



# Data and Technology Are Revolutionising the Workforce of Tomorrow. Are we keeping up?

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September 2024

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# INTRODUCTION

The digitalisation of the economy has brought about changes to the way work and business is organised and conducted, impacting on occupations, professions and related capabilities needed to service the economy efficiently. The change in the organisation of work with subsequent occupational and professional demand undoubtedly has implications for both learning processes that are required and using the technology that is now available. Since all sectors of the economy are experiencing radical technological change, transforming old and creating new occupations and professions becomes an imperative.

This results in education and training changes, and as both education and the workforce become increasingly mediated by technology, researchers and educators continue to look for technology-mediated solutions to improve engagement and learning outcomes. Research has found that micro-credentials and digital badges are currently extremely motivating to learners and promotes community-building, equity, and flexibility when implemented well (Reider, 2022). In South Africa, the Qualification Council for Trades and Occupations (QCTO) is progressively addressing the need for new occupations to keep up with arising gaps in the labour market, albeit the progress is slow.

Considering the need for specific online educational methodologies and learning outcomes, the importance of governance, ethics, and equity becomes increasingly evident and is therefore explored. The key question is whether South Africa's education and training system can keep pace with the rapid technological advancements and adequately prepare a workforce for this evolving landscape whilst still bearing in mind that certain human values must remain intact.

## THE ROLE OF INTEROPERABILITY IN ENHANCING EDUCATIONAL OUTCOMES

The current reality is a data-driven world where an almost continuous stream of data is generated through processes, platforms and applications monitoring their use (Mortier et al., 2014) and can be used for planning of future programs required by the labour market. This is also the digital age wherein the very way in which we recognise learning is being challenged as we are confronted with concepts such as interoperability, immutability and disintermediation (Rajab et al, 2020). Interoperability is a key concept in the digitalisation of the education sector, enabling different systems and platforms to work together seamlessly.

It is possible to use machines, algorithms and a flow of data to make our lives better to solve complex or complicated problems faster. In addition, interoperability, assists in developing “something that is, jointly, more useful and more innovative than the sum of its parts” (Rehm et al., 2022) and artificial intelligence delivers more powerful and useful information, improved interfaces, better problem solving and information handling (Meng et al., 2020), with the potential to create new economic opportunities requiring up-skilling and re-skilling for increased and continued participation in the global economy (Department of Science and Technology, 2019).

In the context of South Africa's Post School Education and Training (PSET) sector, interoperability has the potential to significantly enhance educational outcomes by facilitating the sharing of data across institutions and enabling more informed decision-making (Rajab et al 2020). For example, by integrating data from multiple sources—such as academic records, employment data, and market trends—institutions can gain a more holistic understanding of learner needs and outcomes (Siemens, 2013). This, in turn, can inform the development of more targeted and effective educational programs and interventions. As new technologies like artificial intelligence (AI), machine learning, blockchain, and the Internet of Things (IoT) develop, they create entirely new industries and occupations. For example, AI has given rise to roles like data scientists, AI specialists, and machine learning engineers. Additionally, interoperability can support more efficient administrative processes, reducing duplication of effort and enabling institutions to allocate resources more effectively.

The PSETCLOUD project, an initiative that intends to ensure that data sets in the South African post school education and training (PSET) sector is designed to be interoperable, well-synchronised and used effectively as a source of information for planning and improving efficiency in the PSET system (Rajab et al, 2020). This is in keeping with the mandate of the State Information Technology Agency (SITA) to ensure reduction in duplication and to enable people to share information. SITA has created minimum operability standards to allow government data systems to talk to one another and exchange data freely (Rajab et al, 2020), and these standards will be explored further while remaining cognisant that the PSET sector is highly complex and comprises a large number of stakeholders with varied and separate data systems. These stakeholders could be supported by an effective shared platform that is able to provide accurate and up-to-date data to the different role-players and support effective reporting, planning and decision making. It is important that stakeholders work together to develop common standards and protocols for data sharing and integration, while also ensuring that data privacy and security are maintained (Rajab & Ntuli, 2023).

Ideally, over time, this system could be populated with real-time data to enhance its responsiveness. Linking such a system to other sources of data such as relevant market and industry indicators could further enhance the system’s analytical capability and could include

big data approaches. Big data refers to datasets that are very large, diverse, combinable, flexible and scalable (Williamson, 2016). Big data is continuously generated and can be analysed in or near real time. This provides the capability for the provision of static snapshots as well as dynamic and continuously updated insights, where the value of “non-traditional data” such as data from citizens, NGOs and the private sector contributes further to the spectrum of research that can be done in a credible manner. The journey into the future with the PSET CLOUD begins with a long-term vision and should continue to be pursued to benefit all citizens of South Africa, especially given the significant progress that has already been made.

Furthermore, South Africa, through the National Development Plan 2030, aims to address a growing divide in society by utilizing information and communication technologies (“ICTs”) to build a more inclusive society in order to eliminate poverty and reduce inequality. The stated aspiration of this effort is that “by 2030, ICTs will underpin the development of a dynamic and connected society and a vibrant knowledge economy that is more inclusive and prosperous” (National Planning Commission, 2012), including holding one of the keys to address the issues of vast unemployment in South Africa (Department of Science and Technology, 2019). Achieving true interoperability requires careful planning and coordination across the PSET sector.

## **THE IMPORTANCE OF DATA GOVERNANCE IN THE DIGITAL AGE**

As post-school education institutions increasingly rely on digital systems to manage learner data, the need for robust data governance frameworks becomes paramount. Data governance refers to the policies, procedures, and standards that ensure data is managed effectively, securely, and ethically across its lifecycle (Abraham, Schneider, & Vom Brocke, 2019). In the context of South Africa's PSET sector, establishing strong data governance practices is crucial not only for protecting learner data but also for enhancing the overall efficiency and effectiveness of the educational system.

Effective data governance involves ensuring that data is accurate, consistent, and accessible to authorised stakeholders while being protected against unauthorised access and breaches (Otto, 2011). This requires clear guidelines on data ownership, data sharing, and data privacy, as well as mechanisms for monitoring compliance with these guidelines. It is. Therefore,



essential that data governance is prioritized to mitigate the risks associated with increased data sharing and to build trust among all stakeholders (Rajab & Ntuli, 2023).

Data privacy has become arguably one of the biggest talking points in the datasphere, characterized by a progressive loss of privacy (Véliz, 2020) – from government agencies shrivelling people (Lyon, 2014) to some big tech companies selling access to personal user data to third parties for targeted advertising (Llorca-Abad & Orón, 2016). Scandals, including the Edward Snowden National Security Agency leak (von Solms & Van Heerden, 2015) and the Cambridge Analytica data scandal (Boldyreva et al., 2018), show how easily people can be manipulated and have their rights infringed. How will countries in the developing world avoid such infringement given that there is very little by way of regulation or policy to protect the individual's rights or their data? In some cases, where policies do exist, it is not clear how are they governed. Much more needs to be done to ensure more dialogue centred around the empowerment of citizens which will build agency of individuals in line with data privacy laws such as the Protection of Personal Information Act, No.4 of 2013 (POPIA) in South Africa (Tiell & Metcalf, 2016).

Most institutions respond to POPIA as a limiting factor in sharing data and there is a need for more engagement and advocacy around Self Sovereign Identity (SSI), what the concept means and how it can be adopted to protect the data of individuals. While technological advancements provide solutions to current challenges, it is ultimately up to us to use these opportunities responsibly and with care. How we navigate this space reflects our consciousness and worldview.

## **BALANCING INNOVATION WITH ETHICAL CONSIDERATIONS**

While technological innovation offers significant opportunities for improving the management and analysis of learner data with labour market demands, it also raises important ethical considerations. One of the key challenges in this regard is ensuring that the use of big data and other advanced technologies does not infringe on learners' rights to privacy and data security nor should we allow what Zuboff (2019) describes as “the crucible of an unprecedented form of power marked by extreme concentrations of knowledge and free from democratic oversight” (Zuboff, 2019). As institutions and government agencies collect and analyse large volumes of learner data, they must do so in a manner that is transparent, accountable, and respectful of individual privacy.

Moreover, the use of big data in education must be carefully managed to avoid reinforcing existing inequalities. Data-driven decision-making processes could inadvertently disadvantage learners from marginalized communities if the data used is biased or incomplete (Barocas & Selbst, 2016). To prevent this, it is crucial that institutions adopt ethical guidelines for the use of big data, including measures to identify and mitigate potential biases in data collection and analysis (Floridi & Taddeo, 2016).

## CURRENT UNEMPLOYMENT STATUS

Stats SA's quarterly surveys consistently show that unemployment is the top concern for South Africans, with the issue being particularly acute among different age groups. An Afrobarometer survey from August 2024 highlights that 54% of respondents aged 18 to 35, 56% of those aged 36 to 55, and 42% of those over 56 identify unemployment as the country's most serious problem. South Africa currently has the highest unemployment rate globally, even when accounting for differences in international measurement methods, with Djibouti and Kosovo following at a considerable distance.

Given this critical challenge, technological advancements present a significant opportunity to address unemployment in innovative ways. By embracing digital transformation, South Africa can create new industries, improve access to education and skills training, and foster entrepreneurship, particularly among the youth. For instance, the rise of remote work and digital platforms can open up global job markets, while advancements in AI and automation can lead to the creation of new roles that did not exist before. However, this requires strategic investment in education, infrastructure, and policies that ensure technology is accessible and inclusive and there is insufficient evidence that this is the case.

Moreover, technology can help bridge the gap between existing skills and those required in a rapidly changing job market. By providing online learning platforms, virtual apprenticeships, and digital literacy programs, South Africa can empower its workforce to adapt to the demands of the 21st century economy. This approach not only addresses the immediate concern of unemployment but also positions the country to compete in a global digital economy, turning a challenge into an opportunity for sustainable growth. Once again, where there are pockets of such innovation, these have not made the desired impact to reduce unemployment.

# FUTURE CONSIDERATIONS

As automation technologies are transforming traditional roles by automating routine tasks, the shifts often affect changes to job descriptions, requiring workers to adapt by learning new skills or focusing on more complex, human-centric tasks. For instance, in manufacturing, automation has reduced the need for manual labour but increased demand for technicians who can manage and maintain automated systems. As technology evolves, there is an increasing demand for workers who are not only skilled in their primary field but also proficient with relevant technologies. This trend is driving a need for continuous learning and professional development, often through micro-credentials and digital badges (Commonwealth of Learning, 2019).

A key consideration is to ensure that technological advancements benefit all learners, regardless of their background or circumstances. This requires a commitment to equity and inclusivity, ensuring that all learners have access to the resources and opportunities they need to succeed in a rapidly changing world (McKinsey Global Institute, 2019). It also requires a focus on building digital literacy and data literacy among both learners and educators so that they can effectively navigate and leverage the opportunities presented by technological innovation (Siemens, 2013).

Furthermore, as the education sector becomes increasingly data-driven, it is important to maintain a balance between technological efficiency and human-centred values (Williamson, 2016). Education is fundamentally about human development, and while technology can enhance this process, it should not overshadow the importance of personal interaction, creativity, and critical thinking (Bertoli, 2017).

## HUMAN VALUES AS A FOUNDATION

While technological and educational advancements are critical, they should not overshadow the fundamental human values that form the basis of a just and equitable society. These values—such as empathy, respect, fairness, and compassion—are essential in guiding decisions and actions, especially in a rapidly changing world. The focus on technological innovation and efficiency can sometimes lead to the marginalisation of human values. For instance, in the rush to adopt new technologies, the well-being of individuals and



communities might be overlooked. This neglect can result in increased inequality, loss of personal autonomy, and diminished social cohesion. True progress is not just about technological advancements but also about ensuring that these developments are aligned with human dignity and ethical considerations. Maintaining this balance requires conscious efforts to integrate human values into every aspect of governance, education, and policy-making.

Education and training can play a significant role in fostering these values. Educational systems should not only focus on imparting technical skills but also on nurturing critical thinking, ethical reasoning, and a strong sense of social responsibility. This holistic approach can prepare individuals to navigate the complexities of the modern world while upholding human values.

Ignoring human values may increase social alienation, ethical dilemmas, and the erosion of trust in institutions. Sustainable progress is only possible when human values are at the forefront of decision-making processes.

## CONCLUSION

In conclusion, the integration of technological innovation in South Africa's post-school education sector, particularly through initiatives like the PSETCLOUD project, offers significant potential for improving the management and analysis of learner data to meet the growing demands of workplaces for more relevant skills. As workplaces themselves are being transformed by technological innovation, so too must institutions of higher learning remain agile and adapt to keep up with current trends. However, this potential can only be fully realised if it is accompanied by a commitment to continue embracing technology with strong data governance, ethical considerations, and a commitment to equity and inclusivity as the sector collaborates and with all stakeholders within the PSET ecosystem.

In the long term, as the sector continues to evolve, of equal importance is that stakeholders remain mindful of the broader implications of these changes and work together to create an education system that is not only efficient and effective but also just and humane. It is here that we must use the learning from neuroscience, leadership development, consciousness, ethical behaviour, kindness and care for others. By doing so, South Africa can ensure that its education system is well-positioned to meet the challenges and opportunities of the digital age, ultimately benefiting all citizens and addressing unemployment.

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