



Sustainable Transformation in South African Rural Universities: A Digital Perspective

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Purpose: This study investigates the relationship between digital transformation and sustainability in South African rural universities, focusing on the effects of digital technologies on educators, students, administrators, policymakers, and the community. It aims to understand the implications for inclusive education, cultural preservation, and economic empowerment within the unique context of South African rural communities.

Study design/methodology/approach: The research employs a transformative framework and the Unified Theory of Acceptance and Use of Technology (UTAUT) to analyse the dynamics involved in digital tool adoption. It emphasises strategic planning, infrastructure investment, training, and inclusive policy formulation as critical components for effective digital integration. The study also highlights the importance of continuous monitoring and evaluation to ensure the successful alignment of digital initiatives with sustainability goals.

Findings: The findings reveal that strategic investment in digital infrastructure, comprehensive training programs, and inclusive policies are essential for effectively integrating digital technologies in rural universities. The study underscores the potential of digital transformation to enhance inclusive and equitable education, bridge disparities, and promote the holistic development of rural universities. It also highlights the positive impact on cultural preservation and economic empowerment within rural communities.

Originality/value: This study examines digital transformation in the context of South African rural universities, offering valuable insights into how digital technologies can be leveraged to promote sustainability. Focusing on rural communities' unique challenges and opportunities, the research advocates for a transformative approach that enhances education, empowers communities and contributes to sustainable higher education in South Africa and beyond.

Introduction

South African rural universities face unique challenges in their quest for sustainability. This study explores the role of digital transformation in enhancing sustainability and innovation within higher education spaces in rural South Africa (Albertus, 2019; Ajani & Gamede, 2020; Kruger & Steyn, 2024). The contemporary landscape of higher education is transforming, with digital technologies emerging as pivotal enablers. Integrating digital transformation becomes imperative as South African universities strive for sustainability, particularly in rural settings. This study embarks on a comprehensive exploration of the role of digital technologies in fostering sustainability and innovation within South African rural universities. By delving into the multifaceted dimensions of digital transformation, this research aims to contribute nuanced insights to inform policy, practice, and future initiatives in the higher education sector.

Awolaye, Siya and Adewumi (2019) posit that South Africa's higher education system reflects a complex tapestry shaped by historical, social, and economic dynamics. Rural universities, in particular, grapple with distinctive challenges, including resource constraints, faculty recruitment difficulties, and the imperative to address the diverse needs of dispersed populations (Cloete et al., 2015; Iwara, 2023). The advent of digital technologies offers a paradigm shift in addressing these challenges. Digital transformation involves integrating technology to revolutionise processes, enhance accessibility, and foster collaboration (Kaplan & Haenlein, 2016; Mgwashu et al., 2020). For South African rural universities, digital

transformation holds the potential to not only overcome existing hurdles but also to pave the way for sustainable development (Bates & Sangra, 2011; Damoah & Omodan, 2022).

According to Trevisan et al. (2023), the convergence of education and technology, often called digital transformation, offers a catalyst for positive change in rural higher education. Digital tools, platforms, and methodologies present an unprecedented opportunity to overcome traditional barriers, making education more inclusive and adaptive. The transformative potential lies in adopting digital tools and in the strategic utilisation of technology to address specific challenges faced by South African rural universities (Kaplan & Haenlein, 2016). This paradigm shift requires a holistic approach, encompassing e-learning initiatives, sustainable infrastructure development, community engagement, and strategic partnerships to create a conducive and innovative educational environment.

Central to this transformation is the integration of e-learning platforms. These platforms can surmount geographical constraints, providing remote access to quality education (Ng'ambi et al., 2016; Kanyane, 2023). Through the lens of digital education, this study seeks to unveil the opportunities and challenges that arise in adopting e-learning within the unique context of South African rural universities. Digital solutions extend beyond the realm of education, offering avenues for enhanced resource management. Cloud-based systems, for instance, facilitate streamlined administrative processes, efficient data management, and optimal resource allocation (Westerman et al., 2011; Craciun et al., 2023). Understanding how digital infrastructure contributes to sustainable resource utilisation is crucial for the holistic evaluation of digital transformation initiatives.

Digital technologies can also serve as bridges between universities and their local communities. Collaborative initiatives can be fostered through digital platforms, leading to mutual growth and sustainable development (Awolaye et al., 2019; Pakkan et al., 2023). This aspect adds a socioeconomic dimension to the digital transformation narrative, emphasising the interconnectedness of educational institutions and the communities they serve. The digital transformation of higher education necessitates a parallel transformation in the skills and competencies of faculty and staff. Continuous professional development through online courses and workshops becomes integral in ensuring educators are adept with the latest pedagogical approaches (Bates & Sangrà, 2011). This study explores the dynamics of professional development in the context of digital transformation.

Harnessing the power of data analytics is another dimension of digital transformation. Data-driven decision-making enables universities to gain insights into student performance, optimise course offerings, and enhance overall institutional effectiveness (Siemens & Long, 2011; Gerged et al., 2023). This research delves into the implications of data-driven strategies for informed decision-making in the South African rural higher education context. Thus, digital platforms offer avenues for promoting inclusivity in education. By tailoring resources to diverse learning styles, languages, and cultural contexts, digital transformation can foster an inclusive learning environment (Rumble, 2001; Carayannis et al., 2012; Choudhury & Pattnaik, 2020).

This study scrutinises the dynamics of inclusivity and accessibility within the digital transformation landscape of South African rural universities. South African rural universities encounter multifaceted challenges, including limited resources, faculty recruitment and retention difficulties, and the imperative to cater to diverse and dispersed student populations (Cloete et al., 2015). The geographical remoteness of these institutions exacerbates these challenges, necessitating innovative solutions for effective educational delivery (Ajani & Gamede, 2021). Moreover, pursuing sustainability in higher education requires a comprehensive understanding of the unique contextual factors shaping the South African rural educational landscape.

Sustainability in the context of rural university education goes beyond immediate technological advancements (Boughey & McKenna, 2021; Trevisan et al., 2023). It involves the creation of resilient systems that can adapt to changing circumstances while maintaining a focus on long-term ecological, economic, and social impacts (Molla & Cooper, 2011). As these universities play a vital role in empowering local communities and contributing to regional development, their sustainable transformation aligns with broader national and global goals for educational equity and socioeconomic progress. While digital transformation presents myriad opportunities, the sustainability of digital infrastructure is a critical consideration. This research explores the nexus between digital technologies and sustainable infrastructure development, encompassing factors such as energy efficiency and ecological impact (Molla & Cooper, 2011; Zhuo & Chen, 2023).

In synthesising these diverse dimensions, this research sets out to unravel the intricate interplay between digital transformation and sustainability in South African rural universities. This study explores the intricacies of sustainable digital transformation in South African rural universities. By exploring the challenges, opportunities, and best practices, it seeks to provide insights that can guide policymakers, educational leaders, and stakeholders in formulating effective and sustainable digital integration strategies. The literature review will critically examine existing research on digital transformation in higher education, specifically focusing on the South African context, laying the groundwork for a comprehensive understanding of the subject. The subsequent sections will delve into a comprehensive literature review, providing a theoretical foundation for the study and identifying gaps that warrant further investigation.

Transformative and UTAUT Theories in the Context of Digital Transformation in South African Rural Universities

Theoretical frameworks are foundational to research, providing a conceptual lens through which phenomena are understood. They structure relationships, concepts, and variables with theoretical frameworks drawing from established theories to guide research. A well-constructed framework includes key concepts, variables, and propositions, informing research questions and hypotheses while enhancing conceptual clarity. These frameworks are closely tied to literature reviews, aiding in situating studies within broader academic discourse and identifying relevant literature gaps. They offer flexibility, allowing for refinement as insights emerge, and may integrate elements from multiple theories for a comprehensive understanding.

Theoretical frameworks guide the selection of research methods and data analysis techniques, facilitating hypothesis testing and validation of findings across various research designs. In the context of digital transformation in South African rural universities, theoretical frameworks like the Transformative Learning Theory and the Unified Theory of Acceptance and Use of Technology (UTAUT) are essential. They provide a structured approach to understanding the transformative processes within these institutions, guiding the development of interventions and policies based on theoretical understanding. Continuous reflection and refinement ensure the theoretical framework's adequacy, relevance, and coherence, serving as the backbone of research endeavours in exploring digital transformation in educational settings.

Transformative Learning Theory

The Transformative Learning Theory, developed by Jack Mezirow, emphasises the profound shifts in understanding that individuals experience through critical reflection. It posits that learning is not merely the accumulation of information but a process of perspective

transformation. In the context of South African rural universities, this theory holds significance as it addresses the need for a profound change in the educational landscape. Transformative Learning Theory encourages educators and administrators to reflect critically on their current practices and embrace a mindset open to the transformative potential of digital technologies. This is particularly relevant in the context of South African rural universities striving to bridge educational disparities through technology.

The theory acknowledges that transformative learning involves unlearning existing beliefs and practices. In the South African context, where traditional educational methods may have deep-rooted significance, unlearning becomes a critical aspect of embracing digital transformation. Transformative Learning Theory aligns with the goals of empowering students and creating inclusive educational environments. In South African rural universities, digital transformation is not only about technology adoption but also about empowering diverse communities through equitable access to educational resources. Mezirow's theory emphasises the role of educators as change agents. In the context of South African rural universities, educators become catalysts for change by facilitating transformative learning experiences by integrating digital tools. Transformative Learning Theory recognises that transformation is an ongoing process. South African rural universities must continuously adapt their digital strategies to meet evolving educational needs, fostering a culture of lifelong transformative learning.

Unified Theory of Acceptance and Use of Technology (UTAUT)

Developed by Venkatesh et al., the UTAUT consolidates various technology acceptance models to understand user behaviour and technology adoption. In the South African rural university context, UTAUT provides insights into factors influencing the acceptance and use of digital technologies. These factors are *Performance Expectancy (PE)*: UTAUT posits that users are more likely to accept technology when they perceive it as beneficial to their performance. In South African rural universities, aligning digital tools with educational outcomes is crucial for fostering acceptance among educators and students. *Effort Expectancy (EE)*: The theory emphasises the importance of perceived ease of use.

For successful digital transformation in South African rural universities, addressing concerns related to the complexity of technology use is essential, ensuring that educators and students find digital tools user-friendly. *Social Influence (SI)*: UTAUT recognises the impact of social factors on technology adoption. In South African rural communities, where communal values are significant, the acceptance of digital transformation is influenced by the collective perception of educators, students, and community stakeholders. *Facilitating Conditions (FC)*: The theory suggests that the availability of necessary resources and support influences technology adoption. In the South African context, ensuring adequate infrastructure, training programs, and ongoing support is essential to create facilitating conditions for digital transformation. *Gender and Age as Moderators*: UTAUT introduces moderators such as gender and age.

Considering the diverse demographics in South African rural universities, understanding how these moderators influence the acceptance and use of technology becomes crucial for effective implementation. *Cultural Factors*: UTAUT acknowledges the influence of cultural factors on

technology adoption. In the South African context, where cultural diversity is rich, accounting for cultural nuances becomes imperative for successful digital integration.

Integration of Theories in the South African Context

The Transformative Learning Theory and UTAUT complement each other in the context of South African rural universities. While Transformative Learning focuses on mindset shifts and critical reflection, UTAUT delves into the practical aspects of technology acceptance, creating a holistic framework. Combining both theories empowers educators, students, and community stakeholders. Transformative Learning Theory provides the philosophical foundation, inspiring a mindset conducive to change, while UTAUT offers practical guidelines for technology adoption. Transformative Learning Theory aids in addressing resistance to change by fostering a deep understanding of the need for digital transformation. UTAUT, on the other hand, offers strategies to mitigate resistance through targeted interventions based on performance, effort, and social factors.

The integration of these theories supports the creation of inclusive digital environments in South African rural universities. It ensures that digital transformation is technologically driven and aligned with transformative educational goals. Both theories emphasise the importance of continuous learning and adaptation. In the dynamic landscape of South African rural universities, where contextual factors play a pivotal role, this integrated approach allows for flexibility and responsiveness to evolving needs. In conclusion, the transformative potential of digital transformation in South African rural universities is enriched by integrating the Transformative Learning Theory and UTAUT. This combination offers a comprehensive framework that addresses mindset shifts, practical challenges, and the diverse socio-cultural context, ultimately contributing to the sustainable evolution of higher education in South Africa.

Research Methodology

This study employed a systematic review approach to explore the phenomenon under study.

A systematic literature review (SLR) was a robust research methodology employed to comprehensively and systematically gather, evaluate, and synthesise existing knowledge within a specific research area. In the context of "Sustainable Transformation in South African Rural Universities: A Digital Perspective," an SLR was an invaluable approach to examining the available literature on the integration of digital technologies for sustainable transformation in higher education institutions situated in rural South Africa.

The first step in conducting an SLR involves clearly defining the research questions and objectives. This study's overarching questions revolved around understanding how digital technologies contributed to sustainable transformation in South African rural universities and identifying the challenges and opportunities associated with this integration.

The systematic nature of the review ensured a transparent and replicable process (Melo et al., 2023). Researchers established explicit inclusion and exclusion criteria for selecting relevant literature.

This study considered literature focusing on the digitalisation efforts in South African rural universities and their impact on sustainability, academic outcomes, and institutional development. The search strategy involved systematically exploring academic databases, journals, conference proceedings, and relevant institutional repositories. Keywords such as "digital transformation," "sustainability," "South African rural universities," and related terms were used to identify pertinent literature. Additionally, citation tracking and reference list analysis were employed to broaden the scope of the review. Data extraction involved systematically collecting relevant information from selected studies (Otu et al., 2023). This included details on the digital technologies implemented, sustainability outcomes, challenges faced, and recommendations provided. The extracted data was then synthesised and analysed to identify patterns, trends, and gaps in the existing literature.

The SLR contributed to a comprehensive understanding of the past state of digital transformation in South African rural universities, shedding light on successful initiatives and areas requiring further attention (Kanyane, 2023). The findings informed past research directions, policy development, and practical strategies for enhancing sustainability through digital interventions in higher education institutions. Moreover, by adopting a systematic approach, this literature review ensured a rigorous and objective analysis, minimising bias and providing a reliable foundation for past evidence-based decision-making in the realm of sustainable transformation in South African rural universities with a digital perspective (Melo et al., 2023).

Interplay Between Digital Transformation and Sustainability in South African Rural Universities

Digital transformation in South African rural universities intersects with global perspectives on sustainability, encapsulating a multifaceted interplay that transcends traditional educational paradigms (Pakkan et al., 2023). As higher education institutions globally grapple with the imperative to evolve in the digital age, the sustainability of this transformation becomes a central focus. This essay engages in a comprehensive discussion, exploring the intricate dynamics of the interplay between digital transformation and sustainability in South African rural universities within the broader global context (Kanyane, 2023). While Iwara (2023) argues that digital transformation, characterised by integrating advanced technologies into educational practices, has emerged as a global phenomenon reshaping higher education landscapes. South African rural universities, like their global counterparts, navigate the challenges and opportunities this transformative wave presents.

E-learning platforms have become instrumental in overcoming geographical constraints and providing remote access to quality education in rural settings (Ng'ambi et al., 2016). This global trend underscores the interconnectedness of educational institutions worldwide in leveraging digital technologies to enhance access and inclusivity. In the realm of resource management, cloud-based systems have gained prominence as tools for efficient administrative processes and

optimal resource allocation (Westerman et al., 2011; Ji et al., 2023). This global perspective on leveraging digital infrastructure for sustainable resource utilisation resonates with the challenges South African rural universities face.

The ability to streamline operations, reduce costs, and enhance overall institutional efficiency aligns with the broader global goals of sustainable higher education practices (Out et al., 2023). Community engagement takes centre stage in the global discourse on sustainable development, and digital technologies play a pivotal role in fostering collaboration between universities and local communities (Awolaye et al., 2019). While the specific contexts may vary, the overarching aim of enhancing socioeconomic development through collaborative digital initiatives transcends borders. By aligning with global perspectives on community engagement through digital means, South African rural universities contribute to the broader narrative of sustainable development. Professional development in the digital age is a shared concern among educators globally (Kanyane, 2023).

The need for continuous training and upskilling to navigate the evolving digital landscape is a common theme (Bates & Sangrà, 2011). Ajani and Gamede (2021) assert that South African rural universities, in aligning with this global perspective, recognise the importance of fostering digital competencies among faculty and staff. This mutual emphasis on professional development highlights the universality of challenges and opportunities presented by digital transformation in higher education. Data-driven decision-making, facilitated by analytics, is a global trend reshaping higher education governance and strategy (Siemens & Long, 2011).

Using data to inform decisions about student performance, course offerings, and institutional effectiveness resonates with the global higher education community. While grappling with unique contextual challenges, South African rural universities contribute to the global discourse on the strategic use of data to ensure informed decision-making for sustainable development. Inclusivity emerges as a common thread in the global dialogue on digital transformation in higher education (Otu et al., 2023). The customisation of resources to cater to diverse learning styles, languages, and cultural contexts aligns with the broader goal of fostering an inclusive learning environment (Rumble, 2001).

By embracing digital technologies to address inclusivity challenges, South African rural universities become integral participants in the global pursuit of equitable education (Scott & Ivala, 2019). The sustainability of digital infrastructure emerges as a global concern, emphasising the need for environmentally conscious practices in technology adoption (Molla & Cooper, 2011; Pakkan et al., 2023). While navigating their specific challenges, South African rural universities contribute to the global dialogue on sustainable digital infrastructure. Considerations of energy efficiency and ecological impact resonate with the broader global commitment to environmentally responsible technological practices.

However, the interplay between digital transformation and sustainability in South African rural universities is challenging (Trevisan et al., 2023). The digital divide, both within the country and globally, remains a significant impediment to achieving sustainable outcomes. Access to digital resources, quality internet connectivity, and digital literacy disparities persist, creating inequalities in educational opportunities. While global perspectives highlight the transformative

potential of digital technologies, the reality of bridging these divides requires concerted efforts at both national and international levels (Craciun et al., 2023).

Kanyane (2023) avows that globalisation introduces a dimension of benchmarking and collaboration, urging South African rural universities to align with global best practices while preserving their unique identity and addressing specific contextual challenges. The adoption of digital technologies must be contextualised to suit local needs, ensuring that sustainability efforts are sensitive to the South African rural landscape's cultural, social, and economic nuances (Scott & Ivala, 2019; Ajani, 2023). Striking this balance becomes a crucial aspect of the interplay between global perspectives on digital transformation and the sustainability of South African rural universities. Moreover, the financial implications of digital transformation pose challenges that resonate globally.

While the potential benefits are substantial, the initial investments required for infrastructure, training, and ongoing maintenance can strain institutional budgets. Balancing financial sustainability with the imperative for digital innovation becomes a delicate task, necessitating strategic planning and collaborative partnerships (Melo et al., 2023). Conversely, the interplay between digital transformation and sustainability in South African rural universities unfolds within a broader global context (Trevisan et al., 2023). The shared challenges and opportunities underscore the interconnectedness of higher education institutions worldwide in navigating the complexities of the digital age.

Kanyane (2023) reports that as South African rural universities contribute to the global digital transformation and sustainability discourse, synthesising global perspectives and localised strategies becomes imperative. Thus, through collaborative endeavours, shared insights, and a commitment to inclusive and sustainable practices, these institutions can carve a path that aligns with global trends and addresses their communities' unique needs (Scott & Ivala, 2019). In this dynamic interplay, the evolution of South African rural universities becomes a national imperative and a testament to the transformative potential of digital technologies in shaping the future of higher education worldwide.

Digital Transformation in South African Higher Education Context

Digital transformation in higher education, particularly in the context of South African rural universities, is a multifaceted and dynamic process that holds significant implications for academic practices, student learning experiences, and institutional sustainability (Kruger & Steyn, 2024). This study adds to the discursive literature on the global perspectives on digital transformation in higher education, emphasising its relevance and challenges within the unique context of South African rural universities. Iwara (2023) affirms that globally, higher education has witnessed a paradigm shift towards online learning, driven by integrating digital technologies into pedagogical practices (Dhawan, 2020).

The digital transformation transition has been accelerated by the widespread availability of digital resources, learning management systems, and collaborative tools (Scott & Ivala, 2019). Blended learning, combining traditional face-to-face instruction with online elements, has gained prominence globally (Graham, 2013). This model accommodates diverse learning

styles, promotes flexibility, and enhances student engagement. The continuous evolution of technology, including artificial intelligence, virtual reality, and big data analytics, has created new possibilities for personalised learning experiences and data-driven decision-making in higher education (Daniel, 2016).

Digital platforms have facilitated global collaboration among scholars, researchers, and students. Virtual conferences, collaborative research projects, and international partnerships have become more accessible, transcending geographical barriers (Weller, 2020). Despite the advancements, a persistent global challenge is the digital divide, with disparities in access to technology and digital literacy (Selwyn, 2017).

This gap exacerbates inequalities in higher education, hindering the full participation of students and educators. Moreover, faculty members globally face challenges in adapting to digital pedagogies and integrating technology effectively into their teaching practices (Bates & Sangrà, 2011; Mgqwashu et al., 2020; Pakkan et al., 2023). Professional development opportunities are crucial to equip educators with the necessary skills. Ensuring the quality of online education and aligning it with accreditation standards pose challenges. Establishing robust quality assurance mechanisms is essential to maintain the integrity and credibility of digital learning programs (Allen & Seaman, 2017; Scott & Ivala, 2019).

South African rural universities confront infrastructural challenges, including limited access to reliable electricity and internet connectivity (Cloete et al., 2015; Ajani & Gamede, 2021; Craciun et al., 2023). Insufficient infrastructure hampers the seamless adoption of digital technologies. The digital divide is pronounced in South African rural areas, with disparities in digital literacy skills among students and educators (Ng'ambi et al., 2016). Bridging these gaps is imperative for fostering inclusivity. Rural universities often face financial constraints, restricting their capacity to invest in digital infrastructure and faculty development (Cloete et al., 2015; Trevisan et al., 2023).

Adequate funding is essential for sustainable digital transformation. South Africa's cultural and linguistic diversity adds complexity to digital transformation efforts. Customising digital content to be culturally responsive and inclusive is crucial for effective learning (Cloete et al., 2015). South African rural universities can leverage digital platforms for community engagement. Collaborative initiatives that address local challenges and involve communities in co-creating knowledge can foster sustainable development (Awolaye et al., 2019).

The rise of e-learning platforms allows South African rural universities to extend educational access beyond physical boundaries. Blended learning models can be tailored to accommodate the specific needs of rural students (Ng'ambi et al., 2016; Iwara, 2023). Establishing strategic partnerships with government agencies, non-profit organisations, and private sectors can enhance resources and support for digital infrastructure development (Cloete et al., 2015). Implementing faculty development programs is crucial for enhancing educators' digital competencies.

Training initiatives can empower faculty members to effectively integrate technology into their teaching practices (Bates & Sangrà, 2011; Pakkan et al., 2023). Customising digital content to be inclusive of diverse cultures and languages is essential for South African rural universities.

This approach ensures that digital resources resonate with students' cultural contexts (Cloete et al., 2015). Advocating for government support and policies tailored to the unique needs of rural universities is pivotal. Financial assistance, infrastructure development initiatives, and digital literacy programs can be facilitated through collaborative efforts (Cloete et al., 2015; Ajani & Gamede, 2020).

Adopting community-centric approaches to education involves engaging local communities in the digital transformation. This collaborative model fosters a sense of ownership and relevance in the educational journey (Awoleye et al., 2019). Integrating environmental sustainability practices into digital transformation initiatives aligns with global efforts. South African rural universities can implement eco-friendly technologies and promote sustainability in their digital infrastructure (Cloete et al., 2015). Establishing mechanisms for continuous quality improvement ensures that digital transformation aligns with the evolving needs of South African rural universities (Maphalala & Ajani, 2023).

Regular evaluations and feedback mechanisms contribute to sustained excellence (Cloete et al., 2015). The global trends in digital transformation in higher education have profound implications for South African rural universities. While challenges persist, the opportunities and best practices discussed underscore the potential for meaningful and sustainable digital transformation (Maphalala & Ajani, 2023). By addressing the unique contextual factors, fostering inclusivity, and leveraging strategic partnerships, South African rural universities can navigate the complexities of digital transformation and contribute to advancing higher education in the global landscape.

Challenges, Opportunities and Best Practices

South African rural universities operate within a dynamic educational landscape, facing numerous challenges, exploring opportunities, and adopting best practices to ensure sustainability and global relevance (Ajani & Khumalo, 2023). This comprehensive discussion delves into the multifaceted interplay of challenges, opportunities, and best practices that characterise South African rural universities from a global perspective.

One of the primary challenges facing South African rural universities is the need for adequate infrastructure. Limited access to reliable electricity, internet connectivity, and modern facilities hampers the effective integration of digital technologies, hindering the institutions' competitiveness on a global scale (Cloete et al., 2015; Khoalenyane & Ajani, 2023). Disparities in digital literacy and access to technology contribute to a significant digital divide among students and educators. Bridging this gap is crucial for ensuring equitable participation in the digital era, as global education increasingly relies on digital platforms (Ng'ambi et al., 2016; Ajani, 2023).

Moreover, the financial constraints further compound the challenges South African rural universities face. Limited resources restrict investment in essential infrastructure upgrades, faculty development programs, and quality education initiatives (Cloete et al., 2015). Ajani and Khumalo (2023) report that the lack of comprehensive faculty development programs poses a significant challenge. Faculty members may struggle to adapt to digital transformation,

hindering the effective integration of technology into teaching practices and impacting the overall quality of education (Bates & Sangrà, 2011).

Moreover, resource limitations may constrain research output, inhibiting the institutions' contribution to global academic discourse (Maphalala & Ajani, 2023). The lack of research capacity hampers the pursuit of excellence and diminishes its impact on global knowledge production (Cloete et al., 2015). Afolabi et al. (2022) highlight socioeconomic factors, including poverty and limited access to educational resources, as barriers to enrolment and student success.

Addressing these challenges is pivotal for fostering equitable access to education and improving global competitiveness (Cloete et al., 2015; Tadesse & Muluye, 2020). However, amid these challenges, opportunities for growth and innovation arise. Digital learning platforms present an opportunity to overcome geographical constraints and deliver quality education to remote areas (Adnan & Anwar, 2020; Ajani & Khumalo, 2023). E-learning initiatives can enhance accessibility and inclusivity and provide opportunities for global collaboration (Ng'ambi et al., 2016). Additionally, community engagement catalyses sustainable development. Collaborative initiatives with local communities address societal needs and foster a sense of shared responsibility (Awolaye et al., 2019).

Furthermore, South African rural universities have the unique opportunity to conduct research that addresses local challenges, providing valuable insights into global knowledge (Cloete et al., 2015). Implementing strategic partnerships with government agencies, non-profit organisations, and private sectors can bolster resources and support sustainable development initiatives (Cloete et al., 2015). Comprehensive faculty development programs empower educators to integrate technology effectively into their teaching practices (Bates & Sangrà, 2011; Soudien, 2020; Ajani, 2023).

Hence, curriculum innovation, community-centric approaches to education, and institutional capacity-building initiatives are essential for sustainable growth (Cloete et al., 2015). Additionally, strategic communication strategies are crucial for building the reputation of South African rural universities on a global scale (Cloete et al., 2015). Through collaboration, innovation, and strategic planning, South African rural universities can navigate challenges, seize opportunities, and ensure sustainable development and global competitiveness.

Implications of the Study

The study's implications for the interplay between digital transformation and sustainability in South African rural universities are multifaceted and extend to various stakeholders, including educators, students, administrators, policymakers, and the broader community. The study's findings and insights have profound implications that resonate with the challenges and opportunities inherent in adopting digital technologies in the unique context of South African rural universities.

The study implies that educators and students in South African rural universities stand to benefit significantly from the integration of digital technologies. Empowering educators with digital tools enhances their teaching capabilities, fostering innovative and interactive student learning

experiences. The study suggests that using digital tools can improve learning outcomes judiciously. Educators can leverage technology to tailor teaching methods to diverse learning styles, providing students with a more personalised and effective educational experience. By embracing digital transformation, South African rural universities have the potential to bridge educational disparities.

The study implies that digital technologies can facilitate equal access to educational resources, thereby contributing to a more inclusive and equitable educational landscape. The findings highlight the importance of cultivating digital literacy skills among educators and students. Integrating digital tools in the educational process encourages the development of essential skills that are increasingly relevant in the digital age.

The study underscores the need for strategic planning in implementing digital transformation initiatives. Administrators and policymakers must carefully consider the long-term sustainability of digital solutions, aligning them with the overarching goals of education in South African rural universities. The findings suggest that substantial investment in digital infrastructure and training programs is imperative. Policymakers should prioritise initiatives that ensure educators and students have access to the necessary tools and possess the skills required to maximise the benefits of digital technologies.

Policymakers need to formulate policies that promote inclusivity in the digital transformation journey. The study implies that policies should consider the diverse socio-cultural contexts of South African rural communities to ensure that digital initiatives are accessible and relevant to all. Administrators and policymakers should establish mechanisms for continuous monitoring and evaluation of digital transformation initiatives. This involves assessing the effectiveness of implemented strategies, addressing challenges promptly, and adapting policies to align with evolving technological landscapes.

The study suggests that community engagement is crucial for the success of digital transformation initiatives. Building trust and garnering support from local communities contribute to a collaborative approach that considers South African rural societies' unique needs and perspectives. Digital transformation should be approached with sensitivity to cultural preservation. The study implies that efforts should be made to integrate digital technologies in ways that respect and preserve the rich cultural heritage of South African rural communities.

The adoption of digital technologies has the potential to stimulate economic empowerment within South African rural communities. The study implies that initiatives promoting digital literacy and entrepreneurship can create economic growth and sustainability opportunities. The study highlights the importance of knowledge exchange and collaboration on a global scale. South African rural universities can benefit from international partnerships and collaborations that bring diverse perspectives, resources, and best practices in digital transformation. The findings suggest that digital transformation in South African rural universities aligns with global efforts toward sustainable development.

Integrating digital technologies contributes to achieving education-related Sustainable Development Goals (SDGs), fostering a global agenda for positive change. Thus, the study's implications on the interplay between digital transformation and sustainability in South African

rural universities are far-reaching and transformative. The findings call for a comprehensive, collaborative, and contextually sensitive approach to digital integration, ensuring that the benefits of technology are harnessed to enhance education, empower communities, and contribute to the sustainable development of higher education in South Africa and beyond.

Conclusion

Digital transformation is integral to the sustainable development of rural universities in South Africa. By embracing innovative technologies, these institutions can overcome challenges, foster community engagement, and provide quality education, ensuring a brighter future for students in rural areas. This study delves into the intricate interplay between digital transformation and sustainability in South African rural universities. The findings illuminate a complex landscape where digital technologies offer both challenges and opportunities for educators, students, administrators, policymakers, and the broader community. The study emphasises the need for strategic planning, investment in infrastructure and training, inclusive policy formulation, and continuous monitoring and evaluation to ensure the effective integration of digital tools. It underscores the importance of community engagement, cultural preservation, and economic empowerment in the context of South African rural communities.

Moreover, the implications extend globally, emphasising the significance of knowledge exchange, collaboration, and alignment with sustainable development goals. The study envisions a future where digital transformation fosters inclusive and equitable education, bridges disparities, and contributes to the holistic development of South African rural universities. As these institutions navigate the digital landscape, it is imperative to strike a balance that respects cultural diversity, preserves heritage, and aligns with the broader global agenda for positive change. Ultimately, the study advocates for a transformative approach that leverages digital technologies to enhance education, empower communities, and contribute to the sustainable advancement of higher education in South Africa and beyond.

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