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Reclaiming self-sovereignty for all South African citizens' data by 2030

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PSET CLOUD

Innovation through collaboration

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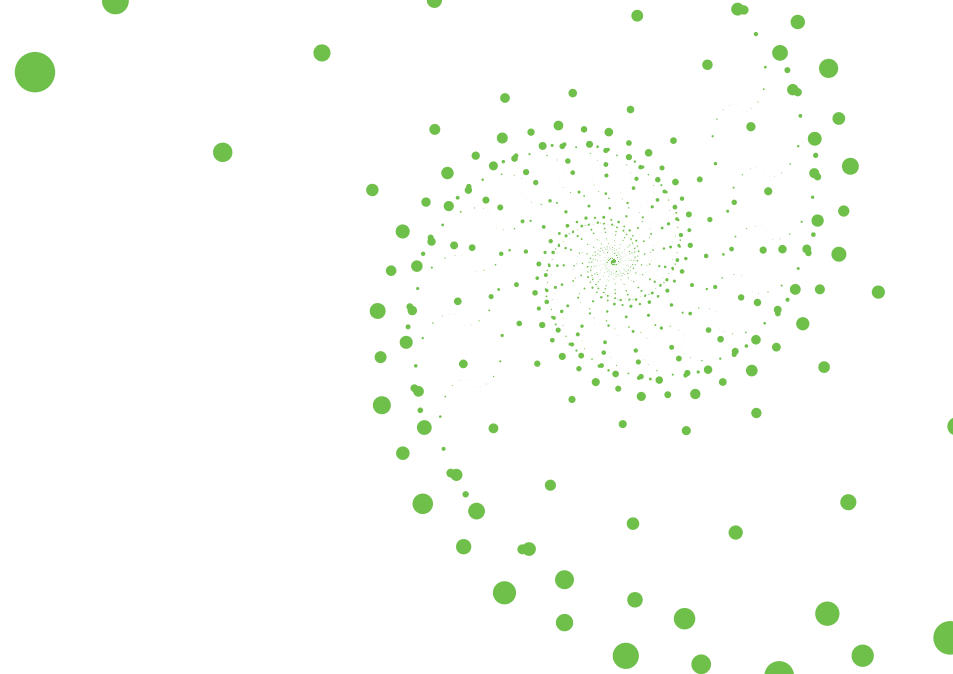
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Acronyms and abbreviations

ACQF	African Continental Qualifications Framework
AI	artificial intelligence
CHE	Council on Higher Education
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
EBSI	European Blockchain Service Infrastructure
EU-GDPR	European Union-General Data Protection Regulation
ESSIF	European Self-Sovereign Identity Framework
FOSS	free open source software
GPL	general public licence
ICTs	information and communications technologies
ICT4D	ICT for Development
JET	JET Education Services
IMF	International Monetary Fund
M&E	monitoring and evaluation
merSETA	Manufacturing, Engineering and Related Services Sector Education and Training Authority
MVP	minimum viable product
NDP	National Development Plan
NSA	National Skills Authority
OECD	Organisation for Economic Co-operation and Development
PSET CLOUD	Post-School Education and Training Collaboration for Learning Opportunities for the Utilisation of Data
QCTO	Quality Council for Trades and Occupations
SADC	Southern African Development Community
SAFBC	South African Financial Blockchain Consortium
SAQA	South African Qualifications Authority
SSI	self-sovereign identity
TCO	total cost of ownership
TVET	technical and vocational education and training
UNESCO	United Nations Educational, Scientific and Cultural Organisation



My father was born in 1911 in Cape Town. Apparently, his mother was South African and his father Norwegian. He went to school in Cape Town and left school with a standard 6. He was a taxi driver. He went to serve in the South African army during World War II. I have no records of any of this. He was married twice; first to Sally with whom he had three sons and then Monica with whom he had two sons. I have no records of these events other than my own memory and the information I can get from my family. I was born in 1956 in East London. I was Monica's second son. By the time I was old enough to ask questions, my dad was not open to any discussion or sharing of information about his past. He also kept no records. In my life he and Monica co-owned and managed three small shops trading patent and traditional medicines and second-hand furniture in East London. I understand he gave up his right to British citizenship to become a South African and get a South African passport and ID document. I have no record of this. I also have no record of his birth other than a photocopy of his South African identity book. The only record I have of his death is a photocopy of the service leaflet distributed at his funeral. Over time most of this will be lost or forgotten, and like I have no information about my grandparents on my father's side, my grandchildren will have very little if any verifiable information about my father, their great-grandfather. This should not be the case in the 21st century where image and data storage is no longer a challenge. The point of this story is that all the information about a person's life accomplishments and milestones has value far beyond the 'commercial' value associated with a job application and career building. It represents the uniqueness of that person and provides a far deeper understanding of who they are and were. Surely in the 21st century this information can be digitally stored in a secure way that ensures that only people with the necessary permission can be given access to the data they need to be informed as required?

John Arnesen

Introduction

James Keevy



South Africa is a country of many contradictions. With a Gini coefficient estimated at between 0.63 and 0.7 in 2021, the country is the most unequal in the world (IMF, 2020). Many of its citizens are unemployed, which has been further exacerbated by the Covid-19 pandemic. Statistics South Africa's 2021 quarterly labour force surveys found that the official unemployment rate was 32.6% in Quarter 1 and 34.9% in Quarter 3. Young people (15–34 years) are disproportionately represented in these numbers, with 43.6% not in employment, education or training (so-called 'NEETs') (Statistics South Africa, 2021a; 2021b). In this same country, sophisticated financial systems are internationally respected, with new technological innovations being developed and utilised through cryptocurrencies, increasingly new forms of credentialing (Dale-Jones and Keevy, 2021; Rajab et al., 2020) and, linked to these developments, new forms of digital governance (West and Beukes, 2021; Manda, 2017). This juxtaposition, combined with the impetus of post-pandemic recovery initiatives, poses a unique opportunity for a reset of the education and training system to be more open, fairer and, critically, founded on the principles of self-sovereignty (Tapscott, 2021).

This paper contains a set of case studies contributed by a diverse range of authors as part of a crowd-authored initiative that took place between December 2021 and January 2022. The call for contributions was limited to experts and partner organisations that have been directly or indirectly involved in a national digital platform initiative, called the Post-School Education and Training Collaboration for Learning Opportunities for the Utilisation of Data (PSET CLOUD).¹ The PSET CLOUD is a platform that aims to enable users such as learners, government, industry, non-governmental organisations and education institutions to share and use data for decision-making that promotes a more efficient and responsive post-school education system. The PSET CLOUD was initiated by the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA)² and JET Education Services (JET).³ The platform

¹ <https://psetcloud.org.za/>

² <https://www.merset.org.za/>

³ <https://www.jet.org.za/>

development is taking place as a national initiative under the oversight of the Department of Higher Education and Training (DHET)⁴ and with close proximity to the South African Qualifications Authority (SAQA),⁵ Umalusi,⁶ the Quality Council for Trades and Occupations (QCTO)⁷ and the Council on Higher Education (CHE).⁸ The platform development had been under way for four years at the time that this paper was prepared and has involved key partners and subcontractors, such as the Council for Scientific and Industrial Research (CSIR),⁹ Reos Partners,¹⁰ COOi Studios,¹¹ Kaitoma Creatives¹² and JumpCO.¹³

A detailed theory of change underpins the PSET CLOUD and has undergone several iterations. The overall impact statement reads as follows: 'South African citizens make informed labour market decisions that lead to increased employment in line with NDP [National Development Plan] targets.'

Following more than two years of foundational work, the minimum viable product (MVP) is currently under development by JumpCO, JET and merSETA's technical partner for this task. Steady progress is being made, and the plan is for the first iteration to be demonstrated at the international DigiTrans¹⁴ conference on 28 February and 1 March 2022. The PSET CLOUD is overseen by a steering committee composed of senior management representatives from JET and merSETA. An external advisory group provides guidance at key intervals while a wide range of stakeholders have been involved in the development of a series of future scenarios.

This paper consists of eight vignettes, followed by a concluding section. Each vignette has been contributed independently and they do not necessarily link to each other in a logical sequence. Four key questions do however run across the contributions:

- 1 How can the South African education and training system be reset in a way that allows it to leapfrog many of its contemporaries?
- 2 How can the key ideals of open, fair and self-sovereignty be realised?
- 3 What developments are already in place that can be strengthened and combined?
- 4 What new governance models exist, and how can they be realised in the South African context?

As the authors, we invite robust engagements with our contributions and trust that this paper will provide an important anchor point for discussions addressing unemployment in South Africa through the development of digital platforms. We strongly advocate that these discussions are underpinned by an awareness of and respect for individual data privacy rights, enhanced interoperability across data systems and new thinking on the recognition of learning through digital credentialing.

4 <https://www.dhet.gov.za/>

5 <https://www.saqa.org.za/>

6 <https://www.umalusi.org.za/>

7 <https://www.qcto.org.za/>

8 <https://www.ch.ac.za/>

9 <https://www.csir.co.za/>

10 <https://reospartners.com/>

11 <https://www.cooistudios.com/>

12 <https://www.kaitomacreatives.co.za/>

13 <https://jumpco.io/>

14 <https://psetcloud.org.za/digitrans-2022>

VIGNETTE 1

The right to regulate one's own career and all related data

Christopher J. Beukes



Rather than thinking of a career as a lifelong series of developmental stages – as expected from the work of 20th century developmental psychologists such as Daniel Levinson and Donald Super – Hall (1996) suggests that the 21st century career should be viewed as a series of short learning stages. Citizens must make frequent changes and adjustments while forming goals and implementing plans in the vocational aspects of their lives (Chen, 2004). Similarly, Greenhaus (2003) states that a career in the 21st century is not measured by a citizen's chronological age or life stages but by continuous learning changes. In essence, for a citizen to make informed learning decisions, they need access to all past and present, formal and informal learning experiences to maximise their potential success. Similarly, potential education and training opportunities should be made available to each citizen. This information should be made available in an integrated and interoperable manner.

The continuous need to audit and align one's skills to manage one's own career is depicted in Beukes' (2009) model of self-regulatory employability. This audit and alignment process cannot be effective if citizens have only limited access to their records of formal and informal education and training. A further limitation is the potential lack of information of education and training opportunities available to citizens. Education and training data and information must be perpetually available to each citizen in order for them to regulate their careers. Each citizen's data and information for regulating their own careers should be seen as confidential. An ethical and responsible entity needs to protect this data and ensure that all formal and informal learning records and relevant opportunities are available on a continuous basis.

The right to regulate one's own career and all related data is enshrined in the South African Constitution; Section 22 declares that 'every citizen has the right to choose their trade, occupation or profession freely'. Education and training are the foundation of all trades, occupations and professions. As such, the right to choose one's education and training forms the basis of this right. This right, coupled with the right to privacy and not to have one's property searched (Section 14), sets a legal constitutional case for self-sovereign data control. Where a citizen's education and training data is their own property, this should be accessible but strictly confidential to citizens, unless required by law. The PSET CLOUD has the potential to ensure that each citizen's education and training data is interoperable from multiple sources and confidentially accessible to citizens. Citizens can then decide what education and training data they would like to share for any specific purpose. If education and training data is not managed through ethical and responsible entities, there is a risk that it could be sold for profit or used through social engineering techniques to commit fraud technologically or politically.



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VIGNETTE 2

Grounding data self-sovereignty on free open source software solutions

Bangani Ngeleza



The choice of software platforms for the pursuit of self-sovereignty is an important part of ensuring the optimal appropriation of its value. Free open source software (FOSS) solutions present opportunities that not only extend the concept of sovereignty beyond data to also include the underlying software, but also have a range of other relevant benefits, some of which are outlined briefly below. Not only is FOSS affordable to obtain, but it also has many cost advantages on total cost of ownership (TCO). The availability of the source-code for instance means that organisations are able to make adaptations without needing to pay for the services of the company that developed the software. The absence of licensing costs also contributes to lowering the TCO. In addition, the relative stability of FOSS resulting from a large community of developers eliminating errors means the costs of support are low (Cassell, 2008).

Open standards in software development are a contributory factor to the use of FOSS and are most beneficial to governments, which tend to consume huge amounts of information whose optimal value is realised when it is readily accessible to citizens (Hwang, 2005; Simon, 2005). Open standards allow for a modular development of FOSS solutions, meaning that there is no need to rely on one software provider for the total solution; rather, it is possible to combine software from different sources, thus limiting vendor lock-in (Simon, 2005). Open standards supporting FOSS can also be beneficial for the development and sharing of educational resources by educators (Pfaffman, 2007), an important factor for developing countries.

There are several researchers who have shown that the security achieved with FOSS exceeds that achieved with proprietary software (Mosoal et al., 2006; Sherif, Zmud and Browne, 2006; Drozdik, Kovacs and Kochis, 2005; Hwang, 2005; West and O'Mahony, 2005). According to these researchers, this is due to the open availability of the source code in FOSS, allowing more people to view it and to detect and correct errors. The frequency with which FOSS updates are made available to the public also contributes to improved security as it allows for developers to test the software well ahead of its final release. For instance, a survey of Linux development by Evans Data

found that 92% of their Linux systems had never been infected with a virus and 78% had never been cracked (Simon, 2005).

The fact that users of FOSS have access to the source code makes it possible to adapt this form of technology innovation to local requirements (Cassell, 2008; Mosoval et al., 2006). The South African government can benefit from general public licence (GPL)-based FOSS solutions because these can be adapted and modified in order to suit any local conditions, including local languages and cultures (Mtsweni and Biermann, 2008; Mutula, 2007). FOSS allows users who require certain additional features to be implemented to do so without hindrance (Bjorgvinsson and Thorbergsson, 2007; Hwang, 2005; Simon, 2005). There is the example of a web browser developed in Uganda ('Kuyangirizi') that has been translated into Luganda. A Zulu version of OpenOffice is available in South Africa. These local-language versions are examples of how FOSS can be geared towards supporting developing countries to create technology products that fit their specific needs (Camara and Fonseca, 2007). A further benefit specifically for developing countries is that FOSS can result in the development of a domestic ICT support industry that can provide employment opportunities. It enables developing countries to bridge the digital divide (Mutula, 2007; Cook and Horobin, 2006).



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VIGNETTE 3

Conceptualising self-sovereign identities

Paul Laughton



Self-sovereign identity, also known as SSI, is a digital identity movement that enables individuals to control their identity without intermediary authorities. This enables interaction with the same freedom and trust as one is accustomed to in a conventional offline environment. Self-sovereign identities ultimately allow individuals to control how their identities are managed on a global level (Sharma, 2020). The traditional centralised identity systems have several security weaknesses and do not support user control. Self-sovereign identity was proposed as an attempt to provide user control and a secure model for managing identities. Traditional centralised models have a number of drawbacks, such as potential loss of data due to common hardware or device malfunctions (Shuaib et al., 2021).

The proliferation of information in the digital economy has led to the fragmentation of identity data currently experienced among numerous online identity repositories. The average person has their data distributed among various governmental, financial and social data hubs. This can cause complications such as duplicate entries, mismatches and outdated data, in addition to the challenge of maintaining all these different identity repositories. Added to this, a lack of universal standards and interoperability among the identity repositories makes it challenging for people to store, obtain, remove, or share their personal data (Soltani, Uyen and An, 2021). Nowadays, the digital virtual online and physical worlds have become increasingly interconnected, highlighting the necessity and importance for a self-sovereign identity (Shuaib et al., 2021). Currently, popular user-centric designs have turned centralised identities into interoperable federated identities with centralised control while also allowing some level of user consent about how to share an identity (and with whom). Although this is an important step toward true user control of identity within self-sovereign identities, it is nevertheless only one step (Allen, 2016).

There is a significant need for self-sovereign identities since governments and companies share an unprecedented amount of personal information, processing and cross-correlating everything from viewing habits to purchases, to where people are located during the day, to where they sleep at night, and with whom they associate.

In addition, technology allows for greater access to human rights and to the global economy for developing countries, who are looking to digitisation and the adoption of technology in the 4th Industrial Revolution. When effectively implemented, self-sovereign identity can offer such benefits while also protecting individuals from the ever-increasing control of those in power (Allen, 2016).

Historically, one of the first references to identity sovereignty occurred in early 2012, when developer Devon Loffreto (2012, n.p.) wrote about 'sovereign source authority', stating that individuals 'have an established right to an "identity"', but that national registration destroys that sovereignty. At the same time, Patrick Deegan began work on an open-source framework that gives users control of their digital identity and their data in decentralised systems called Open Mustard Seed (Allen, 2016). Due to political differences, self-sovereign identity has begun to influence and feature in international policy. One significant event that has largely created interest is the refugee crisis that has beset Europe, resulting in many people lacking a recognised identity due to their flight from the state that issued their credentials (Allen, 2016).

True user control is the heart of self-sovereign identity, a term that is increasingly popular in fields where user data is required (e-government, e-commerce, health, etc.). An important feature of self-sovereign identities is that users become the rulers of their own identity rather than merely advocating that users stand at the centre of the identity process (Allen, 2016). Self-sovereign identity is the next step beyond user-centric identity and that means it begins at the same place: the user must be central to the administration of their identity. User consent is a key focus requiring interoperability of a user's identity across multiple locations with the user's consent, along with true user control of that digital identity, collectively creating user autonomy. To ensure this, a self-sovereign identity must be transportable and not restricted to one site or locale. However, it must be acknowledged that a self-sovereign identity can be a double-edged sword – usable for both beneficial and harmful intent. To achieve its aims, an identity system must balance transparency, fairness and support of the commons with the continuous protection of individuals (Allen, 2016).



An important feature of self-sovereign identities is that users become the rulers of their own identity rather than merely advocating that users stand at the centre of the identity process.



VIGNETTE 4

Case study: European Blockchain Service Infrastructure

Simphiwe Ntuli



The European Blockchain Service Infrastructure (EBSI) is an initiative by the European Commission and the European Blockchain Partnership that aims to connect Europe by delivering cross-border public services through the use of blockchain technology (Verbeek and Lundqvist, 2021). At the heart of this initiative is self-sovereign identity (SSI) which is being used to implement an SSI model in Europe, allowing users to create and control their own identity across borders (Pastor, 2021) without having to rely on central authorities (Dávila, 2020). To achieve this, the European Self-Sovereign Identity Framework (ESSIF) was developed with the objective to create and define standards for European SSI as well as provide the necessary supporting capabilities based on EBSI infrastructure with a focus on identities of natural persons and legal entities (Dávila, 2020).

In terms of how the objective is meant to be achieved, the following factors have been identified as key to success in this endeavour:

- Definition of specifications and guidelines for technological components of ESSIF: EBSI wallet, ledgers (public and private), Identity HUB, trusted issuers registries, application programming interfaces (APIs) to access diverse services, etc.;
- Definition of trust and governance frameworks: ESSIF Trust Framework, ESSIF Governance Framework;
- Creation of core services and minimal reference implementations for capabilities;
- Design and provision of flows for the different processes that can take place: the creation of identity, issuance of verifiable credentials (e.g. verifiable IDs, verifiable attestations), sharing and verification of verifiable presentations, etc.; and
- Interaction and alignment with the broader SSI market/ecosystem.

Subsequently, in late 2021, the EBSI ran a multi-university pilot that encouraged early adopter member states to test their solutions in a real-life setting. The pilot ran for four months, ending in November 2021 (Fillis, 2021). The goal of the pilot was to:

- Allow member states to test the interoperability of their solutions with other key actors in the ecosystem;
- Allow for the exchange of verifiable credentials by students and universities, trusted accreditation organisations, trust issuers, holders of credentials, wallet providers and other partners;
- Demonstrate that the EBSI can implement cross-border verification of educational credentials based on SSI principles;
- Show that a verifiable attestation (such as a diploma) issued by one member state can be verified by a university or third party, for example an employer from another member state.

According to the European Blockchain Partnership quarterly meeting held on 9-10 December, the pilot was a success. Willeke, from the City of Amsterdam and a graduate from Saxion University of Applied Sciences in the Netherlands, successfully applied to do a Master's degree at the University of Rovira i Virgili in Spain using her Verifiable_ID, aligned to the electronic IDentification, Authentication and trust Services (eIDAS), and her Bachelor degree completed at Saxion University (Martin, 2021). The pilot successfully demonstrated cross-border interaction using the decentralised paradigm, verifiable credentials and SSI provided by the EBSI and ESSIF, and the source of trust provided by the blockchain ledger, all in a decentralised way – thus avoiding profiling, preserving citizens identity and fully empowering citizens with real ownership and control over their identities and data in an easy way, thanks to ESSIF conformant wallets (Martin, 2021).

In contrast with what is happening in Europe, Africa is lagging behind. Europe is at a stage of piloting their solutions, having done the groundwork and established the collaborations, legal and technical frameworks, and developed standards along with regulations and policies. However, there have been some developments in the space of SSI in South Africa, with entities such as the South African Financial Blockchain Consortium (SAFBC) and BankservAfrica working towards the realisation of SSI in the country. BankservAfrica, with the support of PricewaterhouseCoopers, has been facilitating discussions with banks (Absa, Capitec Bank, Standard Bank, First National Bank, Investec and Old Mutual), fintech companies and government to explore the building blocks for a digital identity programme to unpack critical success factors in realising a holistic digital identity programme for South Africa (BankservAfrica, 2021a; 201b). The outcomes of these discussions, together with results from international case studies, surveys, interviews and focus group discussions, found that:

- A digital identity is key to the growth of a digital economy;
- A trusted and secure digital identity will improve online transactions; and
- Consumers will gain social and economic benefit.

Furthermore, it became apparent that, due to the critical role of identity management in the 4th Industrial Revolution, there is a growing need for the roll-out of a digital identity programme in South Africa. For the benefits to be realised and the impact on the economy to take full effect, the digital identity policy at government level and the development of integrated solutions by businesses need to be a high priority for all stakeholders (BankservAfrica, 2021a; 2021b). As a result of their findings, BankservAfrica and their community of partners are moving to phase two of their initiative, which involves:

- A business stream to establish the commercial model that works for all participants while keeping the end-user consumer top of mind;
- A governance stream for building trust and governance and to establish the participation rules, the minimum requirements and to ensure a healthy, mobilised ecosystem; and

- A technology stream that will involve creating a sandbox for community members to test use cases and to test their digital identity solutions for interoperability, different attributes and technology skills (BankservAfrica, 2021c).

As a member of this community, Absa has already declared in the public space that they want to introduce SSI in their organisation (Pillay and Mouton, 2021). As an industry leader, Absa is positioned to influence forward progress within the SSI space in South Africa. Further, as one of the top four banks in South Africa, their interconnectedness with institutions in South Africa and across the rest of Africa can only serve to benefit the SSI development process.



There have been some developments in the space of SSI in South Africa, with entities such as the South African Financial Blockchain Consortium and BankservAfrica working towards the realisation of SSI in the country.



VIGNETTE 5

The importance of widespread adoption via grassroots networks

Mario Marais and Sara Vannini



The journey to widespread adoption of any ICT for Development (ICT4D) initiative can use different approaches. High-level networks between entities concerned with self-sovereign identity (SSI) have been discussed. The importance of individual decisions for open, fair self-sovereignty has been emphasised. A key issue for self-sovereignty, though, is the role of grassroots networks to make people aware of the choices they can make on an individual level, which remains an understudied area. Awareness creation and the diffusion of ideas, concepts and practices – that is, adoption – is a space in which ‘intelligent intermediaries’ (Gopakumar Rajalekshmi, 2007), ‘social connectors’ (Díaz Andrade and Urquhart, 2010), ‘infomediaries’ (Gómez, Fawcett and Turner, 2012) and, especially, ‘local champions’ (Renken and Heeks, 2019) have played a large role. The focus on champions can either be intensely individually based, or more nuanced and placed in a community context. Choice exists to prioritise the individual’s actualisation versus their loyalty towards being part of a community. A pertinent question here is whether (a) the idea of champions as single individuals or (b) a shift to a more collective role of championship would be a better fit for this kind of development initiative.

In a recent paper, Marais and Vannini (2021) argue that more attention should be paid not only to the family of ICT4D approaches that follow bottom-up, participatory strategies in ICT4D (e.g. Bentley, Nemer and Vannini, 2017) but also to possible differences in value systems and frameworks that leverage communities’ self-organisation, and that build on existing relationships within and between communities rather than relying solely on single individuals. In communities, these existing relationships may already have resulted in innovation, development and social transformation. Because they are founded on existing and enhanced social capital (Marais, 2012) facilitated by shared value systems, they may be more resilient and sustainable over time.

Marais and Vannini (2021) propose a network approach that builds on existing grassroots experiences and that scales up community-level development initiatives already led by a variety of actors, including local champions and less visible individuals,

as well as non-governmental, faith- and community-based organisations. Intentionally enabling networks within the systems in which ICT4D projects operate requires adopting a relationship-based and social-capital approach as one of the foundations for sustainable development. The practice of 'network weaving' (Holley, 2013a; 2013b) is therefore proposed, combined with the adoption of the value system on which it is built (Marais and Vannini, 2021).

The concept and practice of network weaving was started by June Holley (2013a; 2013b) to help low-income entrepreneurs in the Appalachian region in Ohio, one of the poorest regions of the United States, to create networks that would bring opportunities and social change to their communities. According to Holley's framework (2013b), networks are complex sets of relationships among people and communities. Networks have the ability to address power imbalances both by encouraging intentional peer relationships that recognise the value and contribution individuals can make, and by considering every individual to be a potential leader in the network who has the ability to connect and initiate collaborations. In this way, 'power is distributed, not concentrated' (Holley, 2013b, p. 10). Finally, the framework recognises the inclusion of all stakeholder voices in the process of generating change as an important way to redistribute power. The potential of network weaving to complement and advance the development approaches advocated in this article are summarised below.

First, network weaving focuses on co-creation processes and on all stakeholders' participation. Networks include diverse stakeholders, each with their different perspectives. Stakeholders are like nodes of networks, and, in network weaving, they are organised in a non-hierarchical way. Having a network mindset, then, implies decentralised decision-making and collective action, requiring that local communities participate in development-strategy decisions that are usually made by governments and large organisations. A network mindset requires contextual development strategies, where the diversity of interests is represented, and where the space is held for multiple ways of achieving outcomes in which indigenous knowledges, various value systems and so-called expert knowledge can interact and evolve.

Second, network weaving expands on the relevance of intermediaries, infomediaries and champions that has already been established in the literature. By stating that anybody can be a network weaver, the focus on leadership is transferred to a shared, collective idea of 'championship', which is more inclusive, more sensitive to collective dynamics and value systems that are more widespread in non-Western communities, and possibly more sustainable in the long term. This different idea of leadership is especially relevant when it comes to focusing on women's participation in development leadership. Women who are leaders and champions are frequently overlooked. For example, schools in South Africa rely heavily on women teachers, yet school principals are overwhelmingly male (Skosana, 2018).

Third, network weaving is empowering for communities, not only because they have more access to decision-making and to leading the change they want to see but also because it enables them to be aware of the networks they are embedded in, and of the power they have to influence decisions. This increased awareness brings with it more exposure to a plurality of ideas and more peer learning, which contributes to promoting community empowerment, and, ultimately, more agency.

Finally, the approach emphasises the role of ICTs in development as tools (not agents) to foster transparency and to achieve social justice (Smith, 2014). A network approach encourages sharing by default, including the sharing not only of outcomes and approaches from different projects but also of networks themselves so that they can grow and evolve. Networks are inherently flexible: they often lack defined boundaries and have great potential to grow. This natural evolution of networks is beneficial for ensuring the dissemination of good practices: while projects can come and go, and academic findings seldom reach communities outside of researchers' own influence spheres, networks' learning exchanges at the community level can be self-sustaining as new members become involved.

VIGNETTE 6

Social engagement to realise the full potential of technological innovation

Rebecca Freeth and Andrew Akpan



The PSET CLOUD is a technological innovation that pursues the reclaiming of data self-sovereignty. However, as is evident throughout this paper, technological innovation on its own cannot ‘fix’ the many social and political obstacles to realising self-sovereignty. In the case of the PSET CLOUD, social engagement is a valuable complement to technological innovation. Social engagement stimulates dialogue and collaboration between stakeholders who may hold very different positions, hopes and concerns in relation to issues of self-sovereignty and whose active support of the PSET CLOUD is vital for its successful design and adoption. Below, we share some insights from the social engagements that have been conducted in parallel to the technological innovation process.

JET and merSETA, with support from Reos Partners, have followed a process of social engagement that comprised inquiring, convening, inspiring, co-creating, collective strategising and collaborating to strengthen the PSET CLOUD innovation. Each of these steps is briefly elaborated below.

Social engagement began with inquiry. JET and merSETA were starting to embark on technological innovation that held the potential to re-align the PSET system to the supply and demand needs of the labour market. It was an ideal time to learn more about how key PSET stakeholders perceived the current situation of supply and demand, and to hear their uncertainties and concerns about how this situation might play out into the future. A widely held perception was that ‘Overall, the current skills planning, and provisioning system seems to create a lot of frustration ... it’s not working as it should.’ When we asked about the constraints producing this situation, many respondents referred to historical legacies and the pace of change on the skills supply side severely lagging behind that on the demand side. A persistent theme was also lack of coordination within the sector. We heard comments such as:

A key constraint is the silo nature of the PSET system. It has historically been disjointed.

We do not have coordination and collaboration among stakeholders.

Due to the lack of data integration, we're trying to solve the same problem in a piecemeal way.

There is a proliferation of interventions ... We have an enormous number of organisations working on these problems but each one approaches it from a slightly different angle. There is no central coordinating body.

The inquiry process opened the door to more structured engagement across the sector. Once that door was open, JET and merSETA invited key stakeholders to walk through it, into a carefully designed engagement process. Generally, convening stakeholders has the aim of bringing together a group of people who collectively hold a diversity of roles and positions and have influence in the wider PSET system. While convening is an ongoing process, it was important to pay due attention at the early phase of stakeholder engagement. The convening exercise started by bringing a small group of 25 stakeholders into an intensive scenarios exercise aimed at 'scaling deep'. Over time, the convening exercise drew more people in, including larger groups of people from each of the stakeholder organisations – 'scaling out' – with the intention that ultimately, their combined input would enable the envisaged technological innovation to meet the needs of the sector and have significant uptake – 'scaling up' (Moore, Riddell and Vocisano, 2015).

The third step was to inspire the stakeholders to imagine what the PSET CLOUD system could achieve if successful. The theory of change expresses a compelling statement of intended impact – namely that South African citizens make informed labour-market decisions that lead to increased employment in line with National Development Plan (NDP) targets. This statement had to be broad enough to supersede individual stakeholders' interests and targeted enough so that stakeholders could coalesce around it. This provoked stakeholders' imaginations of what the technological innovation of the PSET CLOUD could ultimately realise. An early wireframe model of the minimum viable product (MVP) of the PSET CLOUD was shared as further inspiration of what was possible.

This set the stage for the group of 25 convened stakeholders to co-create a set of scenarios (see Reos Partners, Jet Education Services and merSETA, 2021). As individuals from statutory bodies, government departments, business, academia and civil society in the PSET sector, they had a wide range of interests in PSET and held very divergent perspectives on the reasons for misaligned skills supply and demand. However, over the course of three months, they were able to co-create and adopt four scenarios. These scenarios represented a response to the most troubling uncertainties about the future that had been voiced in the inquiry process. Having a shared set of scenarios (which expressed carefully constructed narratives about what could happen in the next ten years until 2030) triggered a sense of shared urgency for making the PSET CLOUD a success.

After the scenarios exercise, the wider group of stakeholders was invited to consider the strategic implications of these scenarios in a collective strategising exercise. The scenarios proved useful in starting conversations across the PSET sector about some of the social and political challenges to be addressed in order to realise the technological potential of interoperable data platforms. These included questions related to self-sovereignty. How would such platforms be governed and owned? How to take a decentralised approach rather than a command and control approach to data platforms? Individuals from different stakeholder organisations in PSET engaged on these questions to strategise a way forward together.

A growing number of stakeholders have expressed commitment to collaborating towards the realisation of the PSET CLOUD system. This commitment is the product of the many engagements through which JET and merSETA demonstrated how the PSET CLOUD could not only benefit the entire ecosystem but also support individual organisation's mandates and strategies. The realisation of the PSET CLOUD hinges on the willingness of stakeholders to collaborate towards its success.

Our observations thus far are that social engagement has supported JET and merSETA, as initiators of technological innovation, to:

- Communicate early about a new innovation with key stakeholders in a way that draws them into the innovation process while there is still time to influence it;
- Establish shared accountability for advancing principles such as self-sovereignty;
- Innovate in a way that draws on the experience, insights and knowledge of multiple stakeholders;
- Build a more collective sense of ownership of the PSET CLOUD as an innovation;
- Identify future uncertainties that could jeopardise innovation and unlock collective action (rather than collective paralysis) in response to these uncertainties;
- Jointly address dilemmas faced in the technological innovation, for example about data privacy; and
- Foster collaboration in the ultimate application and roll-out of the PSET CLOUD, thus broadening take-up and upscaling.

In conclusion, while technology may enable principles of openness, fairness and self-sovereignty in relation to data, this is not only a technological endeavour. In the context of myriad stakeholders, it is also a profoundly social exercise. It requires dialogue and collaboration between many different people who have a stake in these issues. What is fair for one may not be fair for another; stakeholders need to be able to articulate what they see from their perspective, listen to the perspectives of others, and discover, together, how to realise the significant potential of an innovation such as the PSET CLOUD.



A growing number of stakeholders have expressed commitment to collaborating towards the realisation of the PSET CLOUD system.



VIGNETTE 7

The state of play of self-sovereign identity in the Netherlands

Carla Pereira



Like many other countries worldwide, self-sovereign identity (SSI) is on the rise in the Netherlands. Accordingly, the Ministry of the Internal Affairs and Kingdom Relations, the policy manager for the Dutch (digital) identity infrastructure, published a vision statement on digital identity,¹⁵ and therein confirmed that the Dutch government sees an active role for itself in creating trust in the digital world for citizens and businesses, recognising that having reliable data is crucial for this to happen. However, its own position and policy regarding SSI and how this relates to the vision statement on digital identity was vague. Noting the growing call from Europe and the private sector for the Dutch government to take a clear stance on digital-data exchange, the Dutch government commissioned INNOPAY and TNO to undertake a study¹⁶ to analyse the current initiatives around SSI and digital-data exchange and their implications for the Netherlands. Drawing on desktop research, online surveys from market parties and several interviews with stakeholders and experts in the SSI field, this exploratory study analysed the Dutch SSI playing field, (inter)national developments and future development directions and its impact on public values.

According to this study, while there are many SSI trial initiatives (experiments) in the Netherlands, the landscape is fragmented. More than 90 organisations are directly or indirectly active in the Dutch SSI playing field, classified in one of four categories: SSI users, SSI suppliers, SSI knowledge suppliers, and partnerships and standards-setting institutions. Critical mass has not (yet) been achieved by individual suppliers of SSI solutions. SSI ideas are not (yet) mature enough for large-scale use in society. Limited source data availability and limited reusability in other domains form a barrier to value creation. The various pilot initiatives are showing the potential of SSI, but there is little cooperation between the different initiatives, leading to a fragmented field in both the private and public sectors. There are competing ideas about the best interpretation of SSI because certain essential concepts are not yet properly evolved.

¹⁵ https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2021Z02985&%20did=2021D0648

¹⁶ <https://www.rijksoverheid.nl/documenten/rapporten/2021/10/01/eindrapport-nederlandse-self-sovereign-identity-ecosysteem-ssi>

Organisations still focus mainly on the development of their own products, and to a lesser extent on collaboration and interoperability with other initiatives. Many parties are reluctant to disclose and use data via SSI, which also explains why a critical mass has not yet formed.

There is a lack of clarity on how the different legal frameworks in development relate to each other. Consequently, large commercial parties often move faster than legislative developments, resulting in their domination and disruption of the market. The participants in the field argue that lack of clarity around the developing legal frameworks hampers further upscaling of SSI. This is because the frameworks deal with different aspects of digital-data exchange. When the legal frameworks have been established, new legislative pathways to contain power and manage competition may be necessary.

The following recommendations were put to the Dutch government for consideration for making SSI a reality in the Netherlands:

- An integrated vision linking the Dutch digital-identity landscape and data exchange to an ambitious implementation agenda is necessary. It will need to take European developments around the EU Digital Identity Wallet into account and ensure that both private and public users can realise the social value of digital-data exchange in the shortest possible time.
- Drive public-private cooperation towards consolidating a harmonised and interoperable digital-data exchange field by bringing the knowledge and expertise of the 90+ parties already experimenting with SSI to work towards further upscaling. Additionally, this best practice will need to find its way to the bodies in Europe working on the further detailing of the EU Digital Identity Wallet.
- For the government to break through the chicken-egg problem for digital-data exchange by proactively making source data available via 'digital agents' and/or 'data at the source' interaction models and using source data for the validation and optimisation of its own business processes. By doing so, the social value of digital-data exchange can be realised.

Clearly, the challenges of implementing SSI in South Africa are not unique to developing countries. The analysis in this report has shown that the technology and ideas surrounding SSI are not mature, even in developed countries such as the Netherlands. There are still many unanswered questions that must be crystallised before SSI can fully deliver on its promises, but it seems to be on the right trajectory. The recommendations put forward in this study for the Dutch government should be considered for South Africa since we are experiencing the same challenges, perhaps to a more significant degree.



Large commercial parties often move faster than legislative developments, resulting in their domination and disruption of the market.



VIGNETTE 8

Credential fluency: Measuring human ability in a brave new world

James Keevy and Kelly Shiohira



In a new era of machine learning, algorithms and strong artificial intelligence (AI) that may soon be able to pass the infamous ‘Turing test’ (a measure of whether a machine or programme exhibits behaviour which is distinguishable from human behaviour), measuring human ability has become all the more important (Shiohira et al., forthcoming). Of course, this intent to measure and recognise ability has preoccupied humanity long before the advent of AI. Dating back to the Middle Ages, and even much earlier ancient civilisations, specialised career structures, craft guilds and the early development of university structures in the eleventh century could be described as the antecedents to contemporary concepts of competency, lifelong learning, qualifications, and also jobs and careers (Keevy et al., 2021). As in Huxley’s classic 1932 novel, we use the metaphor of ‘a brave new world’ as we look to the post-pandemic future. In this future, we argue, emerging technologies will, for the first time in human history, make it possible to measure and recognise human ability in a more seamless and articulated manner than has been possible until now (Spencer-Keyse, Luksha and Cubista, 2020; UIL, 2020).

This contribution draws on a wide range of current initiatives that, in one way or another, touch on the application of technology to the measurement of human ability. The perspective is largely African in its origin, but the scope and the scale of collaboration is global. The contribution is presented as a meta review of three main initiatives that the authors are directly involved in, and not as new empirical research. The first initiative included in our review is the development of the African Continental Qualifications Framework (ACQF) (Keevy et al., 2021) with its potential to become a new generation framework, in some ways following the emergent thinking embraced in the Credential Framework for the United States (Rein 2019, cited in Keevy et al., 2019). The ambitious undertaking in South Africa to develop a fully interoperable data ecosystem for the post-schooling sector (see Rajab et al., 2020), currently in its fourth year, is a second source. The third initiative we draw on is an international collaboration on new qualifications and competencies that started as recently as December 2020 and builds on similar work within the European context (see Euler, 2021; UNEVOC, 2020). Additional research and tangential publications

are also considered. Our intention is not to repeat the findings of these initiatives nor to specifically present condensed summaries, as these can be found in the source publications. What is of interest to us is how the initiatives come together on a new canvas to paint a landscape that we will broadly refer to as ‘credential fluency’.

Drawing on the findings of our meta review, we will argue that in order to achieve credential fluency, a more interdisciplinary approach is needed (Herrera, Teras and Gougoulakis, 2020), an approach that builds on the current interplay between trends in three sectors: education and training, proxied through notions of learning outcomes and qualifications; technical and vocational education and training (TVET), proxied through notions of competencies and, more recently, new skills (see ICCF, 2020); and the world of work, proxied through workforce readiness and data-driven recruitment. In some way, the three initiatives included in our meta review resemble these three sectors; although, we would be the first to point out that the last sectoral analysis, the world of work, is also the weakest. From our work in South Africa and Africa, the paucity of research from an employer perspective is a limitation, but this seems to be a concern globally (Knox, Wang and Gallagher, 2019). An important cross-cutting concept, although not defined in the same manner, is that of human ability.

In brief, we view credential fluency as a future state wherein human ability is measured and recognised in a seamless and digital manner. In our view, credential fluency has the potential to build on the interplay between new thinking in education, TVET and the world of work and, as such, presents a new, unified model. Such an emerging interdisciplinary model will be able to draw on the tenets being developed in each separate discipline; but, to quote ancient Greek philosophy, the whole can be greater than the sum of its parts. In our view, the development of new technologies, specifically AI, makes it possible to have this conversation for the first time. The foundational constructs needed to be in place to move towards increased credential fluency, as identified from our meta review, are listed and briefly elaborated below. The more detailed discussions will be elaborated in the full paper.

The first construct we have identified is interoperability, specifically semantic interoperability. As noted by Shiohira and Dale-Jones (2019, p. 22), drawing on Morales and Orrell (2018), ‘interoperability is the ability of discrete computer systems or software to exchange and make meaningful use of shared data or other resources’. In practice, this will mean that data can be used and processed in different applications by different users. Various frameworks exist for interoperability, the most well-known and most widely used being the Data Commons Framework (Goldstein, Gasser and Budish, 2018), which captures ‘both the technical and the societal elements of an interoperable system, as well as the relationships between them, and serves as an important tool for understanding the hierarchies implicit in the development (infrastructure, standards and semantic architecture) and use (interactions between organisations, policy, broader society and individual users) of an interoperable system’ (Shiohira and Dale-Jones, 2019, p. 23). Semantic interoperability provides a more focused interpretation of the construct. Drawing on the linguistic notion of semantics, in this case, the emphasis is on consistency of meaning, relations between items and generally, the ability for metadata to be read more constantly and reliably by machines (Shiohira and Dale-Jones, 2019). In the context of this contribution and its focus on credential fluency, semantic interoperability is a necessary precondition for more seamless and digital ways to measure and recognise human ability; importantly, this approach must focus on both technical and societal elements.

A move towards greater interoperability may, in our view, very well be a precondition for credential fluency, but the construct itself also raises ethical concerns about data privacy and ownership. This, we argue, is the second foundational construct that must be understood and further developed. In modern day society, citizens have limited control over their own data. Third-party applications, both private and public, aggregate to massive data lakes which are, paradoxically, centrally owned, lack portability and have limited interoperability (Dale-Jones and Keevy, 2021). In our view, and drawing on an increasingly large research base, the future trend is towards

decentralised, peer-to-peer data exchange systems wherein ‘no one party controls the relationship with the other’ (Preukschat and Reed, 2019, cited in Dale-Jones and Keevy, 2021, p. 4). The notion of self-sovereign identity (SSI) is often used as an example of such an emerging new trend (US Chamber of Commerce Foundation, 2020). Building on this thinking, there is a definite emergence of a rights-based approach to data ownership, which in some cases even extends to the proposition that connectivity in itself should be a human right (Murahwi and Ntuli, forthcoming). Considering huge global inequalities related to internet access, and the deepening of the same as demonstrated during the pandemic as online learning and working became more mainstream, continental and global efforts to address data privacy and ownership concerns are critically important (Dale-Jones et al., 2020).

The third and remaining precondition for credential fluency is a common taxonomy for the measurement and recognition of human ability. Such a taxonomy does not have to replace well-developed nomenclatures and concepts across education, training and the world of work; however, as a global interdisciplinary community, we at least need a translation device. In the education and training context, qualifications frameworks represent an attempt over the past three decades or more to leverage the increased use of learning outcomes to describe knowledge, skills and competencies. In the world of work, we note conversations about workforce readiness as well as, increasingly, the use of technology to match humans with jobs, not to mention jobs that do not yet exist. Semantic interoperability is well aligned to the construct of common taxonomies and also to the international discourse on data privacy and ownership. Moves towards developing consensus on some of these constructs – such as the Beijing Consensus on AI and Education (UNESCO, 2019) and also, from an African perspective, the ACQF (Keevy et al., 2021) – are pointing in the right direction, but will, in all likelihood, require many years to consolidate into something as ambitious as global agreement on connectivity as a human right.

In summary, our contribution attempts to navigate uncharted waters as we imagine a new world wherein human ability is measured and recognised more seamlessly and more digitally. We argue that this can only be realised through an interdisciplinary approach and in a context wherein semantic interoperability, data privacy and ownership, as well as more common taxonomies, are prioritised, jointly developed and agreed on. In this brave new world, the Turing test may be less important as machines and algorithms better serve humanity by measuring and recognising human ability in ways not possible before.

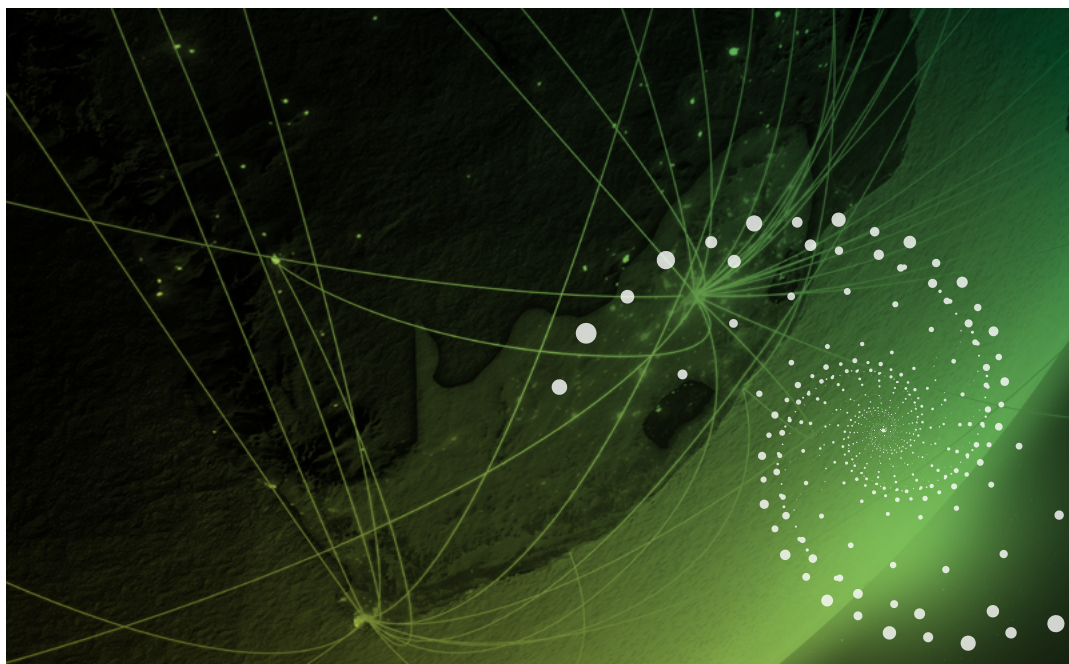
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Concluding comments: Building agency

Rooksana Rajab



The PSET CLOUD is an ambitious project, as noted in the 2020 report, *Unlocking the power of data* (Rajab et al., 2020, p. 1):

What if we could better utilise the new technologies that have become so pervasive in the modern era to improve our education and skills systems in South Africa? Imagine having the potential to link the unemployed to job vacancies or even to start to develop new, just-in-time training programmes for jobs that do not yet exist.

Recognising that data is central to a technology-driven world and that the protection of an individual's data has fast become a reality for all citizens, the level of engagement to build trust between citizens, governments, civil society and companies must take centre stage (Rajab, Ntuli and Barbour, 2021). In the main, the adoption of new technologies may impose considerable challenges to data protection and privacy. Citizens must be sufficiently informed of their rights to data privacy if we are to create a truly empowered and democratic nation. It is important to rethink our model of engagement with citizens and their data so that they are confident in how their data is collected, collated, protected, interpreted and used. The PSET CLOUD must explore models of engagement with citizens, and especially with those in deprived communities. While self-sovereign identity (SSI) holds the key to the protection of data, where each individual owns their own data through blockchain technology, a process of inclusivity of all citizens must remain a leading principle so as not to alienate users.

Apartheid's spatial legacy regarding poverty and deprivation remains one of the greatest challenges confronting South Africa (Noble, Zembe and Wright, 2014). According to Planes-Satorra and Paunov (2017), people from 'deprived communities' typically face a combination of three drawbacks. First, they face a structural disadvantage in lacking the skills or influence to shape their environment in a meaningful way. Second, they face a relational weakness in having limited access to accepted mainstream support mechanisms such as finance, advocacy and

entrepreneurial networks. Finally, they face systemic barriers including discrimination in the labour market. These factors contribute to the alienation of a large proportion of our society and to continued high unemployment rates in South Africa. In the UNESCO report *Reimagining our futures: A new social contract for education*, the International Commission on the Futures of Education (2021, p. 35) emphasises that: 'Technology is not neutral – it can frame actions and decision-making in ways that divide and reshape the world as well as human understanding and action.'

While one of the main objectives of the PSET CLOUD initiative is to strengthen collaboration across the system through the establishment of an effective shared data and services platform, issues of inclusivity, especially of deprived communities, must be carefully considered. Additionally, the platform's analytical capability is expected to be enhanced by linking it to other data sources (such as relevant market and industry indicators) through interoperability. It is necessary to review the post-school ecosystem in terms of how interoperability can best be used for coordinating and sharing data within the labour market using common standards for the individual citizens, institutions and organisations involved in education and lifelong learning. In the past decade, the impact of technology on society has been profound, creating significant opportunities for education, training and development; however, not much has been done to ensure human rights in terms of data privacy and security, notwithstanding legislation such as the **Protection of Personal Information Act (POPIA)** No. 4 of 2013 in South Africa and the European Union's General Data Protection Regulation (EU-GDPR). In light of this deficiency, an interdisciplinary discussion is required to understand and explore the protection of individual citizens' data.

Hence, the importance of relationship-building to enable the navigation of systemic structural challenges and power dynamics that exist between change agents of the PSET CLOUD and the disenfranchised cannot be overemphasised. Creating real impact – and making a positive difference to those who need it most – requires true empowerment of citizens, which in reality is a longer process of building shared social capital. Habisch and Adaui (2013) claim that building social capital happens at three levels: at a personal level, where an individual recognises the value of the community and brokers connection to specific opportunities through their personal network; at an organisational level, where new ways of collaborating and cooperating are explored and developed to provide more opportunity; and at an institutional level, where governance and support processes are changed to provide enduring support and recognition to vulnerable communities to help them participate in society more equitably.

Finally, the question remains whether South Africa has the appropriate level of digital skills and can provide access to technology for all citizens. We recognise that there is a need for citizen empowerment and building citizen agency to enable people to embrace technology and use the PSET CLOUD itself. This will be key to ensuring the CLOUD's successful adoption and impactful use. For this reason, the PSET CLOUD initiative must include a large-scale national advocacy process to ensure that stakeholders are effectively engaged throughout the implementation stages. Such an initiative must place advocacy as a central current that directs communication from isolated or fringe sectors to create multilevel conversations on both the PSET digital ecosystem itself and the benefits of such a system. It is imperative that deprived communities and their partners begin to see themselves and their futures in a new light, transformed through a compelling narrative of change, one that enables new possibilities.

References

- Allen, C. (2016). The path to self-sovereign identity [Blog post]. *Life with Alacrity*, 25 August. <http://www.lifewithalacrity.com/2016/04/the-path-to-self-sovereign-identity.html>
- BankservAfrica. (2021a). *Digital Identity – A South African journey*. Johannesburg: BankservAfrica. <https://www.bankservafrica.com/api/public/v2/filehandler/view/612f2d5e989a0e000128a550>
- BankservAfrica. (2021b). *South Africa's digital identity journey*. Johannesburg: BankservAfrica. <https://www.bankservafrica.com/api/public/v2/filehandler/view/612f2e78989a0e000128a5cf>
- BankservAfrica. (2021c). Crafting the next phase of SA's digital identity story together. *BankservAfrica*, 16 January. <https://www.bankservafrica.com/blog/post/crafting-the-next-phase-of-sas-digital-identity>
- Bentley, C., Nemer, D. and Vannini, S. (2017). 'When words become unclear': Unmasking ICT through visual methodologies in participatory ICT4D. *Special Issue on Cultural Diversity and Community Technology Design: AI and Society*, 34(3). <https://doi.org/10.1007/s00146-017-0762-z>
- Beukes, C.J. (2009). *The relationship between employability and emotional intelligence*. Pretoria: Department of Industrial and Organisational Psychology, University of South Africa.
- Bjorgvinsson, T. and Thorbergsson, H. (2007). Software development for governmental use utilizing free and open source software. *Proceedings of the 2007 International Conference on Software Engineering Research Practice* (pp. 133-140). 2007 International Conference on Software Engineering Research Practice, 25-28 June, Las Vegas, NV, USA. <https://doi.org/10.1145/1328057.1328087>
- Camara, C. and Fonseca, F. (2007). Information policies and open source software in developing countries. *Journal of American Society for Information Science and Technology*, 58(1), 121-132. <https://doi.org/10.1002/asi.20444>
- Cassell, M. (2008). Why governments innovate: adoption and implementation of open source software by four European cities. *International Public Management Journal*, 11(2), 193-213. <http://dx.doi.org/10.1080/10967490802095680>
- Chen, C.P. (2004). A new perspective for career psychology. *Australian Journal of Career Development*, 13(2), 17-28. <https://doi.org/10.1177%2F103841620401300204>
- Cook, I. and Horobin, G. (2006). Implementing e-Government without promoting dependence: open source software in developing countries in Southeast Asia. *Public Administration and Development*, 26(4), 279-289. <http://dx.doi.org/10.1002/pad.403>
- Dale-Jones, B. and Keevy, J. (2021). Digital credentials: Discussions on fluency, data privacy and the recognition of learning in higher education beyond COVID-19. In M. Venter and S. Hattingh (Eds.), *Learning for a better future: Perspectives on higher education, cities, business and civil society* (pp. 193-209). Cape Town: AOSIS Books. <https://books.aosis.co.za/index.php/ob/catalog/book/214>
- Dale-Jones, B., Manda, M., Castel-Branco, E., Magudu, A., Tshabalala, A., Buso, B., Fritz, G.V., Raven, M. and De Wit, Z. (2020). *Putting the individual at the centre: The role of digital identity during the time of COVID-19*. Johannesburg: JET Education Services. https://www.jet.org.za/resources/theme-7-infographic_final.pdf/view
- Dávila, E. (2020). *European Blockchain Services Infrastructure: Harness the power of blockchain services, increasing trust through data security, privacy and transparency*. Brussels: European Blockchain Partnership. <https://www.itu.int/en/ITU-T/webinars/20201104/Documents/Emilio%20Davila-EBSI%20presentation%20ITU%20ED%2004112020.pdf>
- Díaz Andrade, A. and Urquhart, C. (2010). The role of social connectors in seeking computer-mediated information in rural societies. *Human IT*, 11(1), 1-28. <https://humanit.hb.se/article/viewFile/77/60>

- Drozdzik, S., Kovacs, L. and Kochis, P.Z. (2005). Risk assessment of an open source migration project. *Proceedings of the First International Conference on Open Source Systems* (pp. 246–249). First International Conference on Open Source Systems, 11–15 July, Genova, Italy.
- Euler, D. (2021). Concept note. New qualifications and competencies for TVET. Unpublished.
- Fillis, T. (2021). University pilot proves value of a European blockchain. *CEF Digital*, 4 October. <https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/2021/10/04/University+pilot+proves+value+of+a+European+Blockchain>
- Goldstein, E., Gasser, U. and Budish, R. (2018). Data Commons Version 1.0: A framework to build toward AI for good. A roadmap for data from the 2018 AI for Good Summit. *Berkman Klein Centre*, 21 June. <https://medium.com/berkman-klein-center/data-commons-version-1-0-a-framework-to-build-toward-ai-for-good-73414d7e72be>
- Gómez, R., Fawcett, P. and Turner, J. (2012). Lending a visible hand: An analysis of infomediary behavior in Colombian public access computing venues. *Information Development*, 28(2), 117–131. <https://doi.org/10.1177/02666666911429489>
- Gopakumar Rajalekshmi, K. (2007). E-governance services through telecentres: The role of human intermediary and issues of trust. *Information Technologies and International Development*, 4(1), 19–35. <http://dx.doi.org/10.1162/itid.2007.4.1.19>
- Greenhaus, J.H. (2003). Career dynamics. In W.C. Bornman., D.R. Ilgen and R.J. Klimoski (Eds.), *Handbook of psychology. Volume 12: Industrial and organisational psychology* (pp. 519–535). Hoboken, NJ: John Wiley and Sons.
- Habisch, A. and Adaui, C.R.L. (2013). A social capital approach towards social innovation. In T. Osburg and R. Schmidpeter (Eds.), *Social innovation* (pp. 65–74). Berlin, Heidelberg: Springer.
- Hall, D.T. (1996). Protean careers of the 21st century. *The Academy of Management Executive* (1993–2005), 10(4), 8–16. <http://www.jstor.org/stable/4165349>
- Herrera, L., Teras, M. and Gougoulakis, P. (Eds). (2020). Policies and partnership with the world of work – national and cross-national perspectives. *Vocational Education and Training Emerging Issues: Voices from Research*. Fifth International Conference and Research Workshop, 9–10 May 2016, Stockholm. <http://dx.doi.org/10.17045/sthlmuni.3203626>
- Holley, J. (2013a). *Network Weaver handbook*. Athens, OH: Network Weaver.
- Holley, J. (2013b). *An introduction to Network Weaving*. Athens, OH: Network Weaver.
- Huxley, A. (1932). *Brave new world*. London: Chatto and Windus.
- Hwang, S. (2005). Adopting open source and open standards in the public sector: Five deciding factors behind the movement. *Michigan Journal of Public Affairs*, 2, 1–19.
- ICCF (Independent Commission on the College of the Future). (2020). *The college of the future. The UK-wide final report from the ICCF*. Edinburgh: ICCF. <https://www.collegecommission.co.uk/final-report-uk>
- IMF (International Monetary Fund). (2020). Six charts explain South Africa's neutrality. *IMF News*, 3 January. <https://www.imf.org/en/News/Articles/2020/01/29/na012820six-charts-on-south-africas-persistent-and-multi-faceted-inequality>
- International Commission on the Futures of Education. (2021). *Reimagining our futures together: A new social contract for education*. Paris: UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000379381>
- Keevy, J., Castel-Branco, E., Bateman, A., Vally, Z., Overeem, M., Mavimbela, L., Adotevi, J., Sutherland, L., Matlala, R., Kyari, U. and Sibiya, T. (2021). *Mapping report: Towards the African Continental Qualifications Framework*. Addis Ababa: African Union Commission. <https://www.nepad.org/file-download/download/public/127934>
- Keevy, J., Rein, V., Chakroun, B. and Foster, L. (2019). Credentialing in the 21st century: Looking beyond the event horizon. In F. Oswald, T. Behrend and L. Foster (Eds.), *Workforce readiness and the future of work* (Chapter 13). New York: Routledge. <https://doi.org/10.4324/9781351210485>

- Knox, J., Wang, Y. and Gallagher, M. (2019). *Artificial intelligence and inclusive education: Speculative futures and emerging practices*. Singapore: Springer.
- Loffreto, D. (2012). What is 'self-sovereign authority'? *The Moxy Tongue*, 15 February. <https://resources.platform.coop/resources/what-is-sovereign-source-authority/>
- Manda, M. (2017). Towards 'smart governance' Through a multidisciplinary approach to e-government integration, interoperability and information sharing: A case of the LMIP Project in South Africa. *Electronic Government. EGOV 2017. Lecture Notes in Computer Science, 10428*. https://dx.doi.org/10.1007/978-3-319-64677-0_4
- Marais, M.A. (2012). An overview of the role of social capital in development processes. In L. Stillman, T. Denison, A. Sabiescu and N. Memarovic (Eds.), *Ideals meet reality*. CIRN 2012 Community Informatics Conference, 7-9 November, Monash Centre, Prato, Italy. https://www.academia.edu/2946370/An_overview_of_the_role_of_social_capital_in_development_processes
- Marais, M.A. and Vannini, S. (2021). Network weaving to foster resilience and sustainability in ICT4D. *Proceedings of the First Virtual Conference on Implications of Information and Digital Technologies for Development, 2021*. IFIP WG 9.4 Virtual Conference, 2021. arXiv:2108.09808v1
- Martin, L.A. (2021). EBSI and ES-SIF [LinkedIn post]. https://www.linkedin.com/posts/larinyo_early-adopters-programme-activity-6875179641787703296-KPxd
- Moore, M., Riddell, D. and Vocisano, D. (2015) Scaling out, scaling up, scaling deep: Strategies of non-profits in advancing systemic social innovation. *Journal of Corporate Citizenship*, 58, 67-84. https://www.researchgate.net/publication/298971574_Scaling_Out_Scaling_Up_Scaling_Deep_Strategies_of_Non-profits_in_Advancing_Systemic_Social_Innovation
- Morales, L. and Orrell, T. (2018). *Data interoperability: A practitioner's guide to linking up data in the development sector*. Collaborative on SDG Data Interoperability. <https://unstats.un.org/wiki/display/InteropGuide/Home?preview=/36143964/36143971/Guide%20to%20interoperability.pdf>
- Mosoval, F., Gardiner, J., Healey, P., Prestedge, A. and Jonston, K. (2006). The state of open source software in South Africa. *PACIS 2006 Proceedings* (pp.1404-1419). Tenth Pacific Asia Conference on Information Systems, 6-9 July, Kuala Lumpur, Malaysia. <https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1106&context=pacis2006>
- Mtsweni, J. and Biermann, E. (2008). A roadmap to proliferate open source software usage in SA government servers. *Third International Conference on Broadband Communications, Information Technology* (pp. 430-436). <http://doi.ieeecomputersociety.org/10.1109/BROADCOM.2008.82>
- Murahwi, T. and Ntuli, S. (Forthcoming). Connectivity as a human right. Johannesburg: JET Education Services.
- Mutula, S.M. (2007). Paradigms shifts in information environment: prospects and challenges in African libraries. *Library Hi-Tech*, 25(3), 396-408. <http://dx.doi.org/10.1108/07378830710820970>
- Noble, M., Zembe, W. and Wright G., Southern African Social Policy Research Institute (SASPRI). (2014). Poverty may have declined, but deprivation and poverty are still worst in the former homelands. *Econ3X3*, 27 May. <https://www.econ3x3.org/article/poverty-may-have-declined-deprivation-and-poverty-are-still-worst-former-homelands>
- Pastor, M. (2021). *High-level scope (ES-SIF) - EBSI Documentation - CEF Digital*. Brussels: European Commission. <http://hdl.handle.net/10500/5757>
- Pfaffman, J. (2007). It's time to consider open source software. *TechTrends*, 51(3), 38-43. <http://dx.doi.org/10.1007/s11528-007-0040-x>
- Pillay, S. and Mouton, S. (2021). Absa wants to introduce a digital ID in South Africa. *BusinessTech*, 9 September. <https://businesstech.co.za/news/technology/519916/absa-wants-to-introduce-a-digital-id-in-south-africa/>

- Planes-Satorra, S. and Paunov, C. (2017). *Inclusive innovation policies: Lessons from international case studies*. OECD Science, Technology and Industry Working Paper No. 2017/02. Paris: OECD Publishing. <https://doi.org/10.1787/a09a3a5d-en>
- Rajab, R., Nomvete, S., Manda, M. and Keevy, J. (2020). *Unlocking the power of data: A review of the state of readiness of the post-school education and training sector in South Africa for enhanced data interoperability*. Johannesburg: JET Education Services and merSETA. <https://www.jet.org.za/resources/unlocking-the-power-of-data-final-web-nov2020.pdf>
- Rajab, R., Ntuli, S. and Barbour, L. (2021). *Fostering trust through ethical data sharing*. Paper presented at the ICEGOV Conference, 8–9 October, Athens, Greece.
- Renken, J., and Heeks, R. (2019). Champions of IS innovations. *Communications of the Association for Information Systems*, 44(1). <https://doi.org/10.17705/1CAIS.04438>
- Reos Partners, JET Education Services and merSETA. (2021). *PSET scenarios 2021–2030: A guide on using scenarios to align skills supply & demand through interoperable data platforms*. Johannesburg: Reos Partners, JET Education Services and merSETA. https://www.jet.org.za/resources/jet-scenario_final_web-1.pdf
- Sharma, T.K. (2020). Widespread adoption of self-sovereign identity in the wake of COVID-19. *Blockchain Council*. <https://www.blockchain-council.org/blockchain/widespread-adoption-of-self-sovereign-identity-in-the-wake-of-covid-19/>
- Sherif, K., Zmud, R.W. and Browne, G.J. (2006). Managing peer-to-peer conflicts in disruptive information technology innovations: The case of software reuse. *MIS Quarterly*, 30(2), 339–356. <http://dx.doi.org/10.2307/25148734>
- Shiohira, K. and Dale-Jones, B. (2019). *Interoperable data ecosystems: An international review to inform a South African innovation*. Johannesburg: JET Education Services and merSETA. <https://www.jet.org.za/resources/interoperable-data-ecosystems.pdf>
- Shiohira, K. et al. (Forthcoming). Artificial intelligence, intermediate skills, and the future of TVET. Bonn: UNEVOC.
- Shuaib, M., Alam, S., Alam, M. and Nasir, M. (2021). Self-sovereign identity for health-care using blockchain. *Materials Today: Proceedings*. <http://dx.doi.org/10.1016/j.matpr.2021.03.083>
- Simon, K.D. (2005). The value of open standards and open source software in government environments. *IBM Systems Journal*, 44(2), 227–238. <http://dx.doi.org/10.1147/sj.442.0227>
- Skosana, I. (2018). Women teach and men lead? Gender inequality in South African schools examined. *Africa Check*, 3 September. <https://africacheck.org/fact-checks/reports/women-teach-and-men-lead-gender-inequality-south-african-schools-examined>
- Smith, M. (2014). Being open in ICT4D. *Social Science Research Network*, 2526515. <https://doi.org/10.2139/ssrn.2526515>
- Soltani, R., Uyen, T.N. and An, A. (2021). A survey of self-sovereign identity ecosystem. *Security and Communication Networks*, 2021. <https://doi.org/10.1155/2021/8873429>
- Spencer-Keyse, J., Luksha, P. and Cubista, J. (2020). *Learning ecosystems: An emerging praxis for the future of education*. Moscow: Moscow School of Management SKOLKOVO and Global Education Futures. <http://learningecosystems2020.globaledufutures.org/>
- Statistics South Africa. (2021a). *Quarterly labour force survey. Quarter 1: 2021*. Pretoria: Statistics South Africa. <https://www.statssa.gov.za/publications/P0211/P02111stQuarter2021.pdf>
- Statistics South Africa. (2021b). *Quarterly labour force survey. Quarter 3: 2021*. Pretoria: Statistics South Africa. <https://www.statssa.gov.za/publications/P0211/P02113rdQuarter2021.pdf>
- Tapscott, D. (2021). *Platform revolution: Blockchain technology as the operating system of the digital age*. Toronto: Barlow Books.
- UIL (UNESCO Institute for Lifelong Learning). (2020). *Embracing a culture of lifelong learning. Contribution to the Futures of Education Initiative*. Hamburg: UIL. <https://uil.unesco.org/lifelong-learning/embracing-culture-lifelong-learning>

- UNEVOC. (2020). *Trends in new qualifications and competencies for TVET. Perspectives of the European UNEVOC Network*. Bonn: UNEVOC. <https://www.unbonn.org/news/trends-new-qualifications-and-competencies-tvet-perspectives-european-unevoc-network>
- UNESCO (United Nations Educational, Scientific and Cultural Organisation). (2019). *Beijing Consensus on artificial intelligence and education*. Outcome document of the International Conference on Artificial Intelligence and Education: 'Planning education in the AI era: Lead the leap', 16-18 May, Beijing, People's Republic of China. http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/s5987/201908/W020190828311234688933.pdf
- US Chamber of Commerce Foundation. (2020). *Applying self-sovereign identity principles to interoperable learning records*. Washington: US Chamber of Commerce Foundation. <https://www.uschamberfoundation.org/sites/default/files/media-uploads/Applying%20SSI%20Principles%20to%20ILRs%20Report.pdf>
- Verbeek, A. and Lundqvist, M. (2021). *Artificial intelligence, blockchain and the future of Europe: How disruptive technologies create opportunities for a green and digital economy*. Brussels: European Investment Bank and the European Commission. <https://doi.org/10.2867/126279>
- West, J. and Mahoney, S. (2005). Contrasting community building in sponsored and community founded open source projects. *Proceedings of the 38th Hawaii International Conference on System Sciences* (pp. 1-10). 38th Hawaii International Conference on System Sciences, 3-6 January 2005, Big Island, HI, USA. <http://dx.doi.org/10.1109/HICSS.2005.166>
- West, P. and Beukes, C. (2021). *Digital governance advisory note*. Johannesburg: JET Education Services and merSETA. <https://www.jet.org.za/news/all-news/new-publication-digital-governance-advisory-note>

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