resources or environments over a long period. Sustainability in educational institutions refers to the incorporation of environmental, social, and economic considerations into institutional practices. This aims at reducing environmental impact, which is the reduction of waste, energy consumption, and carbon footprint. It also promotes eco-literacy by educating students and society about sustainability, environmental conservation, and climate change. Economic viability is also ensured by implementing cost-effective and resource-efficient practices. These will bring about improved institutional reputation, reduced operational costs, and foster increased community engagement.

B. Digital transformation in educational institutions

According to [9], sustainability goals can be achieved by incorporating green technologies. According to their study, the Internet of Things avails opportunities to enhance sustainability in higher Education Institutions through energy management, building automation, and resource monitoring. This allows institutions to maximize energy usage and reduce waste and carbon footprint. [9] also highlights that green data centers are eco-friendly and can greatly reduce the environmental impact of Higher Education Institutions' information technology infrastructure. Green data centers can reduce energy consumption, waste generation, and carbon emissions through the use of energy-efficient hardware, renewable energy sources, and server virtualization.

[10] focused on the role of digital technologies in bridging the gap between education and sustainable business practices. They note that the integration of digital technologies not only fosters learning but also promotes sustainable practices within the institutions themselves.

C. Digital transformation in Higher Education Institutions.

The digital transformation environment in Southern Africa has encountered significant acceleration in recent years, caused by the increase in smartphone penetration, expansion of internet infrastructure, and growing adoption of digital financial services [4]. The African Union's digital transformation strategy (2020-2030) provides a

comprehensive framework for regional digital development, emphasizing the importance of digital infrastructure, digital skills, and digital entrepreneurship in driving economic transformation [4]. The use of smart technologies is encouraged in Zimbabwe's National Development Strategy 1(NDS1) to increase the use of Information Technology [11]. The Ministry of Higher and Tertiary Education crafted a framework, Education 5.0, that adds innovation and industrialization [3]. This compelled Higher Education Institutions to adopt advanced digital technologies so they can drive national growth [12]. Social distancing protocols during the pandemic also compelled Higher Education Institutions to accelerate the adoption of ICTs [11].

D. Related Studies

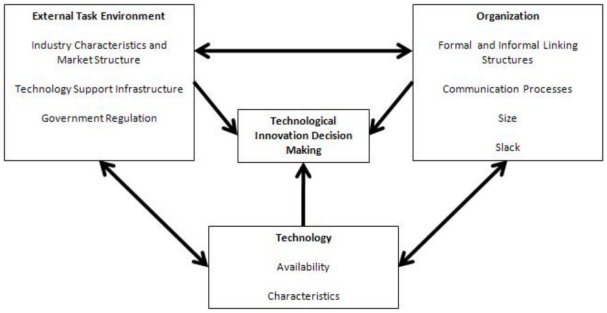
A study by [13] on green campus initiatives done at Durban University of Technology investigated the mechanisms for stakeholder engagement, plant protection, and resource conservation, offering recommendations to enhance sustainability. The study did not look at boardrooms for administrative functions. Rather, it offers insight for policy makers, academics, practitioners, and stakeholders, with an emphasis on the need for formalized environmental policies and enhanced sustainability in education. [4] reveals a significant disparity in digital access and implementation across educational institutions. Their key findings indicate that while education 5.0 has catalyzed digital transformation initiatives, substantial challenges persist, including inadequate ICT infrastructure, limited internet connectivity, insufficient funding, and gaps in teacher digital competencies. Another study by [11] suggests that most Higher Education Institutions in Zimbabwe lack the necessary hardware, software, and staff who are qualified and experienced enough to make the transition from traditional interactions to virtual modes. These are some of the challenges affecting the adoption of advanced technologies for green boardrooms. Scholars such as [14]- [15] have identified incorporating energy management, water management, landscape management, and responsible purchasing as components of a sustainable institution.

E. Theoretical framework

This study is anchored on three major theories that provide the whole picture for analyzing technology adoption, organizational sustainability, and institutional pressures within the Zimbabwean Higher Education Institutions environment.

1) Technology Organization Environment (TOE) framework

The framework was originally developed by Rocco DePietro, Edith Wiarda & Mitchell Fleischer in 1990 [16]. It is the backbone of this study. It explains how institutional context influences the adoption of technology innovations [17]. The technological context of the framework looks at the availability, complexity, and compatibility of "green Boardroom" tools. These are AI-driven energy management, paperless governance portals, telepresence systems, and IoT. The organizational context examines the internal institutional factors that are leadership support, ICT budget availability, and the digital literacy of board members. Lastly, the environmental context analyses external pressures such as Zimbabwe's Education 5.0 mandate, which pushes for innovation and industrialization, as well as the national crisis, which necessitates "green" energy-efficient solutions.



[16]

Fig. 1. TOE Framework

2) Diffusion of Innovation (DOI) theory

Everett Rogers' DOI theory [18] was used to gain knowledge on how the "green Boardroom" concept spread through Zimbabwean Higher Education Institutions. Since these technologies represent a shift from traditional paper-heavy governance to digital-first sustainability, DOI helps identify the relative advantage. It seeks to get information on whether the green Boardroom saves time and money over the traditional methods. It looks for the advantages of moving to green Boardrooms. DOI seeks to analyze the level of difficulties of the new technology tools when used by senior academics and administrators. Lastly, it looks at observability. Can other institutions see the benefits, for example, reduced carbon footprint, faster decision-making, and cost reduction?

3) Institutional Theory

The institutional theory was coined by Meyer and Rowan in 1977. It explained how institutional structures and behaviors are shaped by social, legal, and cultural pressures rather than just economic efficiency [19]. In this context, the theory explains how Higher Education Institutions in Zimbabwe adopt certain technologies not just for efficiency but to gain legitimacy. The coercive isomorphism aspects of institutional theory are displayed when the Ministry of Higher and Tertiary Education mandated the digital transformation of institutions through the education 5.0 framework. Higher Education Institutions are supposed to transform their activities in line with innovation and industrialization. Mimetic isomorphism is shown when an institution adopts green Boardrooms to mimic "world-class" tertiary institutions and improve its global ranking. Normative isomorphism is when there is a professional drive by administrators to align with international ESG standards

The three frameworks address the different concepts required in the adoption of green boardrooms in Higher Education Institutions. The TOE framework addresses the why and how part, the DOI addresses the process, and the Institutional theory looks at the pressures around adoption.

III. METHODOLOGY

The main objective of this study was to answer the question "To what extent are advanced digital technologies being adopted to promote green boardrooms in higher education institutions in Zimbabwe?" The exploratory study adopted a pragmatic research paradigm that is anchored on problem-solving and practical outcomes. This was done through a concurrent triangulation mixed methods design.

The researcher gathered qualitative and quantitative data. This validated "the level of adoption" (quantitative) and explained the "skills gap and cost barriers" (qualitative), which led to the "paperless but not sustainable" reality.

A. *Population and Sampling*

The study targeted six Higher Education Institutions in Masvingo District, categorized into state-owned and private institutions. The quantitative sampling technique used was stratified random sampling. It was used to select participants from the IT Department, administrative registries, and executive boards. This guaranteed a statistically representative view of technology deployment across the different levels of institutions. Purposive sampling was employed for qualitative data. Key informants selected for the study included IT directors, registrars, etc., who have deep insights into education 5.0 policy implementation and budgetary constraints. A sample of five participants from each institution was used.

B. *Data collection instruments*

Three primary instruments were used to capture the multidimensional nature of "green Boardrooms". Structured questionnaires (quantitative) were designed using the 5-point Likert scale to measure the adoption levels of advanced digital technologies. It uniquely assessed the shift from physical to digital governance. A semi-structured interview guide (qualitative) was used to answer the question "why" and "how". These were used to gather information about the underlying causes of the deployment gap, such as high energy-intensive hardware costs and the human capital skills deficit. Document analysis of institutional strategic plans and the national education 5.0 policy was done to compare the current state versus the desired state.

C. *Data analysis procedures*

Quantitative analysis was done using descriptive statistics to rank technologies by adoption rate. A gap analysis was performed to highlight the discrepancies between high paper reduction and low efficiency. Qualitative analysis dealt with interview data, which underwent thematic analysis. This involved coding responses and identifying "neutralizing factors" such as infrastructure cost, skills gap, etc. Data integration involved triangulation, where quantitative trends were merged with qualitative narratives to formulate the conclusion that Zimbabwean Higher education institutions are currently in a ''paperless" transition rather than a fully "sustainable" one.

D. *Ethical Considerations*

Strict adherence to ethical research standards was maintained. Permission from individual institutions was sought. Confidentiality was upheld by anonymizing data from informants. All participants were briefed on the study's aim. The study's ethical considerations were to ensure respondents' confidentiality, anonymity, and voluntary participation.

IV. Results and Discussion

The results obtained from the fact-gathering instruments were analyzed and discussed in this section.

A. *What digital technologies are being used in Higher Education Institutions' boardrooms?*

The participants' responses were shown in "Fig. 2".

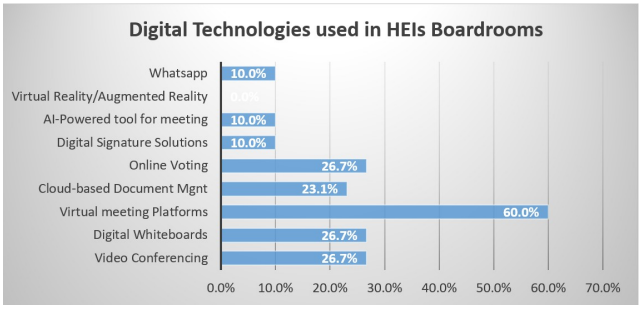


Fig. 2. Digital Technologies Used

TABLE I. An analysis of digital technologies being used in Higher Education Institutions' boardrooms

Theme	Responses
Dominance of Virtual Meeting Technologies	Virtual Meeting Platforms such as Zoom, google meet are being used in the majority of the institutions (60%) showing that they are foundational technologies in implementing green boardrooms.
	Video Conferencing and Digital Whiteboards are used by a significant portion of the institutions (26.7%). This suggests that visual and interactive technological tools are used alongside major meeting platforms.
Upcoming and Niche technologies	Cloud-Based Document Management is gaining momentum with 23.1% adoption. This cloud-based document management is a notable emerging theme, showing a move towards more efficient and accessible document handling in board meetings.
	Online Voting is now an accepted tool with 26.7% adoption in institutions. This shows a growing acknowledgement of the need to streamline and secure decision-making processes in a digital environment.
	Specialized AI and Signature Solutions have Limited, but Present, Use: Digital signature solutions and AI-powered tools for meeting transcription (10%) represent niche but present applications, indicating early adoption in specific areas.
	WhatsApp's Presence was unexpected, showing a 10% use. This suggests informal and or supplementary communication channels are sometimes used
Unexplored or Less Adopted Technologies	Virtual/Augmented Reality is Currently Not Utilized. No institution has shown that they are using this technology in their boardrooms.

The themes highlighted that virtual meeting tools are being utilized, and there is a growing fascination with online collaboration and decision-making. There are also notable early stages of adoption of specialized and/or advanced digital technologies used in the boardrooms.

B. *To what extent do institutions utilize digital technologies in the boardroom?*

"Fig. 3" shows the responses of the participants. Descriptive statistics reveal a mean adoption score of 3.10 (SD = 0.87), indicating that most institutions have reached a 'moderate' level of technological integration as mandated by the Education 5.0 framework. There is a clustering effect at the center, suggesting that Masvingo boardrooms have moved past the initial resistance phase. They are currently in a wait-and-see phase. This represents Mimetic Isomorphism. Boards are adopting enough technology to stay relevant and comply with the ministry's standards without committing to

the high-risk, high-cost full digitalization. Only (6.7%) have achieved full digitalization, which entails a significant bottleneck between extensive use and full digitalization. This suggests that while software (learning management systems/ email) are common, the advanced pillars of education 5.0 such as AI-driven research, cloud-based tools and paperless administration are likely stalled by external factors such as high data costs, lack of special skills and economic difficulties in the country.

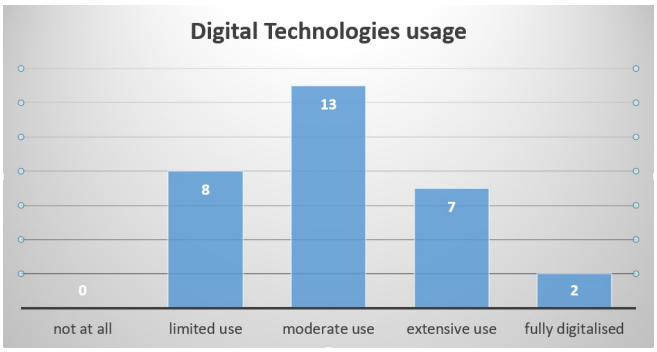


Fig. 3. Digital Technology Usage

C. *Are there any initiatives in place to promote sustainability in your institution's boardrooms?*

"Fig. 4" showed that there is a strong emphasis on sustainability initiatives in higher education institutions, with the majority (72%) having initiatives in place to promote sustainability at the governance level. Despite a positive response, a minority (28%) do not have these in place. This suggests that while sustainability is a growing concern, it is not universally integrated into boardroom practices across all institutions.

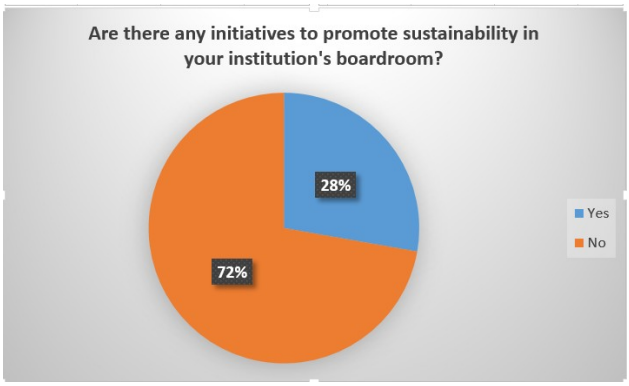


Fig. 4. Initiatives to promote sustainability in institutions' boardrooms

D. *Which digital technologies do you think can enhance sustainability in institutions' boardrooms?*

TABLE II. AN ANALYSIS OF DIGITAL TECHNOLOGIES THAT ENHANCE SUSTAINABILITY IN INSTITUTIONS' BOARDROOMS

Theme	Response
Connectivity and Visualization	Internet of Things (IoT) and Virtual Meeting Platforms are Top Competitors: Both IoT and virtual meeting platforms are seen by half of the respondents (50%) as technologies that can enhance sustainability. This highlights a strong belief in the power of interconnected devices for efficiency and the environmental benefits of reduced travel and paper through virtual interactions.
AI and Cloud Computing for sustainability	AI and Cloud Computing are Highly Valued: Artificial Intelligence and Cloud Computing are both identified by a substantial portion (40%) of respondents as having the potential to enhance sustainability. This indicates an understanding that intelligent automation and scalable, shared computing resources can contribute to more environmentally friendly operations.
Immersive Technologies and Hardware Efficiency:	Virtual/Augmented Reality for Presentations is Emerging: While not as highly rated as the top categories, 33.3% of respondents see Virtual Reality/Augmented Reality for presentations as a sustainability enhancer. This suggests an emerging awareness of how immersive technologies can reduce the need for physical travel and resources associated with traditional presentations.
	Energy Efficient Hardware is a Foundational but Less Emphasized Factor: Only 26.7% of respondents specifically highlighted Energy Efficient Hardware. While crucial for sustainability, it seems to be considered a more fundamental or less "advanced" digital technology in this context, or its impact might be implicitly covered by broader concepts like "I.o.T" or "Cloud Computing" which can leverage such hardware.

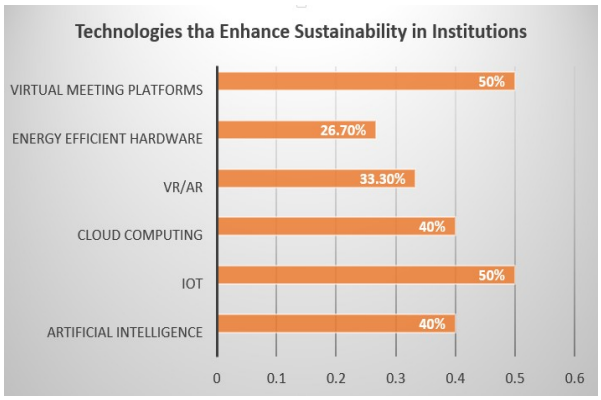


Fig. 5. Technologies that enhance sustainability

The key themes indicate a strong and widespread belief in the benefits of IoT, virtual meetings, AI, and cloud computing for Boardrooms.

E. *How do you envision advanced digital technologies improving sustainability?*

TABLE III. ANALYSIS OF ADVANCED DIGITAL TECHNOLOGIES FOR IMPROVING SUSTAINABILITY

Theme	Response
Cost Reduction through Energy and Remote Work	Energy Consumption Reduction is Key and the top perceived benefit with 61.5% responses suggesting reduction in energy. This shows a strong understanding of digital technologies leading to efficient use of energy across various operations within the boardroom.
	Enhanced Remote Collaboration as a Core Sustainability Driver is equally important at 61.5% suggesting enhanced remote collaboration. This is seen as a major contribution of digital technologies in improving sustainability. This points directly to reduced travel emissions and associated resource consumption
Emphasis on Waste Minimization	Waste Minimization is also Recognized Benefit though slightly less prominent than energy reduction and remote collaboration,

	46.2% of respondents believe digital technologies can contribute to "minimizing waste." This likely refers to reducing paper waste through digitalization but could also encompass more efficient resource allocation generally.

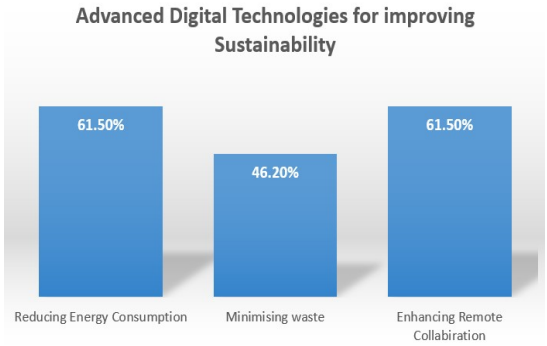


Fig. 6. Advanced Digital Technologies for Improving Sustainability

The primary drivers of sustainability have been stated as a direct link between digital technologies, fostering remote collaborations, and a significant reduction in energy consumption. Waste reduction is also recognized as a benefit to a lesser extent.

F. What challenges are being faced by institutions in implementing advanced digital technologies for green boardrooms?

TABLE IV. AN ANALYSIS OF THE CHALLENGES BEING FACED BY HIGHER EDUCATION INSTITUTIONS IN IMPLEMENTING ADVANCED DIGITAL TECHNOLOGIES FOR GREEN BOARDROOMS

Theme	Response
Financial and Foundational	Cost and Infrastructure are the dominant barriers cited by the majority of respondents 17 (56.65%). This shows that there is a need for strong financial investment in advanced digital technologies, together with the underlying infrastructure.
Human Capital and Skill Gaps	Training is another key obstacle. A substantial number (15 respondents) 50% identified "training" as a challenge. This highlights that even if cost and infrastructure issues are overcome, ensuring that users are adequately skilled and comfortable with new technologies is a critical hurdle to the successful implementation of green boardrooms.

The primary challenges to implementing advanced digital technologies for green boardrooms are financial constraints and the need for robust technological infrastructure, closely followed by the necessity of adequate training for users and stakeholders.

G. Opportunities for advanced digital technologies in promoting sustainability in boardrooms.

The results obtained were crafted into several themes:

1) Improving main Boardroom Functions for Sustainability:

"Improved Governance, Strategic Planning, and Data-Driven Decision Making", this response points to how digital technologies can elevate the fundamental operations of the boardroom. This is done by providing up-to-date data, enabling more informed strategic planning, and refining governance processes. Institutions can make decisions that inherently support sustainability goals. It shows that digital tools are no longer administrative aids but the backbone of strategic sustainability.

2) Fostering Efficiency and Resource Optimization:

"Cost Reduction and Efficiency" are direct benefits identified as the ability of digital technologies to reduce operational costs and increase overall efficiency. This often translates to sustainability through reduced waste, optimized processes, and smarter resource allocation.

"Optimized Resource Utilization**"** explicitly states the opportunity to use resources more effectively, which is a core principle of sustainability. Digital tools can monitor, analyze, and control resource consumption, leading to reductions in energy, paper, and other materials.

These themes provide a twofold advantage where operational cost-cutting and environmental stewardship align perfectly. Focusing on cost-cutting and efficiency through digitalization, they automatically achieve sustainability.

3) Facilitating Remote Collaboration and Information Flow:

"Ease of Information Transmission and Reduced Physical Gatherings," digital technologies offer significant opportunities for seamless information sharing and a reduction in the need for physical meetings. This directly contributes to sustainability by cutting down on travel, associated emissions, and the consumption of resources like paper.

"Collaboration and Networking" advanced digital tools can enhance collaboration among board members and with external stakeholders. This improved connectivity can foster a more integrated approach to sustainability initiatives and knowledge sharing.

By embracing remote collaboration, institutions are successfully decoupling governance quality from physical locations. This reduces the governance carbon footprint (travel, paper-intensive board packs, and energy-intensive physical meetings). This suggests a modern board that is lean, agile, and geographically agnostic, which is essential for global sustainability networking.

The dominant responses revolve around improving the core efficiency and decision-making capabilities of boardrooms through data and strategic planning, directly leading to sustainable outcomes. A strong emphasis is also placed on reducing the environmental footprint by facilitating remote collaboration and optimizing resource use. While most see clear opportunities, a small segment does not currently identify these benefits.

H. What do you recommend and suggest regarding advanced digital technologies for green boardrooms?

The obtained results from the survey were crafted into the following themes:

1) Call for External Intervention/Support:

"Government to intervene on the cost of technology tools and equipment so that institutions would be able to implement digital technologies ". This suggests a need for governmental support or regulation to drive the adoption of green boardroom technologies in institutions of higher learning.

"Green Boardrooms need investment in infrastructure" implies a broader need for resources, awareness, or strategic

direction to establish green boardrooms. Institutions should plan and prioritize investment in digital infrastructure for green boardroom implementation.

A call for external intervention suggests that the implementation of the green board requires a high investment cost of advanced digital tools, which is a major deterrent. Institutions perceive green technologies as a public good that requires government subsidies or tax incentives. Partnering with private organizations can be a solution for green boardroom implementation.

A shift from physical to digital infrastructure points to a shift in institutional asset management. For years, infrastructure in Higher Education Institutions meant physical buildings (lecture halls, offices, and boardrooms). These themes suggest a change towards digital real estate (cloud servers, high-speed connectivity, and advanced conference hardware) as a major infrastructure required for modern, sustainable governance.

2) Institutional Responsibility for Digital Availability:

"Institutions should avail digital technologies to all staff", highlights the internal responsibility of institutions to provide the necessary tools for green boardrooms. A green boardroom cannot exist in a vacuum. If the board is digital and the supporting staff is manual, then the green chain is broken. This theme points to total institutional digitization as a prerequisite for a truly sustainable boardroom.

3) Emphasis on Training and Skills Development:

"People need training regarding advanced digital technology to have a smooth flow of the process". This statement strongly emphasizes the critical role of training in enabling the effective use of digital technologies for green boardrooms. This underscores a perceived skills gap or resistance to new technologies without proper guidance. This theme suggests that the major bottleneck might not be technology but technological inertia. The statement "smooth flow of the process" indicates that, without training, digital tools are seen as disruptions rather than enablers. Digital literacy should be taken as one of the main sustainability competencies.

The major themes revolve around the need for government support, Institutional commitment, and the provision of adequate training to all stakeholders to effectively adopt and use advanced digital technologies for green Boardrooms in higher education institutions. The green boardroom is being framed as a collaborative mandate. It suggests that sustainability is not something a board can achieve alone, but requires a subsidy from the state, commitment from the IT department, and a pedagogical shift for the users.

V. Conclusions and Recommendations

A. Summary of key findings

1) Current state of digitization

The results point out that institutions of higher learning in Zimbabwe have moved from the initial stage of technology adoption but are struggling to reach full digital maturity. Most respondents (43.3%) operate at a moderate level of digitalization. The mean score of 3.1 (on a 1 to 5 scale) confirms that the average participant is slightly above the midpoint. There is a universal adoption since there is no participant who indicated no digital tools at their institution. There is an innovation gap with only 6.7% who have fully digitalized.

2) Strategic benefits. The sustainability link

The study results have shown three primary drivers for transforming boardrooms into "green boardrooms". These include:

- Data-driven Governance: Digital tools are important for providing up-to-date data for strategic decisions that align with sustainability goals.
- Efficiency and Optimization: Digitalization is directly connected to cost reduction and resource optimization, that is energy, paper and waste reduction.
- Environmental footprint: Facilitating remote collaboration and reducing physical gatherings is pointed out to be a major way to cut down travel-related emissions.

3) Barriers to progress

Despite the identified benefits, critical bottlenecks prevent institutions from moving from moderate to full digitization.

- The cost barrier: there is a strong call for Government intervention through subsidizing the high cost of advanced digital equipment. Collaborations with private organizations are also encouraged to implement green boardrooms.
- The skills gap: Technological Inertia is the primary concern. Respondents emphasized that without specialized training, the flow of digital processes remains obstructed.
- Institutional Responsibility: there is a perceived lack of digital availability with a recommendation that institutions must provide infrastructure to all staff not just top level board members.
- Economic crisis: The Zimbabwean economic instability affect green boardroom adoption especially in the energy sector since there is limited financing.

B. Conclusion

The study investigated the intersection of advanced digital technologies and the evolution of "green boardrooms" within higher education institutions. The findings reveal a landscape that is technologically active but strategically maturing, characterized by a clear transition from traditional governance to data-driven, sustainable operations. It identified the different digital tools currently being used in higher education institutions, including virtual meeting tools, video conferencing, and document sharing facilities, and to a lesser extent, online voting and signature solutions.

The perceived benefits of adopting advanced digital technologies were highlighted as improved core boardroom functions for sustainability, fostering efficiency and resource optimization, and facilitating remote collaboration and information flow. The major challenges in advanced technologies for green boardroom adoption were the cost of technology, lack of infrastructure, lack of human capital, and skills gap. This was also highlighted by [4] in their study on digital learning innovations in Zimbabwe.

C. Recommendations.

To move from “moderate” use to fully realized boardrooms, the study recommends a holistic approach:

Policy level: The government should come up with subsidies or frameworks that lower the cost of advanced technologies for educational institutions. The government should encourage or recommend collaborations and partnerships with private organizations for advanced technology cascading and training.

Institutional level: leadership must view digital infrastructure not as an expense, but a core sustainability asset, ensuring access is democratized across all supporting staff. Technology providers can also partner with institutions in promoting digital technology and infrastructure investment through credit lines. They can also offer training of manpower to create a skills base for the use of advanced technologies for green Boardrooms. Institutional leaders can also promote the use of existing tools in promoting green systems and procedures. A phased approach to adoption and implementation will go a long way in realizing the intended goal of green boardrooms. In the long run, institutions can come up with exchange programs with other institutions that are fully digitized and experience the use of these advanced technologies. This will have an effect on eliminating cultural factors that affect adoption of new technology, for example Virtual Reality/Augmented Reality.

D. Future research

The researcher recommended that further research be done to create a framework that will guide higher education institutions in the adoption and implementation of green Boardrooms.

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APPENDIX 1

Questionnaire

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