Exploring the potential of Artificial Intelligence for the South African Qualifications Authority

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Abstract. Artificial Intelligence (AI) technologies continue to transform education, training and the world of work. Its implications for the education, training and work ecosystem, the National Qualifications Frameworks (NQFs), and regulatory authorities such as the South African Qualifications Authority (SAQA), cannot be ignored. SAQA oversees the implementation and development of the South African NQF and coordinates its three Sub-Frameworks: general and further education and training; occupations and trades; and higher education. The NQF Act mandates SAQA to register qualifications and part-qualifications on the NQF, recognise professional bodies and register their professional designations, evaluate foreign qualifications, verify national qualifications, and maintain the National Learners' Records Database (NLRD). This desk research explores the global readiness for AI adoption, emphasising ethical, fair, socially just, and human-rights-centred AI practices. Continental needs assessment and regional policy landscape studies highlight AI's transformative potential but underscore the lack of regulatory policies, human and financial capital, infrastructure, and the need for research and education. Domestically, the Presidential Commission on 4IR (2019-2020), the National Digital and Future Skills Strategy (2020), the Digital Skills Forum (2024), and the inclusion of Coding and Robotics subjects in Grades R–9 curricula (2024), show South Africa's commitment to the Fourth Industrial Revolution (4IR) and AI. At an institutional level, SAQA can leverage AI through collaboration, conceptualised through Anne Edward's 'relational agency,' with multiple stakeholders to enhance its core functions. While AI offers a range of benefits and opportunities, it also presents significant risks and challenges that require continuous co-operation and collaboration.

Keywords: Artificial Intelligence, National Qualifications Framework, Relational Agency, South African Qualifications Authority.

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1 Introduction: Artificial Intelligence

The term Artificial Intelligence (AI) was coined by John McCarthy in 1956, drawing on the work of Turing [1, 2] and is thus not new [3, 4]. According to Crompton and Burke [3], Turing "described the existence of intelligent reasoning and thinking that could go into intelligent machines". AI and its definition have evolved since 1956. It is considered a "broad field encompassing various technologies that have been developed over the past 50 years to enable machines to perform tasks traditionally requiring human intelligence, such as perceiving, reasoning, learning, and interacting" [5]. AI machines and systems can demonstrate intelligent behaviour, including activities associated with human cognition such as decision-making, problem-solving, learning and the ability to perform tasks that normally require human intelligence [6]. AI is significantly transforming sectors and facets of life, including healthcare, manufacturing, agriculture, education, training, and work, among others. It has been "proclaimed as a tool that can be used to enhance and advance all sectors of our lives" [3]. In particular, AI is transforming various dimensions of teaching and learning such as instructional practices, assessment strategies, and administrative processes [5]. AI is integral to the Fourth Industrial Revolution (4IR), which gained traction during the Covid-19 pandemic. Klaus Schwab, Founder and Executive Chairman of the World Economic Forum (WEF), characterises 4IR as a period of transformation driven by the convergence of digital, physical, and biological technologies [7, 8]. As highlighted in **Figure 1**, the 4IR entails the integration or convergence of technological components including, for example, the Internet of Things (IoT), Robotics, Blockchain, Cloud Computing, Artificial Intelligence, Big Data, 3D Printing, and Virtual Reality.

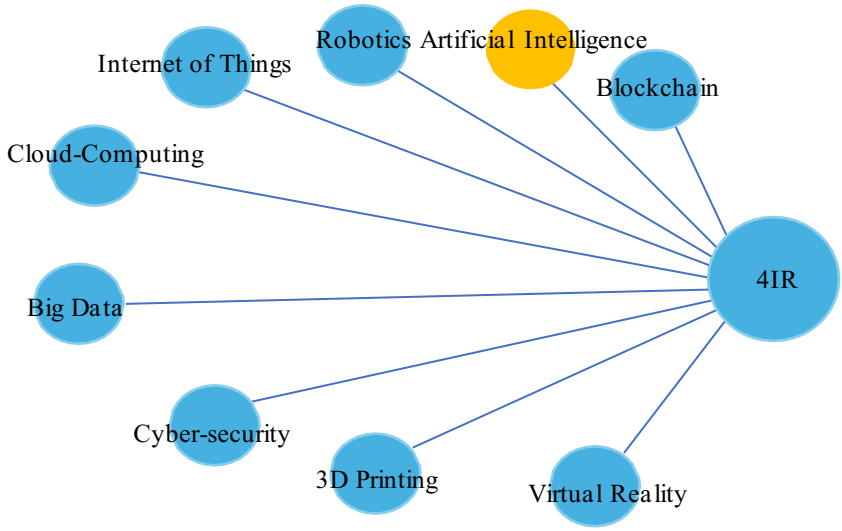

Fig. 1. Some key components of 4IR (diagram by Author, 2024).

The next (second) section of this paper explores the readiness to adopt AI from a global to a domestic (South African) perspective. The third section introduces a conceptual framework that ought to guide relational work (collaboration) in the lifecycle of AI across sectors. The fourth section briefly addresses what NQFs are, followed by the fifth section, drawing the link between NQFs and AI. The last section discusses the select core functions of SAQA as a custodian of the NQF in South Africa and the potential of AI to bring about the efficiency of processes, taking into account related benefits and opportunities, as well as risks and challenges presented.

2 Readiness for Artificial Intelligence Adoption

2.1 Global AI Readiness

The lifecycle of AI adoption can be divided into three phases: pre-adoption, adoption, and post-adoption. Pathak and Bansal [9] explore factors that influence the pre-adoption phase or readiness of organisations for adopting AI. The factors examined encompassed technology, organisation, environment and individual contexts of AI. These factors also featured in the 2023 Government AI Readiness Index, which found varying degrees of readiness for the adoption of AI across different continents and countries [10]. The index assessed readiness using three broad pillars: government, technology sector, and data and infrastructure (see **Figure 2)**.

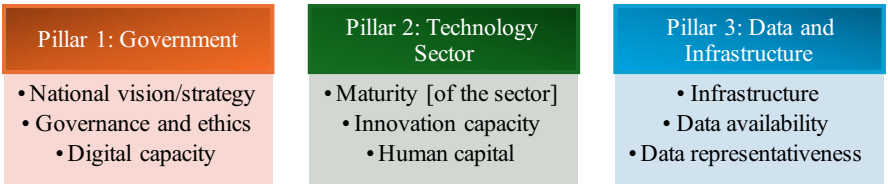

Fig. 2. Pillars of Government AI Readiness [adapted from 10].

Pillar 1 suggests that governments need national strategic visions for AI development and governance, coupled with regulatory and ethical prescripts. A strong internal government digital capacity, including skills development and practices that support adaptability to new technologies, is required. The technology sector, Pillar 2, must be mature enough to supply the needs of the country. Not only must it be mature but needs to have a high innovation capacity underpinned by a business environment supportive of entrepreneurship and good research and development spending. From a human capital perspective, the skills and education of the workforce must be developed and/or re-developed continuously. The third pillar, data and infrastructure, suggests that the development of AI requires the availability of sufficient high-quality data (*data availability*) that is also representative of society (*data representativeness*) to

avoid bias and error in the AI systems developed. The potential of data cannot be realised without the availability of infrastructure (physical or cloud) [10]. The index ranked South Africa 77th (with 47.28% overall readiness score for AI) out of 193 countries globally. Despite this global ranking, South Africa emerged as a leader in Sub-Saharan Africa in two of the three pillars assessed: Data and Infrastructure (63.79% readiness) and Technology Sector (40.22% readiness). South Africa was the only Sub-Saharan African country to score above the global average for the Technology Sector pillar [10]. However, for Pillar 1 (Government), the score was lower at 38.14%, highlighting the need for improvement in terms of national AI strategy and governance.

The three pillars of AI readiness are echoed by other global efforts for ethical and responsible AI adoption. Adopted by 193 countries, including South Africa, UNESCO published the *Global Recommendation on the Ethics of AI*, which promotes human rights, dignity, transparency, fairness and human oversight in AI development and adoption [11]. The Council of Europe similarly published the Framework Convention on AI, Human Rights, Democracy and the Rule of Law adopted by over 46 countries as the 'first-ever' legally binding treaty on AI [12].

2.2 Regional AI Readiness

In 2021, UNESCO conducted an *AI Needs Assessment Survey in Africa* [13] that echoed the findings of the Global AI Readiness Index [10]. The survey found that there is potential for AI development on the continent. However, addressing 'legacy challenges' – such as lack of infrastructure, human and institutional capacity to develop and govern AI and the capacity to maximise its benefits while minimising the risks – is crucial. The survey further noted that policy initiatives for AI governance need to be strengthened; legal and regulatory frameworks for AI governance need to be fostered; the need for enhancing [human and institutional] capacities for AI governance is widely recognised; AI priorities in African countries are varied but offer an opportunity for cooperation; more efforts are needed to advance AI education, research and training. Policy guidelines must address gender bias and discrimination in AI algorithms [13]. Research collaboration/knowledge exchange between and with universities, and a collaborative multi-stakeholder approach to AI development and governance is key. UNESCO subsequently conducted a *Landscape Study of AI Policies and Use in Southern Africa* [14], which identified the lack of national AI policies in the region. However, there are existing policies and legal frameworks that need to be updated to reflect current technological advancements and challenges or form the basis for the development of national AI strategies. The study emphasised ethical and responsible AI adoption – policies need to ensure responsible AI use, human rights-centred and socially good approaches

to AI. Regional cooperation is also crucial to facilitate cross-border data exchange and electronic transactions [14].

2.3 South Africa's Readiness for AI

The policy landscape study by UNESCO [14] found that South Africa, like many other SADC countries, does not have a national AI strategy. While there is no AI-specific national strategy in place, the South African cabinet approved the *National Integrated ICT Policy White Paper* in 2016 [15]. The white paper envisioned an integrated and coherent framework for a digital and knowledge-driven economy. To advance the imperatives of the white paper, President Ramaphosa appointed the *Presidential Commission on 4IR (PC4IR)* for a year (2019-2020). The PC4IR was mandated to develop and propose a national strategy for 4IR and to make recommendations on institutional frameworks and the roles of various sectors [16]. The commission proposed an 8-dimensions national 4IR strategy and recommended investment in human capital development, the establishment of an AI institute, the establishment of a platform for advanced manufacturing and new materials, securing and availing data for innovation, incentivising future industries, platforms, and the application of 4IR technologies, building 4IR infrastructure, reviewing and amending (or developing) policy and legislation, and establishing a 4IR strategy implementation coordination council [16]. Some of these recommendations have been implemented while others are long-term objectives. In terms of the 2016 white paper, the government published the *National Digital and Future Skills Strategy* [17] that prioritises critical and future digital skills and aims to ensure that there is coordinated and integrated implementation across government and various sectors. More importantly, leadership and governance of technologies to ensure successful digital skills generation and development. The PC4IR underlined a skills development ecosystem characterised by silo-mentality and expressed concerns about the speed at which institutions can adapt and ensure that curricula accommodate workplace needs. The *Digital Skills Forum (DSF)*, a mechanism to implement the digital skills strategy, aims to address silos and foster collaboration [17]. The realisation of the digital skills strategy will depend on multi-stakeholder collaboration. Towards the digital skills vision in the schooling sector, the Department of Basic Education (DBE) gazetted approval of changes to the regulations of the *National Curriculum Statement Grade R to 12* by officially adding Coding and Robotics to existing subjects for Grades R to 9 [18] to capacitate learners with digital skills at an early stage of their learning. These subjects were piloted in grades R to Grade 9 between 2021 and 2023.

From global to national perspectives, South Africa first needs to fast-track the development of its national AI strategy, with clear ethical guidelines and regulations, to improve its global ratings and overall readiness for AI. As has been

highlighted in this paper, the successful implementation of the national strategy and adoption of AI relies on investment in, among other things, research, education, skilling, and infrastructure. The introduction of AI-related curricula in basic education also requires the availability of infrastructure. As Heyns notes [19], successful AI adoption depends on access to stable internet connection, electricity, digital devices, classroom space, safety, and (cyber-) security. In addition, learner/teacher attitudes and perceptions towards technologies and training and capacity development of teachers are equally important. Due largely to its apartheid past, South Africa remains one of the most unequal societies in the world, and these disparities are still reflected in the socio-economic outlook. The disparities further exist between schools in rural and urban areas [19]. Unequal access to infrastructure and resources is not unique to the basic education space only but cuts across all levels of education, including post-school education and training. Embracing AI should thus not widen existing inequalities and the poverty gap. Moreover, the success of AI depends on collaborative (public and private sector alike) relationships and the collective agency of stakeholders to draw all the necessary resources together.

3 Relational Agency: A Framework for Collaboration

The successful lifecycle – from conceptualisation to deployment – of AI requires strong relationships and collaborations among diverse stakeholders. This research employs 'relational agency,' as conceptualised by Anne Edwards [20–22], to emphasise collaboration in AI development and adoption. Edwards developed this concept as part of her three 'gardening tools': relational expertise, common knowledge, and relational agency, which together "support new forms of inter-agency work enabling fluidity, responsiveness, and horizontal boundary crossing between diverse services" [21, 23].

A baseline study on articulation/mobility of learners between Technical and Vocational Education and Training (TVET) Colleges and Higher Education Institutions (HEIs) [24] in South Africa stressed that "building relationships within and between stakeholders requires deliberate effort". Relational agency involves – the study noted – understanding and engaging with the motives of others, allowing their expertise and resources to be brought forward and used. It is useful both vertically (in authority hierarchies) and horizontally (across practices at similar levels). Relational agency respects history but focuses on common knowledge created through a shared understanding of the motives of those deliberately working together. The baseline study [24] provided guidelines for forming, maintaining, and sustaining constructive relationships within and between institutions of learning, where the idea was to understand how the

motives of institutions, staff, and learners promoted or hindered articulation/mobility, integration, and joint work [24].

Edwards, the baseline study [24] further notes, unpacked "relational agency into relational expertise, which involves understanding the motives of others and proceeding on the basis of common understanding". There were limits identified in comprehensively understanding the motives and levels of relational agency of individuals in learning institutions. For example, the presence or absence of relational agency suggested the existence of epistemic justice or injustice in relationships between TVET Colleges and HEIs. As such, relational agency was thus considered a tool to potentially address "epistemic injustice within and between institutions of learning to support learner transitioning within and between education, training, development, and work" [22].

The theory is elaborated in "Being an Expert Professional Practitioner: The Relational Turn in Expertise" [20] in which Edwards describes relational agency as working alongside others towards negotiated outcomes. This practice (collectivism) is seen as a "joint and more powerful form of agency… an alternative to the idea of professionals as heroic individuals" (individualism) [20]. While learning takes place as people work together, the primary motive (of relational agency) is more successful task accomplishment. Flexible, responsive, and purposeful interactions characterise relational work. Edwards [20] further suggests that "professional agency needs to be strengthened when practitioners collaborate across organisational boundaries or work flexibly with clients" without overemphasising institutional rituals or bureaucracies. A strong form of professional agency sets the scene for collaborations that involve working across boundaries between practices and informs "understandings of relationships between people positioned differently within the same practices" [20].

Relational agency emerges when working with others to expand the task by recognising the motives and resources that others bring and aligning one's responses to the newly enhanced interpretations. Some of the furnished practical examples [20] include inter-professional collaboration by teachers, health care workers and social workers on a vulnerable (e.g., homeless) child's trajectory (see **Figure 3**) and the development of a piece of mammography by radiographers, engineers, and computer scientists. These professionals must acknowledge each other's (unique but complementary) contributions and expand their understanding of complex issues through mutual understanding, alignment and collaboration towards a shared outcome [20].

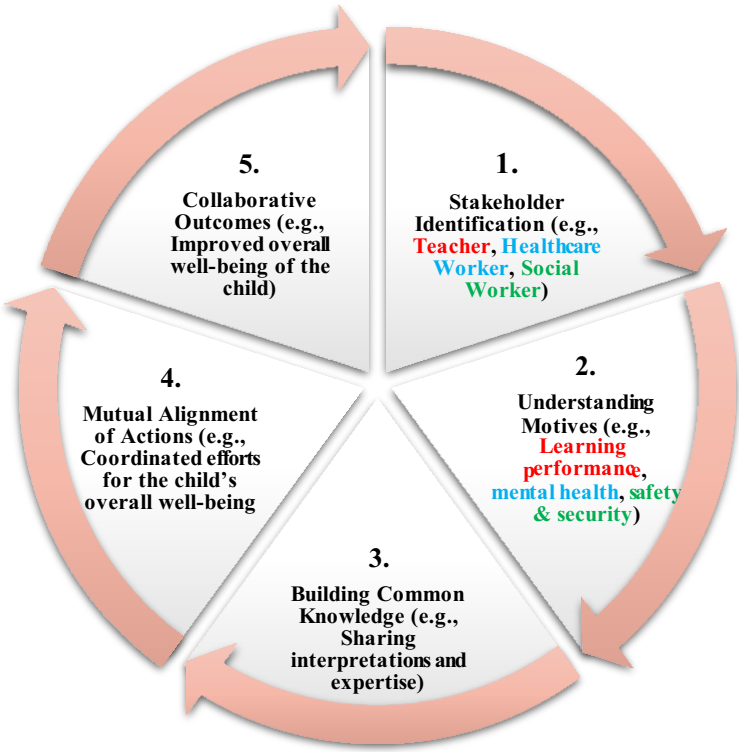

Fig. 3: Relational Agency for a Vulnerable Child (diagram by Author, 2024).

Relationship building occurs where there is a sense of belonging – the lack of which may be considered another limitation. Duhn et al. [23] note that "professionals come together to develop collective capabilities through relationality and a sense of belonging to place and local communities". Moreover, the concepts developed by Edwards allow for exploration, articulation, and building of connections across a network of participants' individual and discipline-specific sense of professional self. To enable them to collectively transform practices that matter to the local communities. A sense of belonging, moderated by network members' critical engagement with local differences and specificities, allows for transformative practices to emerge [23]. Taking the foregrounded factors into account, relational agency can be applied in the context of NQFs and AI.

4 National Qualifications Frameworks

The NQF, as a concept, emerged in the 1980s and has since been developed – and continues to be developed – in most countries globally [25]. Keevy and

Bolton [25] note that the concept is based on two key ideas: (1) the English competence-based model, where learners are assessed based on demonstrated competences and (2) the Scottish outcomes-based model, where aimed-for-learning outcomes shape learning itself. The Organisation for Economic Co-operation and Development (OECD) defined the NQF as "an instrument for the development, classification and recognition of skills, knowledge and competencies along a continuum of agreed levels" [26]

Each country, however, defines the NQF in more context-specific ways. In the South African context, the NQF is defined as a "comprehensive system for the classification, registration, publication, and articulation of quality-assured national qualifications" [27]. It outlines qualification types, their NQF Levels (1 to 10) and credits within the three coordinated qualifications Sub-Frameworks. Furthermore, the framework describes the interrelationships of the qualifications and progression from one level to another [28]. Comprised of three integrated Sub-Frameworks for (1) higher education, (2) occupational and vocational education, and (3) general and further education and training, implementation and further development of the South African NQF is overseen by SAQA.

The NQF Act (Act No. 67 of 2008, as amended) [27] sets out the objectives of the South African NQF which include: (i) creating a single integrated national framework for learning achievements; (ii) facilitating access to, and mobility and progression within, education, training and career paths; (iii) enhancing the quality of education and training; and (iv) accelerating the redress of past unfair discrimination in education, training, and employment opportunities. These objectives are designed to contribute to the full personal development of each learner and the social and economic development of the nation at large [27]. NQFs seek to enable not only the progression of learners within and across education, training and work but also enhance international comparability and evaluation of qualifications. It has become important, as NQFs evolve, for organisations to embrace AI technologies to streamline and enhance processes and practices.

5 Artificial Intelligence in the context of NQFs

NQFs are not spared from the technological revolutions and need to keep up with the developments. Qualifications systems have been very much paper-based, and this tends to make "the development, comparison, and recognition of qualifications a lengthy process" [29]. Azzarà and Garmash [29] note that fragmented paper-based systems can be replaced with digitally connected qualifications systems to enhance transparency, comparability and portability of

qualifications. The creation of a 'data space' for skills and qualifications, facilitated by integrated platforms and interoperable systems, can revolutionise access to qualification information, potentially enabling self-sovereign identities (SSI) where individuals control their digital qualifications for mobility and lifelong learning [29]. NQFs and national contexts vary and the shift to digital systems requires trust, cooperation, and coordination among stakeholders (within and across countries) to maintain common language and standards.

The use of AI in the recognition of qualifications has been examined [30] for mobility and access to education and work opportunities within and across borders. Lantero et al [30] outline three use cases of AI for the evaluation of qualifications:

a) AI for evaluation of qualification *comparability* – which has three steps including identification of elements of a qualification such as official status, awarding institution, duration of learning, workload and learning outcomes.
b) AI for *verification* of authenticity and [possible] *fraud detection*. Databases of qualifications can be trained for automated verification and fraud detection. However, there are privacy, security, and bias challenges to note.
c) AI automation will have an impact on qualification evaluators – automation can save time and improve the accuracy of processes. The development of competences and critical thinking skills to adapt to AI is thus important.

AI-powered digital tools can also help in the inclusion of marginalised groups such as migrants and refugees in education, training and work. Macauley and Jones [31] explore the use of digital tools for recognition, validation, and accreditation ('RVA') of technical and vocational skills of migrants and refugees. The development of e-guidance, e-portfolios, and e-assessment facilitates recognition across borders for all, including migrants and refugees. Macauley and Jones [31] echoed the sentiment that digitisation can help streamline and accelerate paper-based processes such as evaluation and verification of qualifications and reduce costs.

One of the examples of initiatives that utilise AI technology for mobility learners and the workforce for education and work in South Africa is the *Post-School Education and Training Cloud* (PSET Cloud) [32]. This multi-stakeholder collaborative platform aims to bridge the disconnect between the post-education and training systems and work in South Africa. Guided by principles of interoperability, SSI, and credential fluency, it leverages blockchain technology to link skills and employment opportunities [32]. The development of AI technology

in the contexts discussed is supported by regional and global movements around the recognition of qualifications and other credentials and mobility for learning and work across borders such as the African Continental Qualifications Framework (ACQF), Southern African Development Qualifications Framework (SADCQF) and the Groningen Declaration Network (GDN).

While AI brings about the potential to streamline qualifications verification and evaluation processes, detect fraudulent activities, and match learning outcomes to labour-market needs, it raises concerns around equity, inclusivity, ethics, digital divide, bias, language barrier, data security, and gender sensitivity. Moreover, AI challenges the understanding of learning outcomes (what a learner understands, knows, and can do), academic integrity and plagiarism. Institutions of learning are compelled to put in place measures for responsible and ethical use of AI [30–32] for teaching, learning and assessment. It is against this backdrop that collaboration among stakeholders is key.

6 SAQA Functions and the Potential of AI

SAQA, as the custodian of the NQF, is mandated to advance objectives stipulated in the NQF Act and oversees the implementation and further development of the framework. Moreover, it coordinates the three NQF Sub-Frameworks (for (i) higher education, (ii) occupations and trades, and (iii) general and further education and training) [27].

Towards achieving the objectives of the NQF Act, Section 13 of the Act outlines the functions of SAQA, which include implementing the NQF and collaborating with Quality Councils (the Council on Higher Education (CHE), Quality Council for Trades and Occupations (QCTO), and Umalusi); developing and implementing NQF policies and criteria; registering qualifications and part-qualifications on the NQF; recognising professional bodies and registering professional designations; undertaking research and collaborating with international counterparts; maintaining the National Learners' Records Database (NLRD); providing evaluation and advisory services with respect to foreign qualifications; informing the public about the NQF; and providing advice to the Minister responsible for the NQF [27]. The *NQF Amendment Act (Act No. 12 of 2019)* [33], proclaimed in October 2023, expands the mandate to, among other things, the establishment of separate registers for (a) misrepresented and fraudulent qualifications and (b) professional designations [34].

Based on the foregoing ideas, the next sections discuss the potential development and use of AI to enhance some of the functions of SAQA, taking into account the attendant benefits and opportunities as well as risks and challenges.

This exploratory research does not imply that AI technologies have been implemented yet, although SAQA is progressively implementing business automation and data validation and submission tools to streamline and make efficient, its functions – a first step towards harnessing AI.

6.1 Authentication Services

As one of the core mandates, SAQA provides an evaluation and advisory service for foreign qualifications, and verification services for national qualifications achievements. Processes for verification of national qualifications are currently manual and semi-automated. The applications are submitted to SAQA where they are cleaned using an internal cleaning standard template and captured manually into the verifications database. Responses to applicants are also captured manually on the database. Feedback reports to applicants are, however, automated through a database called SAQA *VeriSearch*. *VeriSearch* pulls the verification feedback from the verifications database and applicants can access the reports using the application 'batch code' (unique identifier) or the qualification holder's name, surname, and identity number. The evaluation process is also semi-automated. Applicants submit applications through an online application form and make payment in advance on a built-in *e-commerce* platform. Once an application is submitted to SAQA, screening is done manually. If the application meets the requirements, it is registered by pulling the applicant details and documents using the application number into the DFQEAS online and administration system. Once applications are in the system, work is allocated manually to verifiers/evaluators of qualifications through the verifications database, and responses are captured manually. Foreign qualification holders who applied for evaluation by SAQA qualify for an electronic SAQA Certificate of Evaluation (eSCoE) for real-time confirmation of the evaluation outcome.

AI holds the *potential* to automate some of the routine tasks such as data entry and verification/evaluation of qualifications. AI-powered tools with machine learning and natural language processing can be used to conduct verification/evaluation of qualifications against existing databases – with human oversight. The integration of AI technologies can manage workload and reduce potential backlogs through pattern recognition and quality control. It would also offer real-time updates on applications and processing while chatbots can manage and provide accurate responses to queries and frequently asked questions (FAQs). The *benefits/opportunities* presented include automated document processing for efficient processing of verification/evaluation of qualifications. Again, AI platforms can be used to detect possible fraudulent qualifications relying on machine learning and natural language processing. In addition, processes would be standardised to bring about increased efficiency and reduced

costs to applicants. Faster processing means quicker decision-making for learners to move into learning and work. The *risks/challenges* are varied: verification/evaluation outputs may result in false negatives or false positives; data security risks are higher and sensitive personal data need to be secured; processing of verifications and evaluations may result in bias and unfairness if data used to train AI machines are unrepresentative or skewed. The effectiveness of AI in authentication services depends on the expertise and resources of all stakeholders and dependencies such as education and training providers, issuing bodies and information partners in the value chain where end-users are put first.

6.2 Registration and Recognition

Equally important functions performed by SAQA are the registration of qualifications and part-qualifications on the NQF, recognition of professional bodies and registration of professional designations. Quality Councils, which are responsible for accreditation and quality assurance, recommend qualifications and part-qualifications from providers to SAQA for registration on the NQF. The qualifications and part-qualifications recommended are tracked using manual processes and are assessed against the *Policy and Criteria for the Registration of Qualifications and Part-Qualifications on the NQF* [35]. Those that do not comply with the policy and criteria are returned to the Quality Councils, which then communicate with the providers regarding revisions. Qualifications and part-qualifications that meet the criteria are registered on the NQF by SAQA. The registration processes are mainly manual. Similarly, the recognition of professional bodies by SAQA and registration of professional designations on the NQF also happen through manual processes. Current processes and practices can benefit from AI.

AI tools have the *potential* to provide real-time monitoring and tracking of qualifications registration status, recognition as a professional body and registration of designations. 'Robotic process automation', which allows anyone to define a set of instructions for a robot or chatbot, can assist automate repetitive tasks such as data entry, correspondence, and reporting. AI can help identify emerging trends in the qualification types that are registered or demanded by the labour market using predictive analytics.

The *benefits/opportunities* of introducing these tools are that they allow for quick turn-around times for accreditation and registration of qualifications, recognition of professional bodies and registration of designations. Human error in the processes is also diminished. Real-time statistics/data on registered qualifications, professional designations, and recognised professional bodies are available and can be used for skills planning. Again, the *risks/challenges*

are that data may not be representative and bias is likely to occur. Any successful AI tool depends on the interoperability of the technological systems of the stakeholders. Stronger relationships between stakeholders including education and training providers (qualifications developers), Quality Councils (accreditation regulators), SAQA (registration), professional bodies (professional standards), employers and industry, and learners, in the value chain would ensure streamlining of accreditation, registration, recognition processes and mobility and progression of learners in education, training and work.

6.3 Maintenance of the National Learners' Records Database (NLRD)

The NLRD, a database of all records of learning and related information, comprises national qualifications and part-qualifications registered on the NQF by SAQA; accredited/ approved providers; learner achievements against registered national qualifications and part-qualifications; registers of recognised professional bodies and registered professional designations; and a register of foreign qualifications evaluated by SAQA. The NQF Amendment Act adds a register for misrepresented and fraudulent qualifications and a separate register for professional designations. The Quality Councils are required to load learner records onto the database within 30 days of the data being quality assured. While the NLRD contains rich data to inform policy decision-making, there are gaps because of (i) pre-1994 data that is not in digital format and/or has not been submitted and (ii) failure on the part of some education and training providers (public and private) to submit qualifications and learner achievements to the Quality Councils and subsequently to the NLRD [36]. Currently, entities run data submission files through data validation tools, encrypted and submitted through secure formats electronically. The entities submitting data to the NLRD are legally responsible for the data quality, authenticity, and provision, and must comply with the Protection of Personal Information (POPI) Act [37]. SAQA sets the minimum standards for data quality that submitted data must meet.

AI has the *potential* to automate data submission from the sources (providers) to the Quality Councils and the NLRD. The standardisation of data submission through specifications and the development of automation systems (based on existing Management Information Systems) is the low-hanging fruit. API gateways and systems integration can enable the collection of data from multiple stakeholders in real-time. AI and machine learning can also automate quality assurance and identify and address inconsistencies in data submitted for recording on the NRLD.

The *benefits/opportunities* of representative data availability would provide a full picture of qualifications and learner achievements, and AI can be used for

skills-demand matching, trends analysis and predictive analysis. Some notable *risks/challenges* include but are not limited to, the lack of compliance with legislation to handle and use personal information, data privacy, quality, and representativeness, as well as necessary human and financial capital. The NLRD as a relational database integrates data (with tables linked together) on registered qualifications, accredited/approved providers, recognised professional bodies and registered designations, among others. This makes collaboration, as conceived through the relational agency concept, among stakeholders crucial in ensuring that accurate and up-to-date data are made available, quality-assured and submitted to the NLRD, with the aid of AI.

7 Conclusions

This paper has explored the readiness for adoption and use of AI globally and regionally, which is varied, and considered its associated opportunities and challenges. The discourse around ethical, fair and human-rights-centred AI practices is ongoing. From a domestic context, South Africa is positioning itself to embrace the 4IR and AI as seen in the work of the Presidential Commission on 4IR, the National Digital and Future Skills Strategy, and the inclusion of Coding and Robotics subjects in Grades R-9 schooling curriculum.

Edward's relational agency is an instructive and useful framework of collaboration for successful AI development and adoption. In this context, collaboration requires understanding and engaging the motives or objectives of others, mediating any divergences, building common knowledge or understanding, and aligning actions towards common goals.

Overall, the services rendered by SAQA can benefit from AI solutions that are co-conceived, co-developed and co-implemented. The risks/challenges (albeit not unique to a single organisation) such as potential AI bias and discrimination, data security concerns, lack of infrastructure as well as human and financial capital, must be carefully considered. The overall effective adoption of AI relies on continuous collaboration among stakeholders and the capacity to streamline processes for efficiency in – and the quality of – the education and training system that is learner-centred.

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