DIGITAL TRANSFORMATION CHALLENGES IN HIGHER EDUCATION INSTITUTIONS POST COVID-19

Nobuhle Elizabeth Ndaba *, Gedala Mulliah Naidoo **

* *Corresponding author,* Department of Communication, Mangosuthu University of Technology, Durban, South Africa
Contact details: Mangosuthu University of Technology, 511 Griffiths Mxenge Hwy, Umlazi, 4026 Durban, South Africa
** Faculty of Humanities and Social Sciences, University of Zululand, Empangeni, South Africa

OPEN ACCESS

How to cite this paper: Ndaba, N. E., & Naidoo, G. M. (2024). Digital transformation challenges in higher education institutions post COVID-19. *Corporate Governance and Organizational Behavior Review, 8*(3), 54–63. https://doi.org/10.22495/cgobrv8i3p5

ISSN Online: 2521-1889
ISSN Print: 2521-1870

Received: 11.03.2024
Accepted: 20.08.2024

JEL Classification: A10, A29, I23
DOI: 10.22495/cgobrv8i3p5

Abstract

Higher education institutions (HEIs) encountered an unanticipated and unprepared digital transformation because of COVID-19, which obliged most services, including teaching, learning, and working, to shift from physical to digital and virtual platforms. Digital transformation among employees provided an opportunity for technological upgrades and challenged technological competence and adaptability among employees to enable transitions between physical and virtual platforms. As a result, this paper through the technology acceptance model (TAM) reflects on factors that influence successful transformation of technological adoption among support staff members in a university of technology (UOT). This paper argues that the use of TAM to predict staff members' attitudes toward adopting new technology can assist HEIs in decision-making regarding technology selection. Using descriptive research design and non-probability sampling method, data was collected from 177 support staff members from different departments. The findings of the study, which emanated from surveys, established that employees' digital skills need improvement; lack of digital infrastructure funding; poor planning and unclear forms of communication proved to be a recipe for failure to implement a successful digital shift and in creating acceptance digital user behaviour among the employees.

Keywords: Digital Transformation, Higher Education Institutions, Fourth Industrial Revolution (4IR), Employees, Technology

Authors' individual contribution: Conceptualization — N.E.N.; Methodology — N.E.N.; Validation — G.M.N.; Investigation — N.E.N.; Writing — N.E.N. and G.M.N.; Supervision — G.M.N.; Project Administration — N.E.N.

Declaration of conflicting interests: The Authors declare that there is no conflict of interest.

1. INTRODUCTION

The digital transformation of the Fourth Industrial Revolution (4IR) brought about the urgency to adopt the use of technology among employees in higher education institutions (HEIs) (Mpungose, 2020a; Masinde & Roux, 2020; Luvalo, 2019). The adoption of digital transformation in HEIs was somewhat accepted with reservation (Mpungose, 2020a; Mishra et al., 2020; Reimers et al., 2020); however, in 2020, the use of such technologies in HEIs for teaching, learning, assessing, and working was the only viable means as the COVID-19 pandemic ravaged every segment of society globally. This resulted in the closure of almost all institutions globally (Mpungose, 2020b; Mhlanga, 2021), and higher education was not exceptional in these disruptions.

According to the Department of Higher Education and Training (DHET, 2020), the COVID-19 pandemic brought about a shift in the landscape of higher education in South Africa as innovative instructional ways had to be discovered to save lives and save an academic year. Masinde and Roux (2020) stress that the impact of digital transformation is

significant in HEIs, specifically in departments like human resource and development, institutional planning, research directorate, corporate affairs, information, communication, and technology (ICT), and quality assurance. Mpungose (2020a) advocates that an era of digital transformation has arrived to get rid of operational strategies used in previous revolutions in the current context. The current era of digital transformation delivers a better perspective to align HEIs with advanced technological engagements (Chen et al., 2021; Caballero-Morales, 2021; Naidoo & Israel, 2021) which enables creative ways for policymakers including employees of HEIs to incorporate digital technologies and progressive digitalization in departments and units for a transformed working approach. González-Pérez and Ramírez-Montoya (2022) affirm that the current disruptive footprint of 4IR and related technologies requires HEIs to relook at their institutional strategic plans or goals and modify them for a fast-changing and growing digital revolution of the 21st century. One of the predominant megatrends of the 21st-century university is the adaptation of digital transformation. This is proven by how most universities globally are incorporating 4IR technologies like artificial intelligence (AI), blockchains, augmented realities and others to enhance learning for students and work for employees (Barakabitze et al., 2019).

As such, the digital transformation of HEIs is about advancing and augmenting employee capabilities instead of replacing them with fourth-industrial revolution technologies. Moreover, there is a gap in the literature that details the impact of digital transformation among support staff members in HEIs post COVID-19. Studies conducted are mainly focused on the impact of 4IR in education, the impact of 4IR in industries, and digital transformation among students, to name a few (Clauss et al., 2021). Other studies conducted by Ciampi et al. (2021) and Mhlanga (2021) are about the digital skills gap among students and the use of technology for blended learning in university contexts conducted in India, the United Kingdom, and South Africa, respectively. Other researchers, like González-Pérez and Ramírez-Montoya (2022), also conducted studies on AI and 4IR in industries and companies.

While some parts of the above studies can be used for this study, it would be impractical to generalise findings, recommendations, or a conceptual framework to fit this study given the different aspects, regions, and contexts of the study. It is based on such knowledge that this study is shaped and aligned with the technology acceptance model (TAM). TAM broadly look at the behaviour and attitudes of technology users, and the motives to embrace new technology, which are regarded as perceived usefulness (PU) and perceived ease of use (PEOU). The study aims to determine how support staff members in HEIs embrace digital transformation postCOVID-19.

The structure of this paper is as follows. Section 2 details the literature and components which are necessary for the implementation and adoption of digital transformation such as funding of digital infrastructure and application of TAM to assess employees' attitude towards transformation. Section 3 provides methodological procedures of how participants were selected, data collection and presentation of results. Section 4 analyses data based on the findings. Section 5 discusses the implications of results in line with the literature and uses research gaps of the study to provide solutions and future research on digitalisation in HEIs. Section 6 reflects an overall study, main research findings, and limitations, and suggests approaches for future studies in HEIs and digital transformation.

2. LITERATURE REVIEW

The term digital transformation does not have a standard definition (Kimberling, 2021a, 2021b) as it is used in different sectors having to do with "shift in connectivity", "going online", "virtual", "change", "switch", "evolution", and "reshaping" of traditional methods of execution of duties (Newman, 2018; Schallmo & Williams, 2018; Scherer, 2016; Kimberling, 2021a; Baruffaldi, et al., 2020; Aoki, 2020). Newman (2018) and Schallmo and Williams (2018) clarify that the term digital transformation is further used interchangeably or synonymous with "digitalisation", or "digital age" and has been popular since the beginning of the 4IR era, even more, common during the COVID-19 age in HEIs. Below are some of the concepts from the body knowledge which explain digital transformation.

Table 1. Various explanation of digital transformation

Definition of digital transformation	*Reference*
Digital transformation is how an institution or organisation is future-proofed technologically.	PricewaterhouseCoopers (PwC, n.d.)
A digital transformation is a technological approach to all aspects of the organisation, ranging from business frameworks to clientele encounters to processes and performance.	Verhoef et al. (2021), Xing and Marwala (2017)
Digital transformation is defined as the reshaping and conversion of the organisation's framework which results in innovation and technological success.	Muro et al. (2019)
Digital transformation refers to information technology (IT) modernization (like cloud computing), technological effectiveness, and the innovation of new communicative business configurations using virtual initiatives such as learning or working online.	Kohli and Melville (2019), Kosciejew (2021)
Digital transformation is typically associated with 4IR and the use of technology through the incorporation of AI, virtual realities, quantum physics, robotics machines, and augmented realities within the business.	Warhurst and Hunt (2019)
Digital transformation is a change in culture and operation in an organisation through the blending of digital technologies in operation to improve capability and skill across all levels in a strategic manner.	Lund et al. (2020), Luce (2020)

Digital transformation is a concept that is highly associated with industrial revolutions. To gain a better understanding of digital transformation and what it entails, it is important to understand the evolution of revolutions. Man and Man (2019) caution that the realities of digital transformation should not be celebrated without reflecting on the history of the First Industrial Revolution (1IR), the Second Industrial Revolution (2IR), and the Third Industrial Revolution (3IR) and how each of these

revolutions changed the nature of HEIs to stay relevant against all technological odds. The 1IR (1770–1860) caused a diverse approach to higher education in the sense that it initiated institutional pointers and technological concepts for educational institutions, offering diversified work models using the technology of that time. The adoption of these work models saw a global rise and tremendous transformation in the digital literacy of universities. The 2IR (1860–1900) came into existence during a period known as the production or manufacturing era, which was accelerated using electricity (Barakabitze et al., 2019; Bongomin et al., 2020). According to Mhlanga (2021), this is the same period whereby HEIs experienced an increase and exponential growth in access for enrolment and recruitment of employees. The 3IR (1980–1990) was a period whereby digitalization and online platforms surfaced and were adopted widely by organisations, including universities. The 4IR is highly associated with digital transformation due to the staggering confluence of disruptive technology breakthroughs, uncovering wide-ranging fields such as AI, robotics, the Internet of Things (IoT), autonomous vehicles, 3D printing, nanotechnology, and biotechnology.

2.1. Funding digital infrastructure in HEIs

The risk of digital transformation in HEIs is inequality between "the haves and the have-nots". This refers to students, personnel, and previously advantaged as well as disadvantaged institutions. Inequalities in infrastructure development, transformation, or rebuilding are visible when comparing government-funded institutions with their counterparts who were not affected by the laws of the previous government in South Africa. Mpungose (2020a) mentions that there is a narrative in HEIs that only affording institutions are further funded to enhance their infrastructure to suit the needs of current technological trends, while previously disadvantaged institutions are left behind, if not underfunded, to transform buildings, operational devices, and learning infrastructure (Ali, 2020; Archibald et al., 2019; Ashiq et al., 2021). The funding challenge to complete the successful implementation of digital transformation in HEIs is a stumbling block between change and transformation.

According to the DHET's (2021) report, although funding for research, teaching, and learning increased from 2017 up to date, there has been little monetary investment in digital infrastructure, applications, and the physical outlook of lecture theatres, office space, workshops, and laboratories. The implications of the lack of funding lead to increased tuition fees annually and the use of old models and infrastructure, thus sabotaging efforts to bring digital transformation. Ciampi et al. (2021) mention that digital transformation requires the prioritisation of certain departments over others. Allocating appropriate funds to ICT departments will ensure that infrastructure, connectivity networks, software, and hardware in an institution are well updated to embrace full digital modification, thus improving stakeholder participation, revenue generation, and a positive move towards the smart university of the future.

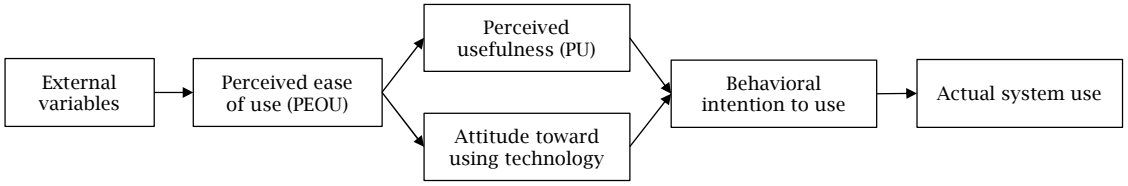
The challenge for public universities specifically is securing funding, setting aside funds for new technological advancements, and prioritising the issue of supporting employee development among the employees (Reimers et al., 2020; Baia et al., 2020). Public universities in South Africa are currently dealing with diminishing budgets due to reduced government funds, and they are experiencing a decrease in stakeholder partnerships due to the current uncertain economic situation. For new digital transformation to thrive in HEIs, substantial financial backing is needed. The biggest cost for the provision of training is related to qualified employees and technological infrastructure.

2.2. Theoretical framework

This paper is underpinned by TAM. TAM details holistic factors which influence technological transformation in the work environment. It broadly looks at the behaviour and attitudes of technology users and the motives to embrace new technology which is regarded as PU and PEOU.

TAM is a model developed by Davis (1989) to determine factors that influence technology acceptance in the workplace. The model offers two important individual beliefs about using technology that is: PU and PEOU; these two components explain the user's intention to use the technology. PEOU determines if a person believes that using a certain technology will be free from effort. PEOU focuses on how the user utilises a specific tool with ease. Studies by Alonso et al. (2010) and Mohammadi (2015) demonstrate that PEOU has a direct and indirect impact through the usefulness of technology. PEOU unlike PU has no critical impact on the behavioural expectation to utilise technology. It does not directly affect the user's behavioural attitude since it affects behavioural expectation through PU. Davis (1989) concluded that PU was the strongest predictor of one's intention to use IT.

Figure 1. Diagram illustrating TAM



Source: Authors' elaboration based on Davis (1989).

2.2.1. TAM model concerning digital transformation in HEI

Research by Hameed and Counsell (2012) recognizes the need to address productivity conundrums in which there is a contradictory relationship between technology investment and organisational performance due to a lack of technology adoption by employees. Studying and developing frameworks help to better understand why employees accept or reject new technology (Venkatesh & Bala, 2008; Zorn et al., 2011). TAM relates with the study when considering factors that influence the success of technology adoption, during the pandemic season, universities have invested time and money into new IT projects that resulted in both success and failure. Choosing and successfully implementing new technology presented a challenge for HEIs seeking to predict not knowing if employees will utilise these new technologies or not.

2.2.2. Conceptualising a model for digital transformation

In the context of the TAM model, PEOU indicates two things about digital and technological transformation in HEIs:

a) employees are more likely to accept and use new technology if they perceive the technology (4IR technologies) as easy to use;

b) PEOU should be determined when an employee believes that working virtually or remotely or using technology is free of effort.

For example, employees may perceive duties like online registrations, virtual training on Microsoft Teams or Zoom, developing work schedules or working through emails are entirely easy functions in bringing flexibility and efficiency.

It is important to note that there are external factors that shape a personnel's PEOU thus creating negative attitudes towards technology such as:

- limited training on software;
- connectivity challenges such as power outages;
- poor network;
- lack of technical support to resolve technical problems associated with working digitally.

2.2.3. Perceived technology usefulness

Digital transformation acceptance is influenced by PU. PU is determined by an employee's belief that, for example, working remotely or migrating manual services to digital platforms enhances job performance. The researchers propose that ICT departments in HEIs take note of the following:

- increase turnaround time for feedback on software, network, or connectivity issues;
- provide multiple and effective means of reaching out like standby personnel, self-service platforms, uploading step-by-step guidelines or videos to troubleshoot system problems;
- conduct regular IT awareness campaigns on cybersecurity, hacking, digital behaviour, and online information protection and finally;
- provide feedback channels where staff members can have their input to improve active communication.

2.2.4. Behavioural intention

The availability of technological access such as tailored workshops, clear channels of communication, provision of data or stability of network connectivity and up-to-date devices influences the behaviour and attitude of employees on whether they will accept or reject technology (Almeida et al., 2020; Anwar & Graham, 2021). Technology acceptance and usage among employees post COVID-19 have exponentially improved, due to the forced work-from-home mandate. The researchers believe that the digital transformation acceptance model is critical due to students' unrest, shortage of physical infrastructure in HEIs, understaffed departments, geographical separation of campuses and staff members' inconsistent time availability due to work due to personal commitments. Institutional progress and viability are dependent on technology acceptance so that members can maintain communication. Therefore, adopting new digital technologies which come with 4IR in HEIs can increase efficiency and establish legitimacy.

3. RESEARCH METHODOLOGY

This study uses a descriptive research design in the form of a survey. A set of structured questions were drawn up on the issues under investigation on digital transformation. Items on the questionnaire were measured on a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Researchers were granted permission and ethically cleared to collect data from specific staff members by the university research ethics committee. Babbie (2020) cautions that researchers must be careful not to harm respondents physically and mentally. To ensure anonymity and confidentiality of respondents, respondents' identities were not revealed during and after the research process, and the information obtained in the study was treated with the strictest confidence to protect the identities of participants. Data was collected from 177 support staff members from the Research Directorate, ICT Department, Institutional Planning Unit, Marketing & Communication, Teaching & Learning Unit, Quality Assurance Department, and Human Resources & Development Department. This study used a quota sampling technique, a procedure in the category of non-probability sampling whereby a researcher chooses a sample of individuals who are representative of a larger population (Bazeley, 2015). The researchers used a digital questionnaire to collect data. A digital questionnaire across all participants in each department was created using Google Forms and the link was distributed to respondents using an internal university email. Quantitative data analysis was conducted, and the completed questionnaires were analysed using Statistical Package for the Social Sciences (SPSS v. 28) software. The questions on the questionnaire were categorised so that responses provide answers to each research question.

4. RESEARCH RESULTS

Table 1 below describes the overall gender distribution by age.

Table 1. Gender and age of respondents

Age (years old)		*Gender*		*Total*
		Male	*Female*	
< 30 years old	Count	5	10	15
	% within age (years)	33.3%	66.7%	100.0%
	% within gender	11.1%	7.6%	8.5%
	% of total	2.8%	5.6%	8.5%
30–39 years old	Count	13	43	56
	% within age (years)	23.2%	76.8%	100.0%
	% within gender	28.9%	32.6%	31.6%
	% of total	7.3%	24.3%	31.6%
40–49 years old	Count	22	59	81
	% within age (years)	27.2%	72.8%	100.0%
	% within gender	48.9%	44.7%	45.8%
	% of total	12.4%	33.3%	45.8%
50–59 years old	Count	3	18	21
	% within age (years)	14.3%	85.7%	100.0%
	% within gender	6.7%	13.6%	11.9%
	% of total	1.7%	10.2%	11.9%
60+ years old	Count	2	2	4
	% within age (years)	50.0%	50.0%	100.0%
	% within gender	4.4%	1.5%	2.3%
	% of total	1.1%	1.1%	2.3%
Total	Count	45	132	177
	% within age (years)	25.4%	74.6%	100.0%
	% within gender	100.0%	100.0%	100.0%
	% of total	25.4%	74.6%	100.0%

Table 1 indicates that 5 males (33.3%) who participated in the study are less than 30 years old, while there are 10 (66.7%) female respondents who participated in the same age category. Within the age category of 30 years old to 39 years old, 13 (23.2%) were male respondents and 43 (76.8%) were female respondents. Within the category of 40 years old to 49 years old, 22 (27.2%) respondents were males whereas 59 (72.8%) respondents were female. In the age category of 50 years old to 59 years old, 3 (14.3%) respondents were males, and 18 (85.7%) respondents were females. The above 60-year-old age category comprised 2 (50%) male respondents and 2 (50%) female respondents. The age distributions are not similar as there are more respondents older than 40 years old ($p < 0.001$). The table indicates the overall gender ratio of males to females is approximately 1:3 (25.4%:74.6%) ($p < 0.001$). These results signify diversity in HEI, in terms of age and gender. It is notable that the majority of respondents are digital immigrants (Amankwah-Amoah et al., 2021), thus technological challenges, confusion, and willingness to explore are expected in this type of respondents.

Participants were requested to indicate their departments and the results are as follows.

Table 2. Department distribution of respondents

Department	*Frequency*	*Percentage*
ICT	49	27.7
Marketing & Communications	42	23.7
Human Resources & Development	29	16.4
Institutional Planning Unit	18	10.2
Teaching & Learning Unit	17	9.6
Research Directorate	13	7.3
Quality Assurance	9	5.1
Total	177	100.0

Table 2 shows the overall respondents' participation per department. The table shows that 49 respondents (27.7%) who participated in the study are from the ICT Department, 42 respondents (23.7%) are from Marketing & Communications, 29 respondents (16.4%) from Human Resources & Development, 18 respondents (10.2%) from Institutional Planning, 17 respondents (9.6%) are from Teaching & Learning, while 13 respondents (7.3%) are from Research Directorate, and 9 respondents (5.1%) from Quality Assurance. Respondents from these departments were chosen based on the strategic roles they play when new developments are introduced in institutions and are believed to be at the forefront of transformation in their institutions. It is notable that the ICT Department had the largest representation followed by Marketing & Communications, whereas Quality Assurance had the smallest representation in the sample. ICT staff members are particularly at the forefront of digital transformation and researchers have noted that over the years the use of external service providers, and consulting firms in HEIs whereby external service providers are mandated to "fill the gap" and "assist departments" like ICT with the latest skills, information, and knowledge of the industry in which full-time personnel are not capacitated to perform due to licence issues, or not having skilled on a specific area.

Figure 2 analyses responses to the statement "*Digital transformation brought challenges in my work process*".

Figure 2. Digital transformation challenges

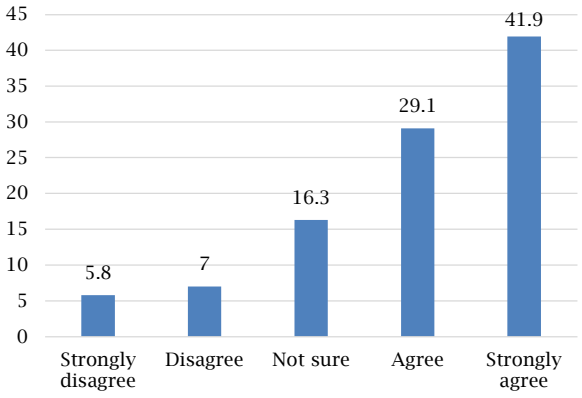


Figure 2 shows that respondents believe that digital transformation brought challenges to their work plan. 41.9% and 29.1% of participants strongly and agree respectively. Whilst 16.3% of participants are not sure of any challenges brought by 4IR, 7% and 5.8% disagree and strongly disagree, respectively, that 4IR brought challenges. These figures challenge policymakers to draft a comprehensive digital transformation framework that provides a structured approach to guide employees through the transformation journey. The primary aim of the digital framework should be to assist employees adopt and ensure a smooth transition of services from physical to digital platforms. In addition, HEIs should have macro and micro digital goals as the one-size-fits-all approach is not applicable to digital transformation.

Figure 3 analyses responses to the statement "*I understand what digital transformation is*".

Figure 3. Responses showing respondents' level of understanding of digital transformation

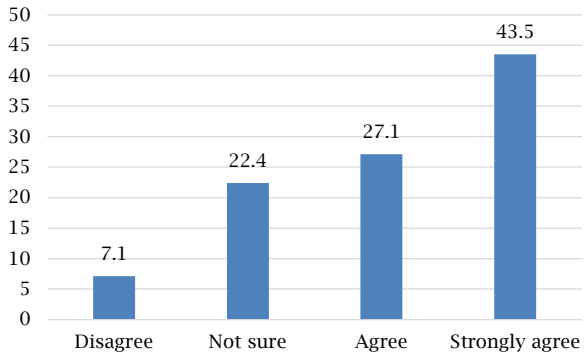


Figure 3 shows that respondents have a high level of awareness about digital transformation. Most respondents 43.5% and 27.1% (strongly agree and agree respectively) show higher levels of understanding of digital transformation whereas 22.4% of respondents are not sure of what is digital transformation and 7.1% do not know what is meant by digital transformation. It is interesting to note that this finding affirms the results of a study conducted by Anshari et al. (2022) confirming that digital transformation became known across HEIs from the beginning of the 21st century, thus making its blueprint among students, staff members and executive management. Moreover, these results imply what Ali (2020) mentions as a synchronous digital understanding between HEIs and industries, whereby the university is relevant to the needs of the industry.

Figure 4 analyses responses to the statement: "*Digital transformation is too complex to understand*".

Figure 4. Digital transformation perception

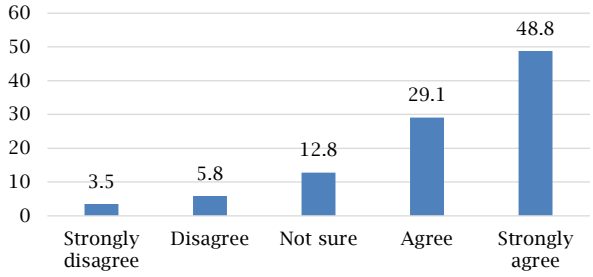


Figure 4 shows that a small number of respondents do not agree that digital transformation is complex to comprehend. It shows that 3.5% and 5.8% of respondents strongly disagree and disagree with the statement, while 12.8% of respondents are not sure. In contrast, 29.1% of respondents affirm the statement and 48.8% of respondents strongly agree that digital transformation is too complex. Warhurst and Hunt (2019) admit that digital transformation is very complex and affects multiple aspects of an organization, and the adoption of new technologies requires a shift in the way a business operates. This complexity can make it difficult to manage and coordinate transformation effectively.

Figure 5 analyses responses to the statement "*Digital transformation is a threat to my job*".

Figure 5. Respondents' views on digital transformation as a threat

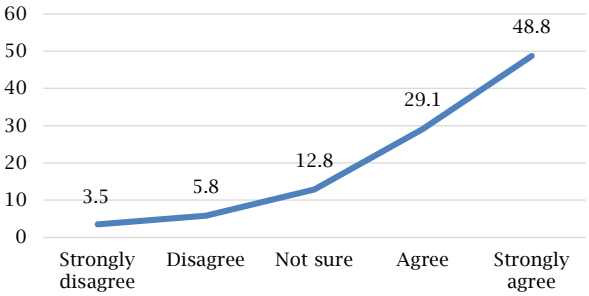


Figure 5 shows that respondents are threatened by the digital transformation phenomenon. About 51.2% of respondents strongly agree with the statement, 26.7% of respondents also affirm that digital transformation threatens their jobs whereas 15.1% of respondents are not sure, and 3.5% of respondents are not threatened by digital transformation. Based on the figures above, one may safely conclude that as HEI started to embrace digital transformation in recent years, there are many fears of the unknown future among employees, fearing that robots will be employees of the future and the advancement of AI chatbots creates digital anxiety among digital immigrants

Figure 6 analyses responses to the statement "*My digital skills need improvement*".

Figure 6. Respondents' views on their digital literacy skills

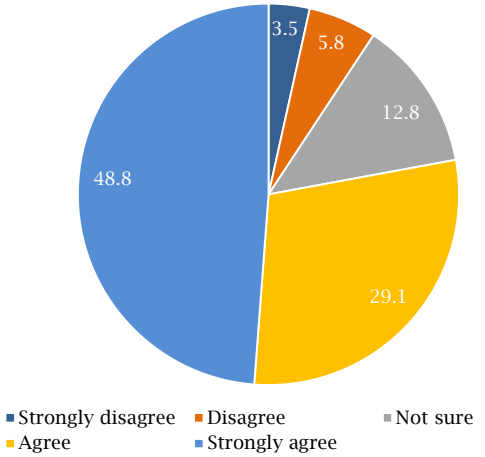


Figure 6 shows that respondents' digital skills need improvement, and it is shown that 46.5% of respondents strongly agree with the statement while 40.7% of respondents are also concurring. Then 7.0% of respondents are not sure if their digital skills need improvement, 4.7% of respondents disagree and 1.2% of respondents strongly disagree with the statement. These results imply that institutions should invest in training their staff members as digital transformation is a constantly changing process underpinned by highly disruptive technological developments and that institutions need to invest in digital infrastructure. Koulouris et al. (2021) mention that employers should invest in digital training of the employees, emphasising that digital training teaches digital responsibility and to communicate professionally and ethically when using digital technologies. Digital transformation training further increases digital dependence by exposing users to copyright issues, information vetting and other online ethical etiquette.

Figure 7 analyses responses to the statement "*There is no training provided for staff members to enhance digital transformation skills*".

Figure 7. Respondents' views on digital transformation training

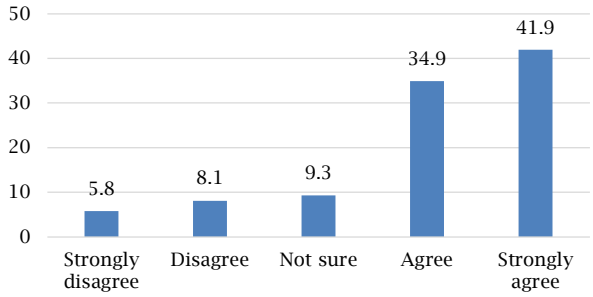


Figure 7 shows that respondents are not trained to use work-related applications or software. It is projected that 41.9% of respondents strongly agree and 34.9% also affirm the statement whilst 9.3% of respondents are not sure. Only 8.1% of respondents disagree and 5.8% strongly disagree. These results indicate that HEIs have not prioritised equipping staff members with current and future technological initiatives, thus challenging the management of the institution to invest more in digital initiatives for relevance of the institution with the current trends and personal development of employees. Lund et al. (2020) caution that digital training is not a one-size-fits-all approach rather there should be a tailor-made program which speaks to an individual unit or department. Digital transformation trainings increase digital fluency among staff members by enabling technology users to have the ability to discern information and be safe and savvy.

5. DISCUSSION OF THE RESULTS

It is important to firstly reflect on how this study is framed and undertaken before recommending future research in digital transformation. The study was conducted in one university of technology (UOT) out of six in South Africa. It is, therefore, recommended that future studies include institutions from diverse locations, and study at least three UOTs so that findings can be generalised across the entire spectrum of such universities. The unit of analysis was limited to support staff members, which generally form a smaller population compared to the student and academic population which form a large part of the university population. Future studies of similar studies can increase the population by including academic staff members, and final or postgraduate students depending on the nature of the problem. Therefore, the outcomes of the study can be generalised to support staff members in UOTs only; and cannot apply to comprehensive and traditional universities as contexts and mandates of institutions are unique. Data was analysed and interpreted such that it provides an overall view of a question based on the respondents' institution. Future research can investigate similar problems based on respondent demographic information such as evaluating the impact of digital transformation among males/females/black/Indian employees in human resource/ICT or age groups of employees of UOTs. Furthermore, HEIs should invest in employee development and retention programs. Employee development and retention programs are critical for HEI employees to embrace technological change and for the success of institutional vision (Warhurst & Hunt, 2019; Kabadayi et al., 2020). Not only do development and retention programs offer opportunities for staff members to improve their digital skills, but they also enhance productivity levels and willingness to embrace change. For instance, employees can be purposefully selected to attend the digital transformation and development courses offered either online or hybrid which enables attendees to navigate and understand skills to evaluate the effects of digital technology and the implementation of organisational transformation in HEIs (Advani, 2023). Digital transformation skills are effective for employees to build a firm digital foundation by integrating and linking 4IR technologies in day-to-day work. The outcomes of these skills yield positive results such as instant digital challenges resolved in the space of hours or few days rather than months and relying on human presence as well as human intelligence. Aker and Herrera (2020) emphasize that capacitating staff members with digital skills is essential for employees to avoid technology anxiety and the fear of job losses in the future. The provision of Internet routers and data bundles to staff members increased the accessibility of digital working whilst indirectly perfecting digital literacy skills among staff members (Mishra et al., 2020; Moraes et al., 2023). As the HEIs become increasingly digital, employees should have access to high-end, better, faster, and reliable digital infrastructure and an ideal digital infrastructure investment that is characterised by build once, monetise for decades. Furthermore, institutions should secure sponsorship and funding solely for the advancement and upgrade of network servers, software, operating systems, firewalls, network security and other related hardware. To capacitate staff members with appropriate skills for the future; feedback, evaluation and responsiveness should be prioritised. In academia, the curriculum is evaluated from time to time to ensure its responsiveness to the economy and industry; a similar exercise should take place with digital

transformation. Technological evaluation needs to be prioritised by institutions to ensure the relevance of support staff employees to the current trends of 4IR. There should be a managing body or committee responsible for ensuring that institutional strategic goals are digitally futuristic.

6. CONCLUSION

The issue of securing sponsorship and funding public universities continues to be a challenge to the national government with the current declining economy of South Africa (DHET, 2021). This causes institutions to prioritise students' needs leaving behind the issue of investing in resources for digital infrastructure. Therefore, the study could not identify time frames where HEIs' digital and physical infrastructure will be synchronous with the demand and the speed of the current technological acceleration. Universities ought to understand that improving the digitalisation of services is an ongoing process that requires commitment, resources, and a strategic approach. By investing in the digital competence of their staff, institutions can enhance teaching and learning outcomes, operational efficiency, and ultimately, their ability to fulfil their educational mission. As the HEI sector becomes increasingly digital, employees should have access to high-end, better, faster, and reliable digital infrastructure and an ideal digital infrastructure investment that is characterised by "build once, monetise for decades". Furthermore, institutions should secure sponsorship and funding solely for the advancement and upgrade of network servers, software, operating systems, network security and other related hardware. HEIs should embrace and adopt a strategic and employee-centric approach to maximise digital growth and technological user acceptance among its employees. Feedback, evaluation, and responsiveness should be prioritised. In academia, curriculum is evaluated from time to time to ensure its responsiveness to the industry; a similar exercise should take place with digital transformation. Technological evaluation needs to be prioritised to ensure the relevance of support staff employees to the current trends and there should be a managing committee responsible for ensuring that institutional goals are digital and futuristic.

The population of the study was limited to support staff members, which is a smaller study population compared to academic staff members and students. This research also was limited to universities of technology in one province, it is recommended that future studies use traditional and comprehensive universities.

Future studies of similar scope can increase the population by including academic staff members, and final or postgraduate students depending on the nature of the problem.

Therefore, outcomes of the study can be generalised to support staff members in UOTs only; and cannot be applicable to comprehensive and traditional universities as contexts and mandates in both institutions are unique.

Future studies can further investigate a similar problem based on respondent demographic information such as evaluating the impact of digital transformation among male/female/black/Indian employees in human resource/ICT or age group of employees of UOTs.

REFERENCES

Advani, A. (2023, January 2). *Education 4.0: Here are 3 skills that students will need for the jobs of the future World Economic Forum.* World Economic Forum. https://www.weforum.org/agenda/2023/01/skillsets-cultivated-by-education-4-0-davos23/

Aker, M., & Herrera, L. J. P. (2020). Smart literacy learning in the twenty-first century: Facilitating PBSL pedagogic collaborative clouds. In S. Yu, M. Ally, & A. Tsinakos (Eds.), *Emerging technologies and pedagogies in the curriculum* (pp. 429–445). Springer. https://doi.org/10.1007/978-981-15-0618-5_25

Ali, W. (2020). Online and remote learning in higher education institutes: A necessity in light of COVID-19 pandemic. *Higher Education Studies, 10*(3), 16–25. https://doi.org/10.5539/hes.v10n3p16

Almeida, F., Duarte Santos, J., & Augusto Monteiro, J. (2020). The challenges and opportunities in the digitalization of companies in a post-COVID-19 world. *IEEE Engineering Management Review, 48*(3), 97–103. https://doi.org/10.1109/EMR.2020.3013206

Alonso, I. A., Verdún, J. C., & Caro, E. T. (2010). Information technology to help drive business innovation and growth. In T. Sobh & K. Elleithy (Eds.), *Innovations in computing sciences and software engineering* (pp. 527–232). Springer. https://doi.org/10.1007/978-90-481-9112-3_90

Amankwah-Amoah, J., Khan, Z., Wood, G., & Knight, G. (2021). COVID-19 and digitalization: The great acceleration. *Journal of Business Research, 136*, 602–611. https://doi.org/10.1016/j.jbusres.2021.08.011

Anshari, M., Syafrudin, M., & Fitriyani, N. L. (2022). Fourth Industrial Revolution between knowledge management and digital humanities. *Information, 3*(1), 292–307. https://doi.org/10.3390/info13060292

Anwar, M. A., & Graham, M. (2021). Between a rock and a hard place: Freedom, flexibility, precarity and vulnerability in the gig economy in Africa. *Competition & Change, 25*(2), 237–258. https://doi.org/10.1177/1024529420914473

Aoki, K. (2020). Technologies for lifelong and life-wide learning and recognition: A vision for the future. In S. Yu, M. Ally, & A. Tsinakos (Eds.), *Emerging technologies and pedagogies in the curriculum* (pp. 41–52). Springer. https://doi.org/10.1007/978-981-15-0618-5_3

Archibald, M. M., Ambagtsheer, R. C., Casey, M. G., & Lawless, M. (2019). Using Zoom videoconferencing for qualitative data collection: Perceptions and experiences of researchers and participants. *International Journal of Qualitative Methods, 18*. https://doi.org/10.1177/1609406919874596

Ashiq, M., Ur Rehman, S., Safdar, M., & Ali, H. (2021). Academic library leadership in the dawn of the new millennium: A systematic literature review. *The Journal of Academic Librarianship, 47*(3), Article 102355. https://doi.org/10.1016/j.acalib.2021.102355

Babbie, E. R. (2020). *The practice of social research* (15th ed.). Oxford University Press.

Baia, E., Ferreira, J. J., & Rodrigues, R. (2020). Value and rareness of resources and capabilities as sources of competitive advantage and superior performance. *Knowledge Management Research & Practice, 18*(3), 249–262. https://doi.org/10.1080/14778238.2019.1599308

Barakabitze, A. A., Lazaro, A. W.-A., Ainea, N., Mkwizu, M. H., Maziku, H., Matofali, A. X., & Sanga, C. (2019). Transforming African education systems in science, technology, engineering, and mathematics (STEM) using ICTs: Challenges and opportunities. *Education Research International, 1*, Article 6946809. https://doi.org/10.1155/2019/6946809

Baruffaldi, S., van Beuzekom, B., Dernis, H., Harhoff, D., Rao, N., Rosenfeld, D., & Squicciarini, M. (2020). *Identifying and measuring developments in artificial intelligence: Making the impossible possible* (OECD Science, Technology, and Industry Working Paper No. 2020/05). OECD Publishing. https://doi.org/10.1787/5f65ff7e-en

Bazeley, P. (2015). Mixed methods in management research: Implications for the field. *Electronic Journal of Business Research Methods, 13*(4), 27–35. http://handle.westernsydney.edu.au:8081/1959.7/uws:40984

Bongomin, O., Ocen, G. G., Nganyi, E. O., Musinguzi, A., & Omara, T. (2020). Exponential disruptive technologies and the required skills of Industry 4.0. *Journal of Engineering, 1*, Article 4280156. https://doi.org/10.1155/2020/4280156

Caballero-Morales, S.-O. (2021). Innovation as recovery strategy for SMEs in emerging economies during the COVID-19 pandemic. *Research in International Business and Finance, 57*, Article 101396. https://doi.org/10.1016/j.ribaf.2021.101396

Chen, C.-L., Lin, Y.-C., Chen, W.-H., Chao, C.-F., & Pandia, H. (2021). Role of government to enhance digital transformation in small service business. *Sustainability, 13*(3), Article 1028. https://doi.org/10.3390/su13031028

Ciampi, F., Demi, S., Magrini, A., Marzi, G., & Papa, A. (2021). Exploring the impact of big data analytics capabilities on business model innovation: The mediating role of entrepreneurial orientation. *Journal of Business Research, 123*, 1–13. https://doi.org/10.1016/j.jbusres.2020.09.023

Clauss, T., Kraus, S., Kallinger, F. L., Bican, P. M., Brem, A., & Kailer, N. (2021). Organisational ambidexterity and competitive advantage: The role of strategic agility in the exploration-exploitation paradox. *Journal of Innovation & Knowledge, 6*(4), 203–213. https://doi.org/10.1016/j.jik.2020.07.003

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Department of Higher Education and Training (DHET). (2020, October 23). *Saving the 2020 academic year: DHET, USAf & SAUS briefings; with Minister*. Parliamentary Monitoring Group. https://pmg.org.za/committee-meeting/31288/

Department of Higher Education and Training (DHET). (2021). *Post-school education and training monitor: Macro-indicator trends*. https://www.dhet.gov.za/Planning%20Monitoring%20and%20Evaluation%20Coordination/Post-School%20Education%20and%20Training%20Monitor%20-%20Macro-Indicator%20Trends%20-%20March%202021.pdf

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st century skills frameworks: Systematic review. *Sustainability, 14*(3), Article 1493. https://doi.org/10.3390/su14031493

Hameed, M. A., & Counsell, S. (2012). Assessing the influence of environmental and CEO characteristics for adoption of information technology in organizations. *Journal of Technology Management & Innovation, 7*(1). http://doi.org/10.4067/S0718-27242012000100005

Kabadayi, S., O'Connor, G. E., & Tuzovic, S. (2020). Viewpoint: The impact of coronavirus on service ecosystems as service mega-disruptions. *Journal of Services Marketing, 34*(6), 809–817. https://doi.org/10.1108/JSM-03-2020-0090

Kimberling, E. (2021a, December 26). *What is the best digital transformation methodology?* Third Stage Consulting Group. https://www.thirdstage-consulting.com/what-is-the-best-digital-transformation-methodology/

Kimberling, E. (2021b, September 23). *What is customer experience?* Third Stage Consulting Group. https://www.thirdstage-consulting.com/what-is-customer-experience/

Kohli, R., & Melville, N. P. (2019). Digital innovation: A review and synthesis. *Information Systems Journal, 29*(1), 200–223. https://doi.org/10.1111/isj.12193

Kosciejew, M. (2021). The coronavirus pandemic, libraries and information: A thematic analysis of initial international responses to COVID-19. *Global Knowledge, Memory and Communication, 70*(4–5), 304–324. https://doi.org/10.1108/GKMC-04-2020-0041

Koulouris, A., Vraimaki, E., & Koloniari, M. (2021). COVID-19 and library social media use. *Reference Services Review, 49*(1), 19–38. https://doi.org/10.1108/RSR-06-2020-0044

Luce, E. (2020, May 1). Tata's lessons for the post-COVID world. *Financial Times*. https://www.ft.com/content/38d127e8-1fd2-4767-8389-4289b55b393b

Lund, S., Madgavkar, A., Manyika, J., & Smit, S. (2020, November 23). *What's next for remote work: An analysis of 2,000 tasks, 800 jobs, and nine countries*. McKinsey and Company. https://www.mckinsey.com/featured-insights/future-of-work/whats-next-for-remote-work-an-analysis-of-2000-tasks-800-jobs-and-nine-countries

Luvalo, L. M. (2019). Relationship between transformation and institutional culture. *South African Journal of Higher Education, 33*(1), 184–199. https://doi.org/10.20853/33-1-2934

Man, G.-M., & Man, M. (2019). Challenges in the Fourth Industrial Revolution. *Land Forces Academy Review, 24*(4), 303–307. https://doi.org/10.2478/raft-2019-0038

Masinde, M., & Roux, P. A. (2020). Transforming South Africa's universities of technology: A roadmap through 4IR lenses. *Journal of Construction Project Management and Innovation, 10*(2), 30–50. https://doi.org/10.36615/jcpmi.v10i2.405

Mhlanga, D. (2021). The Fourth Industrial Revolution and COVID-19 pandemic in South Africa: The opportunities and challenges of introducing blended learning in education. *Journal of African Education, 2*(2), 15–42. https://doi.org/10.31920/2633-2930/2021/v2n2a1

Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during the lockdown period of the COVID-19 pandemic. *International Journal of Educational Research Open, 1*, Article 100012. https://doi.org/10.1016/j.ijedro.2020.100012

Mohammadi, H. (2015). Investigating users' perspectives on e-learning: An integration of TAM and IS success model. *Computers in Human Behavior, 45*, 359–374. https://doi.org/10.1016/j.chb.2014.07.044

Moraes, E. B., Kipper, L. M., Kellermann, A. C. H., Austria, L., Leivas, P., Moraes, J. A. R., & Witczak, M. (2023). Integration of Industry 4.0 technologies with Education 4.0: Advantages for improvements in learning. *Interactive Technology and Smart Education, 20*(2), 271–287. https://doi.org/10.1108/ITSE-11-2021-0201

Mpungose, C. B. (2020a). Beyond limits: Lecturers' reflections on Moodle uptake in South African universities. *Education and Information Technologies, 25*, 5033–5052. https://doi.org/10.1007/s10639-020-10190-8

Mpungose, C. B. (2020b). Is Moodle or WhatsApp the preferred e-learning platform at a South African university? First-year students' experiences. *Education and Information Technologies*, *25*, 927–941. https://doi.org/10.1007/s10639-019-10005-5

Muro, M., Maxim, R., & Whiton, J. (2019, January 24). *Automation and artificial intelligence: How machines are affecting people and places*. Brookings Institution. https://www.brookings.edu/articles/automation-and-artificial-intelligence-how-machines-affect-people-and-places/

Naidoo, G. M., & Israel, C. (2021). A critique of online learning in higher education during the coronavirus lockdown level 5 in South Africa. *African Journal of Development Studies, 11*(1). https://hdl.handle.net/10520/ejc-aa_affrika1_v11_n1_a6

Newman, D. (2018, May 21) Understanding the six pillars of digital transformation beyond tech. *Forbes.* https://www.forbes.com/sites/danielnewman/2018/05/21/understanding-the-six-pillars-of-digital-transformation-beyond-tech/

PricewaterhouseCoopers (PwC). (n.d.). *Is your workforce strategy ready to drive your business forward?* https://www.pwc.com/us/en/services/consulting/business-transformation/workforce-transformation/workforce-strategy.html

Reimers, F., Schleicher, A., Saavedra, J., & Tuominen, S. (2020). *Supporting the continuation of teaching and learning during the COVID-19 pandemic: Annotated resources for online learning*. Organisation for Economic Co-operation and Development (OECD). https://globaled.gse.harvard.edu/files/geii/files/supporting-the-continuation-of-teaching-and-learning-during-the-covid-19-pandemic.pdf

Schallmo, D. R. A., & Williams, C. A. (2018). *Digital transformation now! Guiding the successful digitalization of your business model.* Springer. https://doi.org/10.1007/978-3-319-72844-5

Scherer, M. U. (2016). Regulating artificial intelligence systems: Risks, challenges, competencies, and strategies. *Harvard Journal of Law & Technology*, *29*(2), 353–400. http://doi.org/10.2139/ssrn.2609777

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, *39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research, 122*, 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022

Warhurst, C., & Hunt, W. (2019). *The digitalization of future work and employment. Possible impact and policy responses* (JRC Technical Report No. 2019/05). Joint Research Centre (JRC). https://joint-research-centre.ec.europa.eu/reports-and-technical-documentation/digitalisation-future-work-and-employment-possible-impact-and-policy-responses_en

Xing, B., & Marwala, T. (2017). Implications of the fourth industrial age on higher education. *The Thinker, 73*, 10–15. https://ssrn.com/abstract=3225331

Zorn, T. E., Flanagin, A. J., & Shoham, M. D. (2011). Institutional and noninstitutional influences on information and communication technology adoption and use among nonprofit organizations. *Human Communication Research*, *37*(1), 1–33. https://doi.org/10.1111/j.1468-2958.2010.01387.x