Rebooting the PSET CLOUD

[REBOOT]: The term 'reboot' generally refers to the act of restarting something, particularly in the context of technology and computers. Specifically, in the context of a computer or program, rebooting involves shutting down and restarting the system or application. When a computer or program is rebooted, it goes through a sequence of actions that include shutting down all running processes, closing open files and clearing the system's memory. Once the system is completely shut down, it is then powered back on, and the operating system is loaded again, bringing the computer or program back to its initial state. Rebooting is often performed to resolve issues or glitches that may arise during the operation of a computer or program. It can help clear temporary system errors, refresh the memory and restore the system to a stable and functional state. Additionally, rebooting is sometimes necessary after installing updates or making changes to the system configuration.

Contents

Figures and tables

Acronyms and abbreviations

AI	artificial intelligence
API	application programming interface
CC-PPP	citizen-civil society-public-private partnership
CLOUD	Collaboration and Learning Opportunities and Utilisation of Data
CSIR	Council for Scientific and Industrial Research
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DIG	Data Innovators Group
DOC	Department of Communications
DPSA	Department of Public Service Administration
DTPS	Department of Telecommunications and Postal Services
ESCO	European Skills, Competencies, Qualifications and Occupations
ECTA	Electronic Communications and Transactions Act
ESSA	Employment Services of South Africa
HRD	human resource development
HRDC	Human Resource Development Council
ICT	information and communications technology
ISCO	International Standard Classification of Occupations
ISCED	International Standard Classification of Education
IT	information technology
JET	JET Education Services
LMIP	Labour Market Intelligence Partnership
M&E	monitoring and evaluation
MANCO	Management Committee
merSETA	Manufacturing, Engineering and Related Services Sector Education and Training Authority
MOI	memorandum of incorporation
MVP	minimum viable product

NDA	nondisclosure agreement
NDP	National Development Plan
NGO	non-governmental organisation
NPC	non-profit company
NPC	National Planning Commission
NPMN	National Pathways Management Network
NQF	National Qualifications Framework
NSA	National Skills Authority
NSDMS	National Skills Development Management System
NSDS	National Skills Development Strategy
O*NET	Occupational Information Network
OFO	Organising Framework of Occupations
PAIA	Promotion of Access to Information Act
POPIA	Protection of Personal Information Act
PSET	post-school education and training
QCTO	Quality Council for Trades and Occupations
SAQA	South African Qualifications Authority
SASCO	South African Standard Classification of Occupations
SASQAF	South African Statistical Quality Assessment Framework
SETA	sector education and training authority
SOA	service-oriented architecture
SSI	self-sovereign identity
StatsSA	Statistics South Africa
ToC	theory of change
TVET	technical and vocational education and training
TVETMIS	Technical and Vocational Education and Training Management Information System
UCT DPRU	University of Cape Town Development Policy Research Unit
UX	user experience

Preface

This report has been prepared by a small team of people integrally involved in the conceptualisation and early stage development of a national digital platform that aims to connect government, private sector and informal education and training datasets in real time: the PSET CLOUD.

The report provides a reflective account and synopsis of the work done between 2017, when the idea of linking supply and demand systems first matured, up to March 2023, when the programme of work was prematurely interrupted six months before the conclusion of the minimum viable product (MVP).

The report does not aim to be a publication in its own right, but rather stands as a testimony to nearly seven years of co-creation undertaken by the two founding organisations, JET Education Services (JET) and the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA).

The report consists of five chapters:

1. **The PSET CLOUD journey 2016–2023:** providing a detailed account of the phased design and planning process, including the early ideas that found form in the first theory of change (ToC).

2. **Constructs, governance and taxonomy:** from the outset, the design process seemed to be 'ahead of its time', introducing the concept of interoperability before it became mainstream and always holding the citizen as the end-user as its loadstar.

3. **Failing forward:** this section outlines the difficulties with the first MVP and the lessons learnt, to the point of having the second MVP conceptualised.

4. **Looking from the outside in:** an external evaluation accompanied the process overall, and this section provides a summary of the key findings from the rapid evaluation conducted in 2022.

5. **Rebooting the PSET CLOUD:** Here the team reflects on the transition point in mid-2023 and how the momentum of the work to date can be maintained and ultimately be completed.

As the project team, we are deeply invested in the idea of the PSET CLOUD that looks beyond the limitations brought about by poverty, unemployment and inequality in South Africa. As we write this report, the PSET CLOUD itself has been caught up in governance battles within the PSET sector, resulting in an immediate halt to activities just months away from completion of the MVP.

This report is thus a narrative reflection of our convictions that the foundation has been laid for a system that can radically change the way we link supply- and demand-side data in our country. Through the PSET CLOUD, South African citizens will be able make informed labour market decisions that can lead to increased employment in line with the goals of the National Development Plan.

July 2023

James Keevy, Rooksana Rajab, Simphiwe Ntuli, Barbara Dale-Jones, Hloni Mathala, Motsamai Thinane, Tumelo Ngwako, Boitumelo Manci, Bangani Ngeleza, Kelly Shiohira and Carla Pereira

Foreword: Staying the course

In late 2017, a small team from JET Education Services (JET) started exploring the vision of a more coordinated and digital ecosystem for post-school education and training (PSET) in South Africa. Even in this pre-COVID period, there was no doubt that technological developments were accelerating and that the education system in South Africa, which includes PSET and basic education, stood to benefit.

After testing the appetite for a more interoperable ecosystem approach in basic education, it soon became evident that the basic education landscape was quite congested, with a range of actors vying for the attention of the Department of Basic Education (DBE). The 'DBE Cloud', which was developed with surplus funds from the 2010 Soccer World Cup and overseen by a private company, The Training Room Online (TTRO), was at a nascent stage. The Data Driven Districts (DDD) initiative set up in 2013 showed great potential to support the basic education sector with real time data, but even so, was fairly limited in its capabilities. The private sector was also involved in various efforts to support the sector. The development of an initiative championed by Rand Merchant Bank (RMB) and branded as Edvision was starting out and involved a level of collaboration with the National Association of Social Change Entities in Education (NASCEE).

While all these developments showed promise, the capacity and political will in the basic education sector to try and follow a more coordinated approach was weak. JET thus turned its attention to the PSET sector and started to reach out to potential funders and partners. The Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA) stood out in the PSET landscape as an entity working at the cutting edge of technological innovation and was approached in early 2018 to partner with JET to:

> Establish an integrated, self-sustaining electronic platform for collaboration and learning opportunities, including the utilisation of data, for the PSET system. (merSETA, 2018)

JET was requested to submit an initial project concept format to merSETA, and later on, in November 2019, this was followed by a formal application for a discretionary grant. The idea of a PSET system of collaboration and learning opportunities for the utilisation of data (CLOUD) started to take shape. The JET and merSETA teams found a good rhythm early on in the collaboration, and it was clear that an ecosystem approach in the PSET sector could potentially be developed through this strong partnership. Both JET and the merSETA provided technical expertise and oversight, while the work was funded through an initial merSETA Management Committee (MANCO) approved grant. As the merSETA realised the potential of the PSET CLOUD, it opted to invest not only in the development of the PSET CLOUD, but also in developing its own ecosystem in order to participate in the PSET CLOUD programme as the early adopter.

The five-year programme comprised the building phase of the PSET CLOUD. Several partners were involved in the process over the period, including the Council for Scientific and Industrial Research (CSIR), DiDx, Kaitoma, JumpCo, the University of Cape Town Development Policy Research Unit (UCT DPRU), COOi Studios, Reos Partners and others. Several research outputs were completed during these years, notably an early publication on data interoperability (Shiohira & Dale-Jones, 2019) that set the foundation for the work that was to follow. JET and the merSETA collaborated throughout this period, including through the COVID period, and on all counts, good progress was made with the PSET CLOUD development. Building on the notion of interoperable data platforms, data privacy and data governance soon became central features of the work, leading to the development of a self-sovereign identity (SSI) protocol and concrete thinking on data ownership and the governance of the PSET CLOUD platform (Rajab & Ntuli, 2023) itself through the establishment of a new non-profit organisation (NPO). The DigiTrans Conference held in February 2022 provided a more public platform to share progress on the PSET CLOUD and involved several national and international partners.

An external evaluator played a key role in keeping the PSET CLOUD programme on track, and by early 2023, the planned work was nearing completion, with three main components underway:

1. The development of the minimum viable product (MVP) – an earlier attempt at an MVP was only partially successful but provided important insights for the recommissioning in 2023.
2. The development of the foundational taxonomy for the PSET CLOUD – the first attempt at an MVP showed that the concept of the PSET CLOUD would be better interpreted if a taxonomy was in place.
3. The setting up of the PSET CLOUD NPO – the work was supported by the JET-merSETA Steering Committee and primarily influenced and led by the PSET CLOUD Launch Group made up of representatives from the four constituencies of a new form of private-public partnership that would also involve citizens and civil society (CC-PPP).

The period also saw improved clarity about and focus on what the PSET CLOUD could become:

> The PSET CLOUD is a platform that will enable users such as learners, government, industry, non-governmental organisations and education institutions to share and use data for planning and decision-making that promotes a more efficient and responsive post-school education system to the labour market. (PSET CLOUD Draft Launch Group Recommendation, see Annexure 1)

Throughout this period, JET and the merSETA attempted to share the new thinking both nationally and internationally. The PSET CLOUD was positioned as complementary to existing initiatives, and the team worked closely with the Department of Higher Education and Training (DHET), South African Qualifications Authority (SAQA), the Quality Councils, National Skills Authority (NSA), and also the Presidency's National Pathway Management Network (NPMN) initiative. These ongoing local and international engagements started pointing the team towards the unique contribution that the PSET CLOUD could make in the area of credentialing. The strong international interests in microcredentials that emerged after the COVID pandemic further prompted thinking in the same direction. While the original vision of the PSET CLOUD was wider, it became more obvious that the foundational work was already moving more into the direction of credentials that would complement other parallel initiatives, notably the NPMN.

With plans in place to complete the three remaining deliverables outlined above (the MVP, foundational taxonomy and the PSET CLOUD NPO) by March 2024, the merSETA was thrown into disarray as a result of possible impropriety in the organisation. The investigation had an immediate negative impact on the PSET CLOUD contract, which was first suspended and then terminated in a matter of days without warning at the end of March 2023. JET had to immediately engage with the 13 subcontractors and 19 project staff to manage the financial and reputational risks to all involved. The Launch Group was informed, and so too all the key partners. JET has been left with no choice but to institute legal proceedings against the merSETA to try and find a resolution. At the time of the writing of this report, the legal process was still underway.

What has become clear during the last six years of development is that the PSET CLOUD has consistently been developed and shared using open and non-commercial contracts and approaches. The potential of the PSET CLOUD to achieve its goal, as outlined in its theory of change (ToC), is stronger than ever:

> South African citizens make informed labour market decisions that lead to increased employment in line with National Development Plan targets. (See Figure 1 in Chapter 1)

The early ideas of data interoperability expressed in 2017 have grown exponentially, and today we see several national, regional, continental and international initiatives underway, building on the same or very similar ideas (Chakroun & Keevy, 2023; Rajab & Ntuli, 2023). The disruption brought about by the termination of the grant agreement between JET and the merSETA has been significant but does not have to mean that the foundational principles of the PSET CLOUD become obsolete. As a public good, with open IP, we are confident that much of the PSET CLOUD has been, or will soon be, taken up by complementary developments in South Africa. This 'reboot report' has been prepared to make sure that this IP is captured so that a reboot will be possible in the near future. Such a reboot will likely require the PSET CLOUD to move from the testing environment overseen to date by JET and the merSETA to a more formal hosting environment under the oversight of a state entity.

We owe it to the citizens of South Africa to make sure they receive the benefits of a more seamless system that links supply- (qualifications and training) and demand- (jobs and opportunities) sides within PSET. We now have the building blocks in place, with the technology readily available.

The PSET CLOUD journey 2016–2023

1

Introduction

The Post-School Education and Training Collaboration and Learning Opportunities and Utilisation of Data (PSET CLOUD) was initiated in 2019 as a new multiyear partnership with the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA) to explore and improve interoperability possibilities between different data systems in the PSET sector. However, a purposeful and cautionary approach was selected, and it was decided to initially sign a one-year contract to investigate the potential of improved functionality that will allow for the possibility of better planning and analysis across the education and training system.

A meeting to establish the roles and responsibilities of the key partners involved in the project, viz. JET Education Services (JET) and the merSETA, was held on 15 August 2018. It was decided that a high-level goal setting workshop was necessary to kick-start the project. It was also agreed that the workshop needed to be underpinned by a theory of change (ToC) that would establish broad goals, aims and objectives so that the partners could reach a common understanding of the project's key deliverables.

It was well recognised that leadership for the initiative was required from within the Department of Higher Education and Training (DHET), and initial meetings were held with senior managers to clarify the intent of the PSET CLOUD project and to bring external people on board early on in the process. The key question was whether South Africa was ready for such an innovation and whether the current legislation at the time supported and enabled the PSET CLOUD vision. The programme was planned across four phases:

1. Setting up
2. Establishing the value proposition
3. Design and develop
4. Steady-state and handover

A detailed workplan with key activities for the first year covered the period January 2020 to end March 2021 and was approved by the merSETA. It was agreed that the workplan would be extended for each phase, budgeted for and submitted for approval until final completion of the programme in March 2024.

The theory of change

Strategic discussions on the initial conceptualisation of the PSET CLOUD led to a well-defined infographic based on the ToC. The key focus is the citizen as the end-user being in a position to make informed decisions that lead to employment. The outcome of the strategic sessions provided the roadmap for the Phases 2–4. The early version of the ToC is provided below.

Figure 1: PSET CLOUD early theory of change
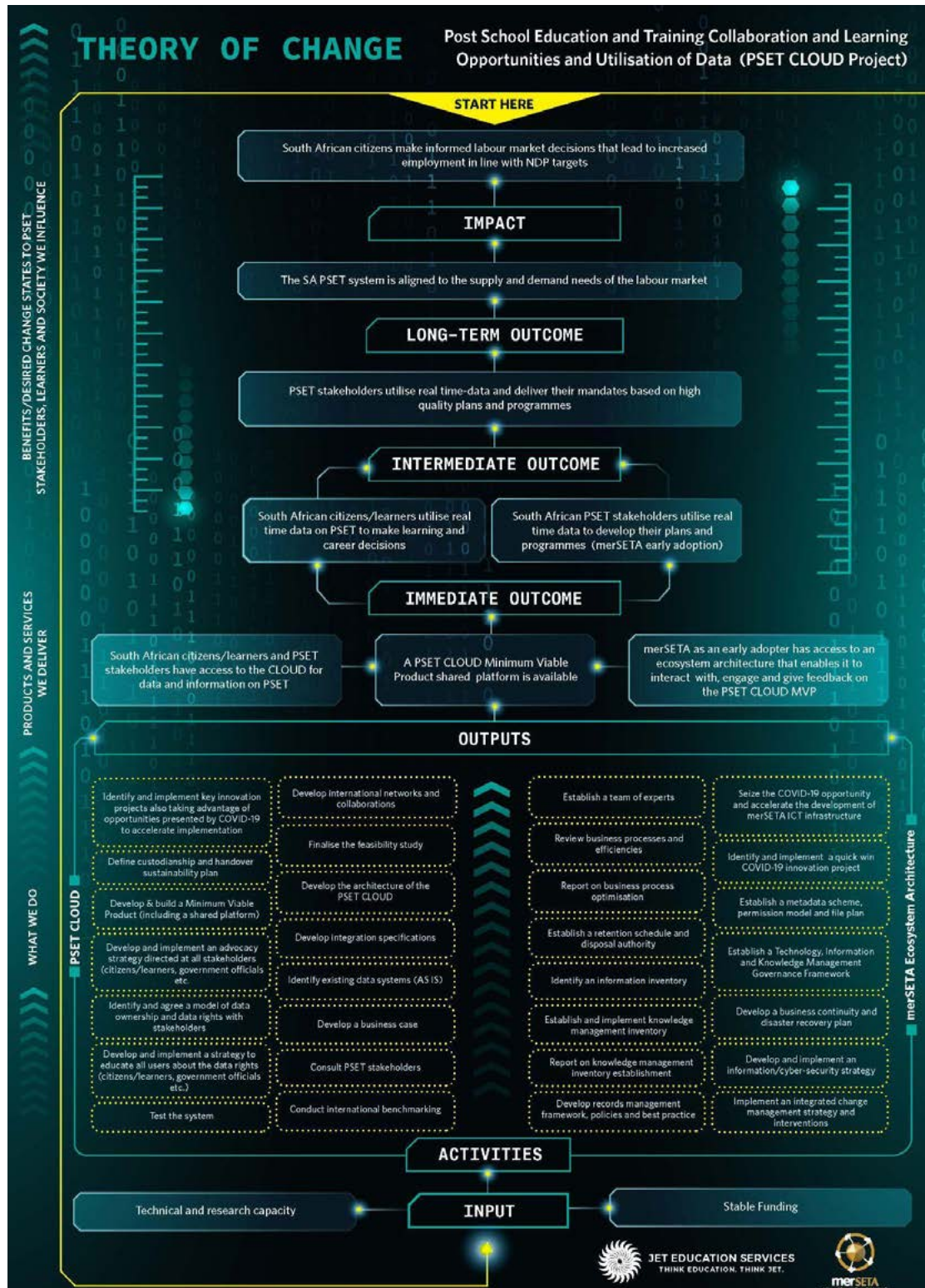
Programme design

<div align="center">

Phase 1

</div>

The first phase focused on the viability of the PSET CLOUD. The agreed timelines for this phase as approved by the merSETA were planned such that it could be determined whether it was feasible to continue to Phases 2–4.

Table 1: Phase 1 timelines

Activity	Time
Conduct a stakeholder analysis	Year 1 (6 months)
Identify existing data systems	Year 1 (6 months)
Conduct international benchmarking	Year 1 (6 months)
Consult PSET stakeholders	Year 1 (9 months)
Conduct a pre-feasibility analysis	Year 1 (9 months)
Conduct a feasibility analysis	Year 1 (9 months)
Develop the architecture for the PSET CLOUD	Year 2–4
Develop integration specifications	Year 2–4
Develop and build minimum viable product description	Year 2–4
Test the system	Year 2–4
Define custodianship and handover sustainability plan	Year 2–4

Phase 1 included a review of international practices, a situational analysis (CSIR, 2019c), a stakeholder mapping exercise (CSIR, 2019b) and a feasibility analysis (CSIR, 2019a) conducted by the CSIR. All these early reports pointed to the need for collaboration to address a deeply fragmented PSET sector. The *Interoperable data ecosystems* review (Shiohira & Dale-Jones, 2019) highlighted the Data Commons Framework (Goldstein, Gasser & Budish, 2018), which was later adopted in the document *Unlocking the power of data* (Rajab et al., 2020) that synthesised the individual reports which explored the state of readiness of the South African PSET sector for the PSET CLOUD. A five-year project cycle was proposed before the second contract agreement was approved.

In moving forward from Phase 1 (the planning phase) to Phase 2 (establishing the value proposition phase), six levels of interoperability were considered:

1. Legal and regulatory, concerned with legal and regulatory constraints;

2. Policy, concerned with collaboration agreements;

3. Core processes, concerned with the alignment of core educational processes;

4. Information, defining the coding of information;

5. Applications, concerned with integration into education related systems; and

6. Information technology (IT) infrastructure, concerned with the communication protocols.

In addition, we needed to recognise that the system levels of governance, standards, data and technologies exist on a continuum.

Figure 2: PSET CLOUD project national data ecosystem approaches
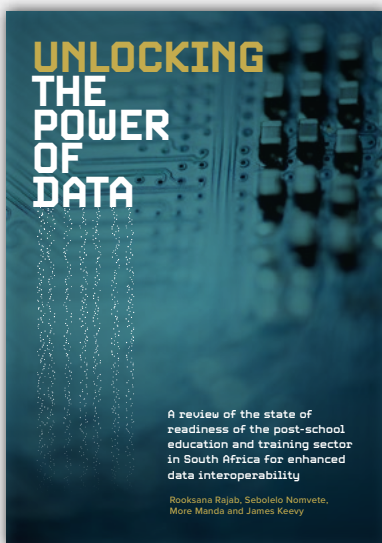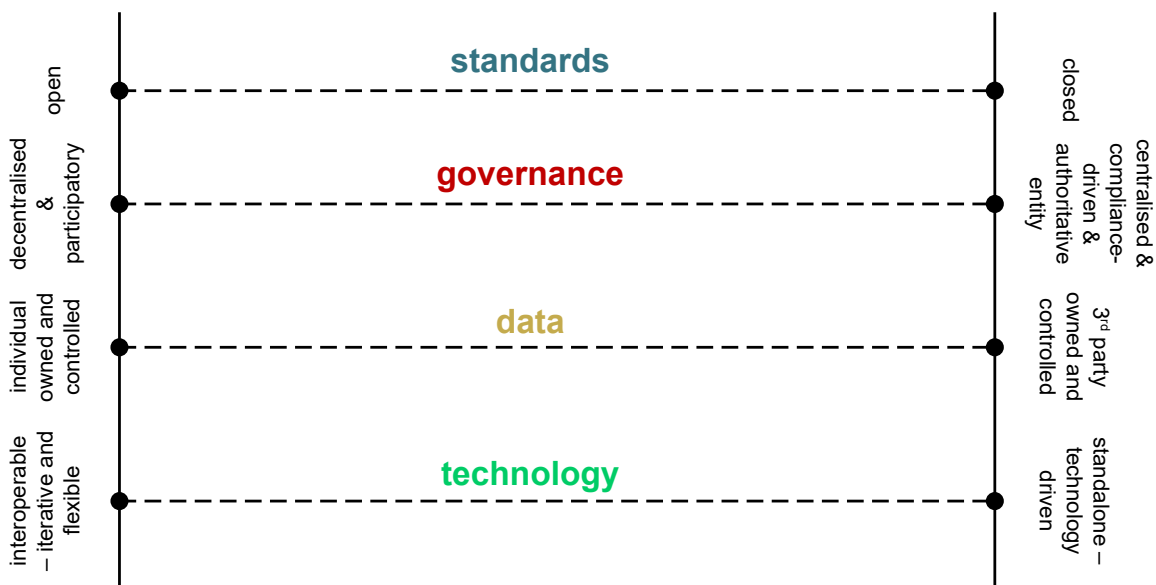
Unlocking the power of data
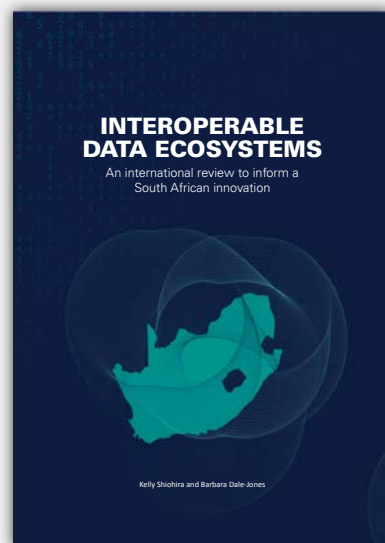
Interoperable data ecosystems

Phase 2 of the programme commenced in 2020 with three focus areas:

1. Stakeholder engagement and scenario planning;
2. Communication strategy and creating awareness of the PSET CLOUD; and
3. Developing a business case for the PSET CLOUD platform for piloting/testing as the programme transitions into Phase 3.

Stakeholder engagement

Reos Partners were appointed to develop scenarios during workshops with key potential partner organisations. The scenarios served as a resource to prompt discussions with colleagues, partners and competitors in relation to the issues the PSET CLOUD needs to anticipate over the next decade to 2030 (Reos Partners, JET Education Services & merSETA, 2021). The scenarios assisted both JET and the merSETA to discern, adapt and proactively intervene to bend the trajectories in directions that better serve young South Africans in their search for meaningful skills, jobs and career paths.

Stakeholders identified five strategic priorities they could pursue to support and augment the PSET CLOUD initiative. These were:

1. Governance and ownership of interoperable data platforms;
2. Decentralisation of data/crowd-driven approaches;
3. Broadening and deepening collaboration;
4. Addressing the skills demand and supply gap through interoperability; and
5. Embracing structural enablers of quality education.

A gap identified was the need to explore the value of lifelong learning and agile credentialing.

Communication

The following deliverables were met during Phase 2 (see Table 2 overleaf).

Business case

COOi Studios was appointed to conduct research on the business case for the PSET CLOUD (COOi Studios, 2020). It was estimated that development of the platform over five years would cost ZAR 10.3 million, with annual maintenance and running costs estimated at ZAR 5.5 million (noting a 5% annual increase). Human resources costs were projected to be 70% of operational costs. The business case report addressed potential funding models to make the PSET CLOUD sustainable beyond its initial development and pilot. The possibilities included the PSET CLOUD operating as a funded non-profit organisation (NPO) or through other funded NPOs, or by means of revenue from subscriptions, subsidies or social impact bonds:

- NPO models could include a competitive model in which multiple providers are established to provide services as mandated by the government (beneficiary broker) or through the benevolence of one or more large donors who agree to fund the system (big bettor).
- Subscription revenue could include revenue from advertising or subscription-based users (e.g. corporates posting positions, human resources managers accessing the system, etc.).
- Subsidies from corporate vendors could include aspects such as zero-rating of data costs related to the PSET CLOUD.
- Social impact bonds are currently one funding mechanism being explored by both international communities and South Africa. In social impact bonds, providers are paid through an outcomes-based contract which includes a return on investment for initial funders, who could be providers or backers.

A successful international conference, DigiTrans 2022, marked the end of Phase 2 in March 2022**.**

Table 2: Key communication deliverables for Phase 2

Key deliverables	Activities
Brand strategy	Development of vision, mission, purpose, target market, values, personality, positioning, value proposition. Includes: reverts and refining, and progress reports
Communications strategy	Stakeholders or audience (who with purpose) Message or topic (what) Communicator (from whom) Schedule or frequency (when/how often) Delivery method (how)
Manual	Definition and philosophy Moodboards Logos Corporate colours Typographic system Photographs and graphic elements Applications
Roll-out strategy	A strategy for rolling out the communications, launch of the website and social media platforms
Website design and development	User experience (UX) design Content creation Development Cross-browser functionality Mobile responsive Search engine optimisation (SEO) tracking and analytics Secure sockets layer (SSL) security and website security and penetration test Interoperability and integration to other websites and data sets
Social media setup	LinkedIn, Facebook and Twitter Naming convention Biography and contact details Banners and avatar design
Training and buy-in sessions	Training document on brand, website and social media

Phase 3 of the programme commenced in 2021, with five focus areas described in a detailed workplan:

1. Developing a two-year advocacy strategy and communicating through social media on an ongoing basis as the platform is developed;
2. Designing a suitable governance model for the PSET CLOUD;
3. Developing a minimum viable product (MVP) and self-sovereign identity (SSI) solution for the PSET CLOUD;
4. Readying the merSETA as the early adopter of the PSET CLOUD; and
5. Developing a foundational taxonomy for the PSET CLOUD.

During Phase 3, an external evaluator, Data Innovators Group (DIG), was appointed to conduct a three-year longitudinal evaluation of the PSET CLOUD. The evaluation was based on the evaluation questions below and included a review of and updating the ToC (see Chapter 4).

Relevance

- To what extent is the design of the PSET CLOUD programme appropriate and consistent with the PSET sector's priorities and policies?
- To what extent have partnerships been developed with and between relevant and key stakeholders?
- What did adoption patterns look like, and what common challenges emerged?
- What challenges and mitigation strategies emerged?

Effectiveness

- To what extent have the activities and outputs of the PSET CLOUD programme been effective in contributing to the likely achievement of the outcomes and impact reflected in the ToC?
- What measurable progress has the programme made since its inception?
- Efficiency:
- To what extent has the implementation of the PSET CLOUD programme been efficient with regards to:
- Organisational design and applied delivery methodology;
- Management and administration including record keeping;
- The readiness of the merSETA to be an early adopter; and
- Cost allocation?

Sustainability

- How sustainable is the PSET CLOUD programme likely to be given the many priorities and demands in the PSET sector?
- What are the challenges to and opportunities for the sustainability of the PSET CLOUD intervention in the medium-to-long term?
- Are there viable alternatives that have potential to address the interoperable principle and envisaged outcomes and impact of the programme?

Programme governance and management

- Is the governance and programme management appropriate for the programme?

Good progress was made between 2021 and 2023, including the development of a logframe and a monitoring dashboard. The PSET CLOUD team presented a plenary session at the 11th annual meeting, 12–14 October 2022 of Groningen Declaration Network (GDN) conference held in Groningen, Netherlands.

merSETA as the early adopter

A critical aspect of the programme was to ensure that, as the earmarked early adopter of the PSET CLOUD, the merSETA's digital ecosystem (i.e. its internal systems and information and communications technology (ICT) infrastructure) could support the free flow of available data to various institutions and organisations involved in the PSET sector, which would enable the advantageous use of data to (i) enhance skills planning and provisioning, and (ii) strengthen, integrate, coordinate and improve efficiencies in the governance and management of PSET. The merSETA needed to ready itself for participation on the PSET CLOUD platform, and in 2018, during Phase 1, it conducted a state of readiness assessment of its technology, people, processes and information.

The findings of the assessment established the priorities formerSETA's Digital Ecosystem Programme, planned to run from 2020 to 2024 (Phases 2–4), and which became a key subcomponent of the PSET CLOUD programme.

This Digital Ecosystem Programme (later rebranded as Programme Phetogo) endeavoured to resolve data, governance, process, behavioural and architectural issues within the merSETA to establish an application landscape that would be able to effectively produce data and performance information of an acceptable quality and in the appropriate format as required by the PSET CLOUD platform.

Programme Phetogo consisted of multiple workstreams within the merSETA, each with a merSETA champion. The identified workstreams were as follows:

- Infrastructure / Technology;
- Enterprise Architecture;
- Records Management;
- Data Management;
- Knowledge Management.

The disciplines that spanned the workstreams were as follows:

- Governance;
- Business Process Optimisation;
- Change Management.

Deliverables included but were not limited to data migration; implementation of new systems or upgrades of existing systems; integration of systems; policy development; process creation or amendments; and so forth. JET, as the implementing partner of Programme Phetogo, assisted the merSETA with resource provisioning, procurement and management of these services. To assist the merSETA, various senior-, mid- and junior-level experts were employed by JET, but based within the merSETA, to work alongside the merSETA champions. In addition, several service providers with specialised skill sets were appointed to execute various workstream requirements.

Report structure

The following chapters provide a more detailed account of the work completed between 2017 and 2023, with some suggestions for the way forward, as follows:

Chapter 2: This chapter outlines the constructs underlying the PSET CLOUD, including core constructs of interoperability, credential fluency and SSI. This chapter also provides an account of the approach to data governance, a future-looking governance framework and the foundational taxonomy that is still under development.

Chapter 3: Here we provide a detailed account of the development of the first MVP, why it failed and also the progress made to get a revised MVP developed.

Chapter 4: This chapter provides a summary of the findings of a rapid review conducted as part of the external evaluation of the PSET CLOUD. The chapter includes suggestions for the way forward.

Chapter 5: The last chapter reflects on what worked and what did not work and then provides a set of concrete recommendations for how the work done to date can be taken forward.

The report includes a set of five annexures: (1) Draft Launch Group recommendation; (2) Draft PSET CLOUD NPO memorandum of incorporation (MOI); (3) Detailed MVP specifications; (4) Draft governance framework; and (5) Draft costing analysis to inform the MVP process.

Constructs, governance and taxonomy

2

## Introduction: A user-centric approach

A user-centric approach is crucial in innovation because it places the needs, preferences and experiences of users at the centre of the design process. Understanding users' problems, desires and behaviours assists innovators to create solutions that truly resonate with the users. The approach leads to more meaningful and impactful innovations, with the final product or service addressing real user needs and delivering a positive user experience. The risk of developing products that fail in the market is minimised, and the chances of adoption and customer satisfaction are increased. Ultimately, a user-centric approach fosters innovation and enhances the chance of success.

Starting with user outcomes in mind is crucial because it ensures that the focus remains on creating meaningful solutions that address specific user needs and deliver desired results. By understanding users' desired outcomes or goals, innovators can align their efforts towards achieving those outcomes rather than just focusing on features or technology. This helps to create user-centric products or services that provide value, meet users' expectations and contribute to the chances of successful adoption and satisfaction, ultimately driving the success and impact of the innovation in the market.

User journeys play a critical role in innovation by providing a holistic understanding of the user's interactions and experiences throughout their engagement with a product or service. By mapping out the user's journey, innovators gain insights into the user's motivations, pain points and needs at each touchpoint. This understanding helps identify opportunities for improvement, innovation and differentiation. User journeys also enable innovators to uncover hidden or unmet needs, discover areas for optimisation and identify potential friction points or bottlenecks in the user experience. By incorporating user journeys into the innovation process, designers and product teams can create more relevant, intuitive and user-friendly solutions that truly meet users' expectations and deliver value.

The innovation journey of the PSET CLOUD was user-centric. Through a series of workshops, the key stakeholders in the PSET CLOUD ecosystem were identified as citizens, employers, and education and training providers. As the project proceeded, representatives from these stakeholder groupings participated in engagements (workshops, interviews, focus groups, etc.) in order that their needs, pain points and desired gains could be identified and solved for.
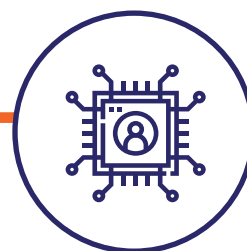
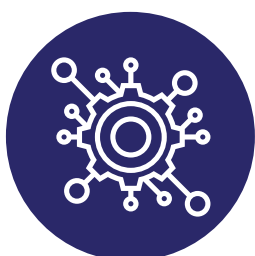## The three core constructs integral to the PSET CLOUD
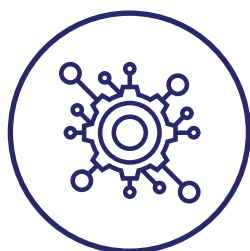
Interoperability   **Credential fluency**   **Self-sovereign identity**

Interoperability

Interoperability is what enables the smooth exchange and use of data between systems. A simple example would be how linked accounts register the same information. A more complex example would be how modern agricultural systems collect soil information through sensors and automatically deploy water or fertilisers as needed, an illustration of the 'internet of things'.

There are different levels of interoperability, which are outlined through a variety of frameworks. The PSET CLOUD project leveraged its own adaptation of the Data Commons Framework from the Berkman-Klein Center at Harvard University (Goldstein et al., 2018), which outlines six levels:

- Technical infrastructure interoperability refers to the servers, ledgers, cloud facilities, etc. that are necessary to achieve the exchange of data.
- Data interoperability deals with the compatibility of the structures of data, for example whether it is qualitative, quantitative, there is alignment in the coding, etc.
- The formats and labels level address the taxonomies in use for the data as well as metadata such as how data is collected and the data sources.

The next three levels deal with meta-levels of interoperability that are necessary beyond the technical and semantic layers and bring out the real value of this framework for the PSET CLOUD project:

- Organisational interoperability speaks to the functions and structures of the different units/divisions/organisations across which interoperability must be achieved. This includes the measures to incentivise collaboration and sharing of data.
- The institutions, laws and policy layer of interoperability speaks to the need for a coordinated understanding and application of protocols for access to data, protection of privacy and ensuring congruent understanding of human rights and, particularly, how these should be applied in the context of data collection, aggregation, analysis, use and dissemination. This layer of interoperability is driven by governance mechanisms.

The final level, the human layer, reminds us not to leave behind the ultimate intended beneficiaries of an interoperable system. This layer promotes inclusive practices, education efforts and knowledge-building across actors as well as the beneficiaries of an interoperable system.

Credential fluency

The concept of credential fluency is a response to some of the challenges that emerge in the connections between education and the world of work. In summary, these challenges can be articulated as:

- The small percentage of an individual's life experience and knowledge which is captured by the formal education sector and/or formal qualifications and credentials;
- The understanding that formal credentials may provide for inadequate signalling between education and the world of work as they do not represent the full range of an individual's experiences and abilities;
- Misalignment between competencies emphasised in education and the requirements of the world of work, exacerbated by rapid change in the required skills driven by influences such as digitisation and the greening of economies;
- A lack of portability and mutual recognition of credentials within and across systems, which particularly impacts individuals who may transition between education and the labour market multiple times; and
- The contributions of the above factors to high unemployment rates.

Credential fluency as a concept mitigates these challenges through the development of systems that leverage technology and other means, for example credential banks and the recognition of prior/accumulated learning. These capture a greater range of informal and non-formal learning that takes place outside of the formal education system and provide for the recognition of credentials across institutions and systems. One of the key aspects of credential fluency is the development of *flexible credential systems*, for example stackable credential frameworks, that enable credentials and/or competencies obtained through multiple media and formats (e.g. formal courses, platform-based remote learning such as massive open online courses (MOOCs), work experience, including in the informal sector, etc.) to be applied towards formal qualifications.

The achievement of credential fluency will contribute to improved alignment and signalling between the world of education and the demands of the labour market and enable particularly youth in disadvantaged circumstances to better leverage the varied means of education available to them, including those that are less financially burdensome than tertiary enrolment.
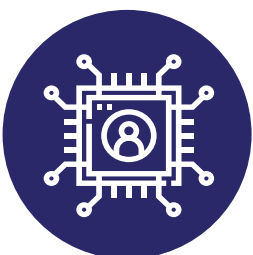
Self-sovereign identity

SSI is a paradigm shift in the way individuals and organisations manage their digital identities. Traditionally, identity systems have relied on centralised authorities such as governments or corporations to validate and control individuals' identities. SSI empowers individuals to have control over their own identity information, allowing them to selectively disclose it to others as needed. SSI leverages decentralised technologies like blockchain and distributed ledgers to provide a more secure, private and user-centric identity model. In SSI, individuals create and manage their digital identities using cryptographic keys. These keys enable them to sign and encrypt their personal data, giving them complete ownership and control over their identity information.

One of the key principles of SSI is the concept of 'minimal disclosure'. Rather than sharing their full identity information with every service provider or organisation they interact with, individuals can selectively share only the specific information required for a particular transaction or interaction. For example, when accessing a website that requires age verification, a user could share only their age without revealing their full birthdate or other personal details. By providing individuals with self-sovereignty over their identity, SSI aims to address many of the shortcomings of traditional identity systems. It offers increased privacy as personal data is not stored in centralised databases that are vulnerable to data breaches or misuse. Instead, information remains under the individual's control, with the ability to revoke access at any time. SSI also fosters interoperability between different systems and services. Since identities are based on open standards and protocols, individuals can use their SSI across various platforms and organisations without having to create separate accounts and undergo repetitive identity verification processes. This not only streamlines the user experience, but also reduces the collection and duplication of personal data across different entities.

The concept of SSI holds great promise in reshaping how identity is managed in the digital age. By putting individuals in control of their own identities, SSI has the potential to enhance privacy, security and convenience while promoting greater inclusivity and empowering individuals in the digital realm. SSI has the potential to revolutionise the education credentialing system by providing individuals with control over their own digital credentials. It provides the following benefits:

Secure and verifiable credentials: SSI allows individuals to have digital equivalents of their credentials such as diplomas, degrees and certificates. These digital credentials are encrypted and contain digital watermarks that verify their authenticity, issuer and integrity. This ensures that the credentials cannot be tampered with and can be easily verified by relevant parties.

User-centric ownership and control: With SSI, individuals have full ownership and control over their credentials. They can choose which credentials to share, when to share them and with whom. This shifts the control from centralised authorities to the individual, empowering individuals to manage their own educational records and share them as needed.

Portability and interoperability: SSI allows credentials to be stored in a digital wallet that individuals can carry with them across different educational institutions, workplaces and platforms. This portability ensures that individuals can easily present their credentials wherever needed, eliminating the need for manual verification and reducing administrative burdens.

Enhanced privacy and security: SSI provides individuals with greater privacy and security for their educational data. Instead of relying on centralised databases prone to data breaches, SSI utilises decentralised technologies like blockchain to store and verify credentials. This ensures that individuals' personal information is protected and minimises the risk of unauthorised access or misuse.

Improved trust and efficiency: By using SSI, educational institutions, employers and other stakeholders can trust the authenticity and validity of digital credentials. The cryptographic mechanisms used in SSI enable efficient verification of credentials, reducing the time and effort required for manual verification processes. This enhances trust and streamlines the credentialing process.

Lifelong learning and micro-credentials: SSI can support the recognition of various types of learning, including non-traditional and informal learning experiences. It allows for the creation and recognition of micro-credentials, which are smaller units of learning that can be accumulated and combined to form a comprehensive educational profile. This enables individuals to showcase their diverse skills and achievements beyond traditional degrees or certifications.

Global recognition and mobility: SSI has the potential to enable global recognition and portability of credentials. By utilising interoperable standards and frameworks, digital credentials can be easily recognised and accepted across borders, facilitating international mobility for students and professionals.

Overall, SSI offers a paradigm shift in the education credentialing system by empowering individuals with ownership, control and portability of their credentials. It enhances privacy, security, trust and efficiency while promoting lifelong learning and global recognition. Implementing SSI in education leads to a more transparent, inclusive and learner-centred credentialing ecosystem.

Data governance and management

Data governance

Data governance is an essential part of the PSET CLOUD (see Annexure 4). A draft data governance and management policy was developed to establish a framework for managing and protecting data assets within the PSET CLOUD. The policy defines the principles, processes and guidelines for data governance, with the goal of ensuring that data is accurate, complete, secure and compliant with applicable laws and regulations.

The policy aims to achieve the following objectives:

Improve data quality: By defining standards for data quality, data classification and data management processes, the policy aims to improve the accuracy, completeness and consistency of data within the PSET CLOUD.

Enhance data security and privacy: The policy establishes guidelines for data security and privacy, including data access controls, interoperability, data encryption, data masking and data retention policies. These measures aim to protect sensitive and confidential data from unauthorised access, disclosure or misuse.

Ensure regulatory compliance: The policy ensures that data governance practices comply with applicable laws, regulations and industry standards such as the Protection of Personal Information Act (POPIA), Electronic Communications and Transactions Act (ECTA), and Promotion of Access to Information Act (PAIA). Compliance with these standards reduces the risk of legal and financial penalties and protects the organisation's reputation.

Foster data-driven decision-making: The policy promotes the use of data to inform business decisions and strategic planning. By ensuring that data is reliable, accurate and accessible, the policy aims to enable stakeholders to make informed decisions based on data insights.

Establish accountability and ownership: The policy assigns roles and responsibilities for data governance. This accountability ensures that data governance practices are transparent, and that data is managed in a responsible and ethical manner.

Overall, the purpose of this data governance policy is to create a culture of data stewardship, where data is treated as a valuable PSET CLOUD asset that is managed with care and diligence. By adhering to this policy, the PSET CLOUD can realise the full potential of interoperable data assets and minimise the risks associated with poor data management practices.

A collection of case studies focusing on the self-sovereignty of citizens' data was published as part of a crowd-authored initiative that took place between December 2021 and January 2022 (Keevy et al., 2022). The call for contributions was limited to experts and partner organisations that had been directly or indirectly involved in the PSET CLOUD programme.

mzansi.citizensdatamatter: Reclaiming self-sovereignty for all South African citizens' data by 2030

A new type of governance framework for the PSET CLOUD

Project governance for the PSET CLOUD refers to the framework and structures put in place to ensure effective decision-making, accountability and control throughout the programme's life cycle. Developing the governance framework involved defining roles, responsibilities and processes to facilitate successful delivery of workstream deliverables and achievement of programme objectives. Below is an overview of the key components of project governance for the PSET CLOUD:

Table 3: Components of PSET CLOUD project governance

Project Sponsorship	Both the merSETA and JET had senior executives who provided strategic direction, support and necessary resources for the project. They were responsible for ensuring alignment with programme goals, securing funding and championing the project's success. On JET's side, the programme was championed by Dr Keevy and on the merSETA side first by Ms Nomvete and later Dr Manda.
Project Steering Committee	The PSC consisted of the project sponsors, supported by senior managers and subject matter experts from both the merSETA and JET. The PSC oversaw the project's progress, reviewed major decisions and provided guidance. The PSET CLOUD Board ensured that the project aligned with organisational priorities and monitored its overall performance.
Launch Group	This structure, made up of representatives of citizens, civil society and the private and public spheres, was responsible for advising the PSC on a relevant and appropriate governance structure. Options for a governance structure for a digital platform were explored and carefully interrogated for their suitability to South Africa and the PSET CLOUD.
Programme Manager	The programme manager, Dr Rajab, was responsible for overseeing project management activities with support from the operations manager, Mr Ngwako. They led the project team, developed and executed project plans, monitored progress, managed risks and coordinated all project activities. The operations manager acted as a liaison between the project team and the programme manager to provide regular updates and seek guidance as needed.
Project Team	The project team comprised individuals with the necessary skills and expertise to carry out the project activities under specific workstreams. The workstream leads were responsible for managing workstream activities to achieve programme objectives within the defined scope, timeline and budget.

A key focus of Phase 3 was designing a suitable governance model for the PSET CLOUD. During the scenario planning sessions, public trust was identified as a critical element for driving the use of the system. It was noted that stakeholders such as the private sector may reject a solution devoid of sound governance. To address these risks, the supply- and demand-side of the economy were considered to participate as active partners in the process.

Established in 2018, the PSC, comprising senior management from both partner organisations (the merSETA and JET) oversaw the implementation of the PSET CLOUD.

As outlined in its terms of reference, the PSC was tasked to (clause 2):

> review and approve work plans, monitor progress in programme execution, provide strategic and policy guidance, and to support communication and dissemination of programme outcomes. The PSC has the decision-making authority to review the overall programme development over its span.

The PSC met quarterly for decision-making, monitored progress and measured the level of identified risks on an ongoing basis between 2018 and February 2023.

In 2020, a reference group was established by invitation from the founding parties to provide expertise and advice. The reference group appointed independent legal facilitators who, at the DigiTrans 2022 conference in February 2022, assisted with obtaining attendees' (representing a wide range of stakeholders) endorsement of the proposal to form a 'launch group' and nominations of members. The Launch Group would represent sectors and stakeholders and would take custody of the process of deciding on and setting up the formal legal structure to house and govern the PSET CLOUD.

The PSET CLOUD: DigiTrans 2022 conference report

Following this public nomination process, the PSET CLOUD Launch Group was established as agreed for a period of 18 months (i.e. until November 2023). The purpose of the Launch Group was to ensure that the PSET CLOUD adopted the values of trust building, inclusivity and transparency. The tasks of its members were to:

- Participate in meetings, represent their constituencies and contribute their skills and independent judgement to debates and decisions on the legal entity and governance structures to be established;
- Explore and investigate the types of legal entities, wider governance models, structures, systems, etc. that could be appropriate for the PSET CLOUD, with the aim of recommending building a sustainable entity able to deliver on its mandate;
- Commission studies and reports and set up short-term focus groups to interrogate the details of issues/aspects of the PSET CLOUD;
- Provide inputs, contributions and recommendations related to the options presented and documents produced; and
- Commission and oversee the issuing of headline summaries/reports on progress to hold the attention of, provide updates to and continue to engage stakeholders.

The Launch Group, during its quarterly engagements, recommended that the PSC should draft and consult on an MOI (memorandum of incorporation) that would form the basis for establishing the PSET CLOUD Non-Profit Company (NPC). The following principles of the MOI were still to be discussed for final approval in November 2023:

- JET and the merSETA are the founders of the company.
- Members of the company are all in a single class, being voting members, each of whom has an equal vote.
- Members of the company are drawn from four equally weighted constituencies, being citizens, civil society, government and the private sector.
- A decentralised infrastructure such as smart contracts and principles of a decentralised autonomous organisation (DAO) to manage collective decision-making to be further explored and the consideration of a hybrid governance model to be further discussed.
- The PSET CLOUD platform will be wholly owned and managed by the company.

The following transition processes were proposed:

- The PSC should oversee the development of the MVP and remain in place as long as the merSETA and JET collaborate to support the further development of the PSET CLOUD platform. The PSC may be expanded with

additional funding partners that contribute to the development of the platform.

- Memorandums of understanding (MOUs) with early adopters should be signed with the PSC until such time that the PSET CLOUD NPC is established.
- Following the finalisation of the MOI for the PSET CLOUD NPC, the PSC should organise a first annual general meeting during which the members would be confirmed and a Board elected, based on the principles outlined.

Various options for the PSET CLOUD's governance structure were explored through research commissioned to explore governance models within the public and private sectors. An NPC, which might include public and private sector data providers (individual and institutional), data users, data processors, open-source developer stakeholders, credentialing institutions, credential-seekers and also public and private sector employment providers, was identified as a possible structure. Furthermore, it was agreed that the governance structure should be clear on the benefits for each of the core stakeholders and work towards co-creation instead of top-down interventions. Consensus on which stakeholders

would become core partners and how power would be distributed hierarchically to best benefit users and citizens had to be reached. The *Digital Governance Advisory Note* recommended the 'CC-PPP' model below (West & Beukes, 2021, 33):
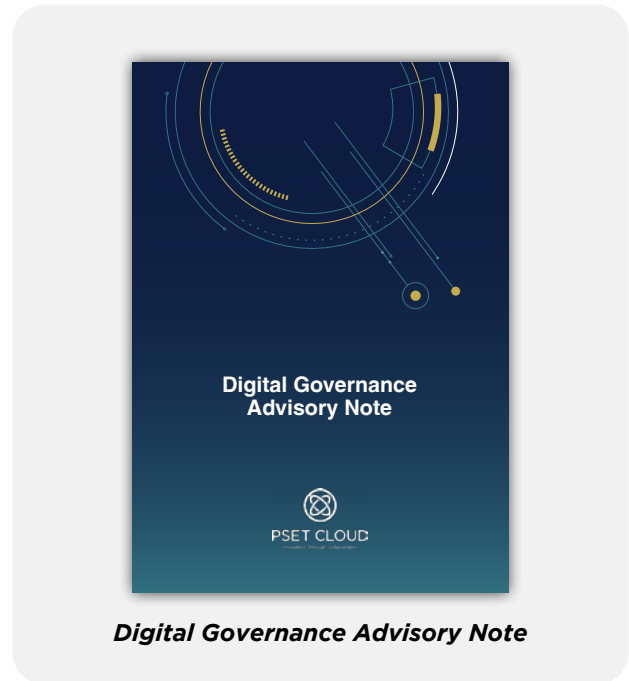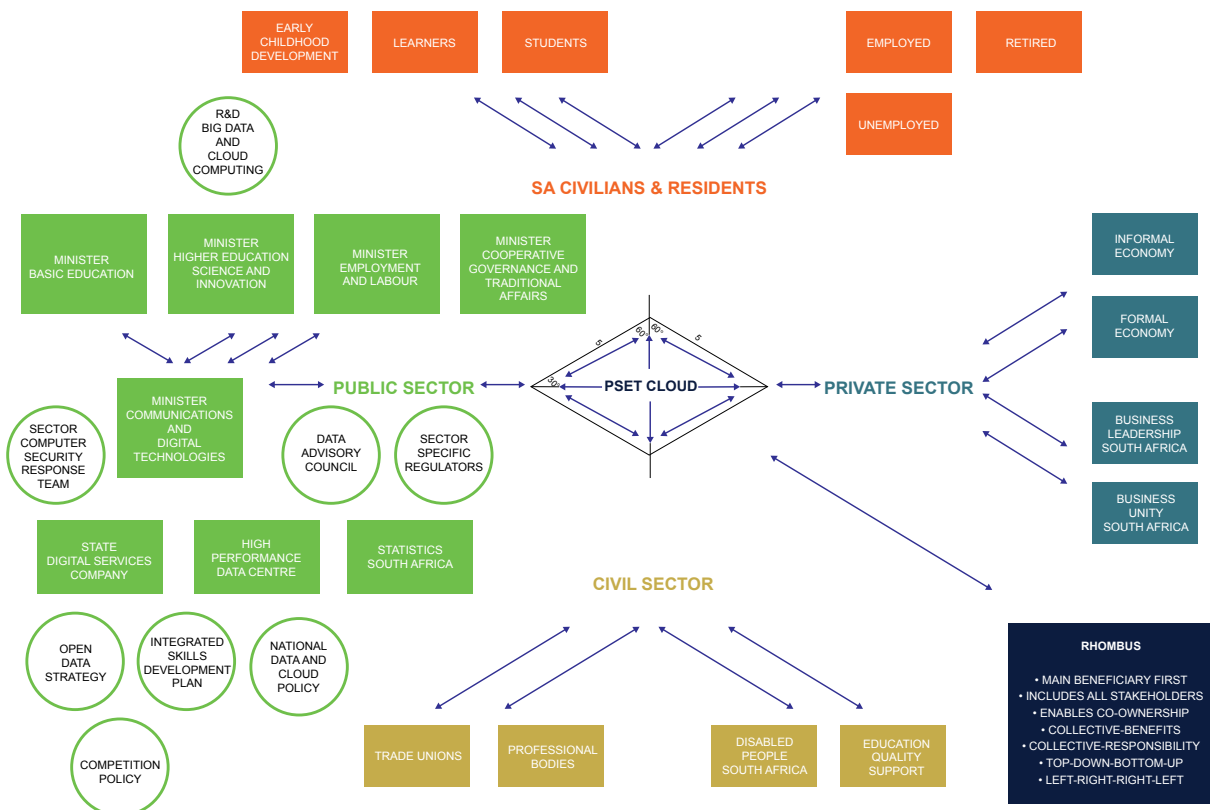

Digital Governance Advisory Note

Figure 3: Citizen-civil society-public-private partnership

In late 2022, the potential of DAOs was explored. The compatibility between the CC-PPP model and the underlying principles of a DAO seemed to align well, and four models were proposed for further exploration (PSET CLOUD, 2022, 12):

In Model 1 (decentralised governance, decentralised ownership), the community of members governs and owns the ecosystem in pursuit of a common vision. Community members own tokens which give them voting rights, and consensus is fundamental. Governance decisions are jointly voted on. Rules and records are transparent. Community members own their data and have the potential to monetise it. This is a DAO, where there is (1) decentralised governance, (2) decentralised decision-making, as well as (3) transparency and where there is the potential for an ownership economy where community members can earn (capital or rewards) for their participation.

In Model 2 (decentralised governance, centralised ownership), the community governs and owns the ecosystem in pursuit of a common vision. Community members own tokens which give them voting rights, and consensus is fundamental. Rules and records are transparent. Community members do not own their data. This is a hybrid model where data and platforms are owned by institutions but governance decisions are jointly voted on. This is a hybrid model which combines some of the principles and mechanisms of a DAO with a more traditional approach to data ownership.

In Model 3 (centralised governance, decentralised ownership), institutions own and can monetise data. There is a top-down setting of goals and vision and the rules, which are constructed by institutions, are not transparent. Consensus is not required in this model, which is the current nature of the PSET ecosystem.

In Model 4 (centralised governance, centralised ownership), there is a top-down setting of goals and vision and the rules, which are constructed by institutions, are not transparent. Consensus is not required in this model and community members do not have voting rights but, while institutions have responsibility for governance, individuals own their own data and have the potential to monetise it. A model like this could be enabled by self-sovereign identity.

A draft MOI for the PSET CLOUD NPC was developed (see Annexure 2). The MOI was submitted to the merSETA and JET governance structures and was formally approved by the JET Board in March 2023.

Towards a foundational taxonomy

In keeping with the Data Commons Framework of Goldstein et al. (2018), the framework of choice for the PSET CLOUD, we embarked on a process to develop a foundational taxonomy for the PSET CLOUD MVP. In the framework, illustrated in Figure 4 (overleaf), the taxonomies are found above the data layer in the third layer from the bottom. This layer deals with 'formats and labels used to sort … information as set out by metadata and taxonomies of datasets' (Goldstein et al., 2018) and focuses on standardisation, which plays a key role in interoperable information systems.

Developing a foundational taxonomy for the PSET CLOUD is premised on the value of mapping, categorising, and standardising a skills and occupations language so that users of the platform are easily able to identify/navigate which clusters of qualifications are linked to specific occupations and which skills are matched to which jobs, using artificial intelligence (AI). To bring the foundational taxonomy for the PSET CLOUD to life, we worked with the Development Policy Research Unit (DPRU) from the University of Cape Town. The DPRU was tasked with:

1. Developing a foundational taxonomy and coding schema for the PSET CLOUD; and
2. Developing a framework for matching jobs and learning opportunities.

The section that follows highlights how reviewing existing taxonomies and mapping different classification systems helped in this task (see UCT DPRU, 2023 for details). The review process involved analysing existing taxonomies to determine their content value and whether they aligned with the objectives of the PSET CLOUD. The review was aimed at unpacking the intricacies associated with mapping different taxonomies to other skill, task and occupation taxonomies, particularly South Africa's Organising Framework of Occupations (OFO).

Furthermore, the review aimed to inform decisions about the nature and extent of mapping pathways used to create a foundational taxonomy. It covered various categories of information, including taxonomy type, purpose, methodology, data composition and structure, unique identifying variables, frequency of updates, cross-walks, and accessibility.

Several taxonomies were examined, namely:

- Occupational Information Network (O*NET);
- European Skills, Competencies, Qualifications and Occupations (ESCO);
- United Kingdom (UK) Skills Taxonomy;
- EMSI Open Skills Taxonomy;
- World Economic Forum (WEF) Global Skills Taxonomy;
- International Standard Classification of Education (ISCED).

In addition to determining the taxonomies' content value for and alignment with the objectives of the PSET CLOUD, the challenges involved in mapping these taxonomies to others such as the South African OFO were assessed.

The feasibility of including certain taxonomies and classifications in the PSET CLOUD foundational taxonomy was also examined. For instance, the DPRU team noted that the Credential Transparency Description Language (CTDL) created by the Credential Engine may not be useful, but its Reference Data Library (RDL) approach to linking data may be beneficial for job portals (UCT DPRU, 2023).

Figure 4: Data Commons Framework (adapted from Goldstein et al., 2018)
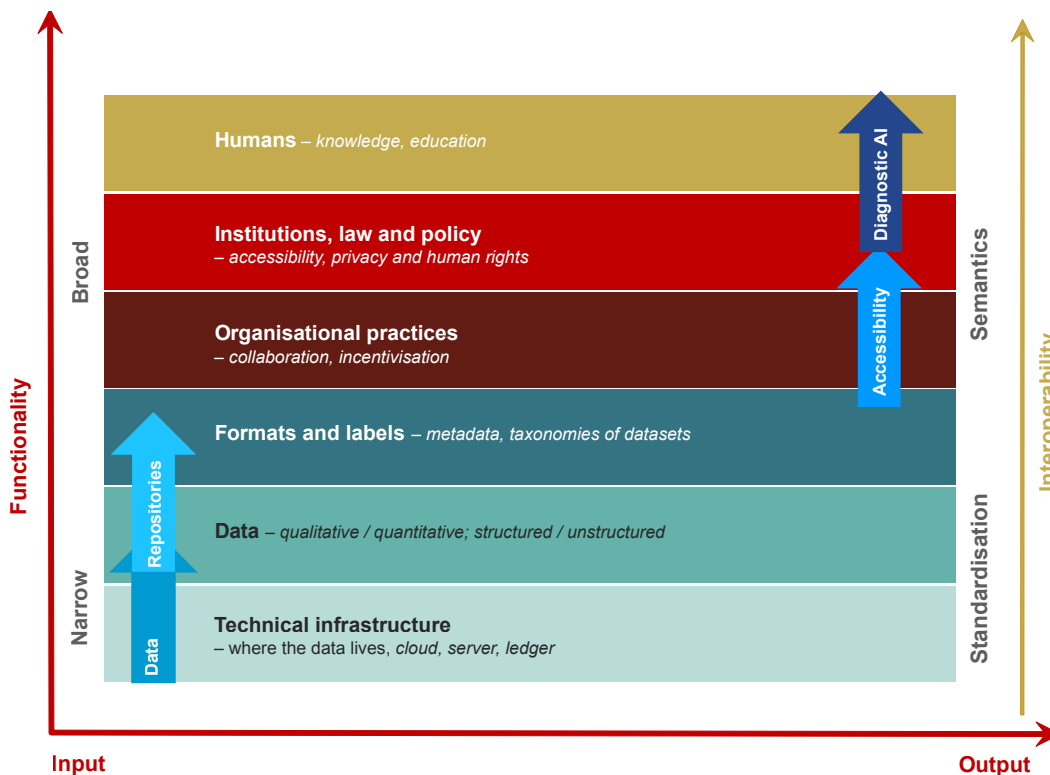
The team also emphasised the importance of selecting an optimal combination of data and avoiding duplication in the taxonomies and classifications. They highlighted that the National Qualifications Framework (NQF), OFO, ESCO, O*NET and Emsi Open Skills taxonomies provide useful occupation data fields for the foundational taxonomy, while the WEF Global Skills and UK Skills taxonomies do not contain such information. Additionally, O*NET provides related occupation information, which could be helpful for job matching and identifying skill gaps.

With the review completed, the next step was to identify the factors that would influence the composition of the foundational taxonomy. Factors to be considered included (UCT DPRU, 2023):

- The type and extent of data provided by different taxonomies, including task, skill and occupation data;
- The methodology used to capture the data, which can affect representativeness and potential biases in the data;
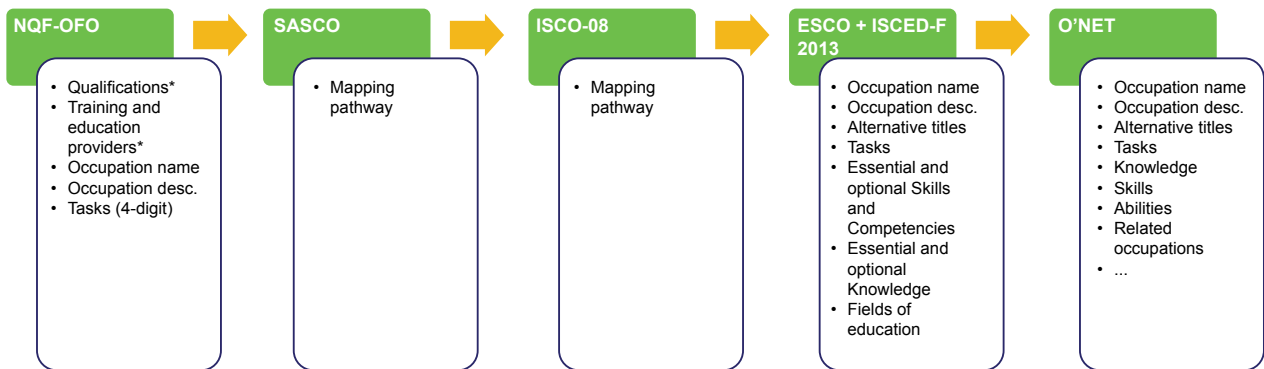- The existence of a unique identifier coded according to an existing nomenclature, which is necessary for mapping different datasets to each other. While some taxonomies have a feasible mapping pathway to others, others do not, which may limit the ability to link data across different taxonomies. Mapping education qualification data to the foundational taxonomy is possible through

existing mappings to the OFO and ESCO taxonomies;
- The feasibility of including certain taxonomies in the foundational taxonomy, considering accessibility and budgetary considerations;
- The importance of transparency and documentation when using a taxonomy as part of a foundational taxonomy. It is crucial to understand how a taxonomy was created, what information it captures, when it is updated and what changes have been made as a result of updates;
- Accessibility considerations play a role in selecting an optimal combination of data for inclusion in the foundational taxonomy; and
- Avoiding duplication when creating a foundational taxonomy by considering whether certain classifications or taxonomies overlap with others already included in the foundational taxonomy.

The review and identification of influencing factors informed the second step of developing a foundational taxonomy for the PSET CLOUD, which entailed using a systematic matching protocol to map occupation codes present in South Africa's OFO to international occupation coding standards employed in the skill and task taxonomies reviewed. The proposed mapping process is highlighted in the image below.

Figure 5: Mapping South Africa's OFO occupation codes to international occupation coding standards

NQF-OFO	SASCO	ISCO-08	ESCO + ISCED-F 2013	O'NET
• Qualifications* • Training and education providers* • Occupation name • Occupation desc. • Tasks (4-digit)	• Mapping pathway	• Mapping pathway	• Occupation name • Occupation desc. • Alternative titles • Tasks • Essential and optional Skills and Competencies • Essential and optional Knowledge • Fields of education	• Occupation name • Occupation desc. • Alternative titles • Tasks • Knowledge • Skills • Abilities • Related occupations • ...

Note: SASCO: South African Standard Classification of Occupations ISCO: International Standard Classification of Occupations

The first step in the mapping process is the NQF-OFO mapping. This mapping provided useful occupation level data – name, description, code and tasks. Importantly, these data fields are mapped to education qualification data, which brings important education supply data into the foundational taxonomy. Next, there is a feasible mapping pathway from the OFO occupation codes to the South African Standard Classification of Occupations (SASCO) codes and International Standard Classification of Occupations (ISCO-08) codes, which in turn allows a mapping pathway to the second key element of the foundational taxonomy – the ESCO taxonomy data. ESCO provides occupation information – name, description, alternative titles, code and tasks – as well as a rich set of data on essential and optional skills and competencies for each occupation. Notably, occupations in the ESCO taxonomy are linked via the knowledge pillar to ISCED-F 2013 fields of education data – thus linking to education supply information. The third key element is the mapping to the O*NET taxonomy using the ESCO-O*NET crosswalk. O*NET provides a plethora of occupation-oriented and worker-oriented data, including skills, abilities, tasks and knowledge. Further, the provision of related occupations data offers another data source that may be useful for the foundational taxonomy.

The DPRU team highlighted that the foundational taxonomy in this form would need further tailoring given that a number of data fields across the taxonomies that comprise the overall taxonomy contain duplicate information. For example, task statements are present in the OFO, ESCO and O*NET taxonomies. As such, further decisions regarding which of the duplicate fields are most useful and appropriate would need to be made, and the interim foundational taxonomy would need to undergo a number of iterations before finalisation.

With the mapping complete, the next phase would be the development of the framework for matching jobs and learning opportunities, which would underpin the opportunity matching on the PSET CLOUD MVP. Furthermore, a coding schema for the taxonomy would need to be developed in order to better categorise and segment the taxonomy. It is important to also note that this taxonomy is highly manual and does not take advantage of tools such as AI and machine learning. The use of these tools must be factored in to the further development of PSET CLOUD taxonomy, so in the reboot of this work component, sourcing a service provider able to translate what has been done so far to an algorithm/model would propel the taxonomy to the next level.

Concluding note

This chapter has provided a detailed account of the constructs underlying the PSET CLOUD. At the time this report was being finalised, many of the processes were underway and still incomplete:

- The data governance framework has been drafted but requires scrutiny and a broader review process that includes partners and stakeholders.
- The governance framework was evolving well, but the interface between the CC-PPP model and the DAO approach remains exploratory.
- The mapping process for the foundational taxonomy of the PSET CLOUD has been completed, but the framework for matching jobs and learning opportunities is incomplete.
- In all three cases, the processes for further work and completion remain intact.

3 Failing forward
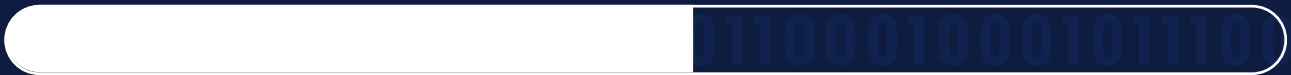
Introduction

The PSET CLOUD project has been and remains an ambitious venture in the labour market industry. The ambition lies in both the technologies envisaged to be used for the platform and the ultimate use of the platform post-development. The technologies are niche and innovative, requiring open-mindedness and forward thinking when approaching the project. With a shrinking labour market due to misalignment between supply and demand resulting in unemployed and despondent youth, the envisaged use of the PSET CLOUD platform to provide automated job matchings through the use of AI and machine learning, online credential verification through the use of SSI, mapping and visualisations of demand-side trends, and recommendations of learning pathways is ground breaking and a definite game-changer in the PSET industry. Typical of ambitious undertakings, the PSET CLOUD has been marred by challenges, from tight project timelines, to limited human capacity, to the re-evaluation of the technology to be used, to collaboration struggles between stakeholders and issues with procurement processes. The internal JET team has nevertheless held its head and morale high in an attempt to see the project through to the end. Thus far, the following prototype user access pages have been designed.

Prototypes developed

- Youth
- Training provider
- Employment provider
- Admin portal

The minimum viable product

The PSET CLOUD MVP is intended to build a business case showcasing the extent to which technology can positively impact the PSET ecosystem. An MVP represents an idea that is still to be developed further. The PSET CLOUD MVP, however, with its extensive detail and functionalities, is more than a minimum product. The PSET CLOUD MVP incorporates a wide variety of technologies – ranging from DevOps, cloud computing, blockchain and SSI to AI and machine learning – and offers some of the functionalities mentioned above such as job matching, labour market trends analysis, online credential verification and recommendations for learning pathways. The MVP highlights the level of ambition and big-thinking behind the PSET CLOUD venture.

The cost estimation made for the initial development of the PSET CLOUD depended largely on the funds provided by the initial funder. It became evident during the second tendering process for development of the MVP that there was a discrepancy between the estimated and actual cost as some service providers' quotations were much higher than had been envisaged while others excused themselves from the tendering process, citing budgetary issues. The subsequent tendering process attempted to make amends by delving deeper into the different factors involved in the development. In order to arrive at a more realistic cost, an analysis was undertaken of the following factors affecting platform development:

> **The application type:** The PSET CLOUD is categorised as a complex platform as it involves new and innovative technologies. This implies that a team with specialised skill sets is required.
>
> **Design approach:** The variety of platform users, including learners, jobseekers, employers and education entities, means that the stakeholders will have different requirements and, ultimately, different experiences of the platform. There needs to be a strong focus on ensuring that the front-facing design of the platform will cater for the required different user experiences. To accomplish this, skills in the user interface / user experience (UI/UX) design space are required.
>
> **Type and source of development team:** This factor focuses on whether the service providers are internal, free-lancers or outsourced. The PSET CLOUD project opted for an outsourced team because of the likelihood of such a team having the required specialised skills, focused availability and experience in developing complex technology solutions.

> **Type of contract:** The PSET CLOUD elected to use a 'time and material' contract, which follows a payment per-hour policy. This allows for flexible working and covers the minimum payable amount for MVP app development.

The extended discussion on the cost estimation of the PSET CLOUD is found in Annexure 5.

MVP Take 1: Important lessons

While a more nuanced approach could be taken in explaining the reason behind the failure of the first MVP, an off-the-bat take on the failure can be summed up in three words: people, processes and technology.

The PSET CLOUD venture was a cross-functional project, and in such a setup, sticking to a common goal and objective is always difficult. There was a struggle to obtain alignment amongst the different stakeholders, with JET and the merSETA, although joint partners, seeming to be pulling in different directions initially. This misalignment inadvertently affected the scope of work and timelines of JumpCo, the appointed development service provider.

The method used for the software development life cycle had loopholes and did not follow a standard agile methodology. It also lacked the correct documentation and displayed scope creep.

There was, furthermore, an incorrect choice of technology stack for the implementation of the MVP: JumpCo chose to use a technology stack endorsed by its technology partner IBM rather than undertaking proper research to identify appropriate technology for the PSET CLOUD MVP implementation. Liferay, the technology platform used by JumpCo, was not fit-for-purpose.

The recommendation document produced to determine whether the Liferay technology stack initially used by JumpCo should be re-used or not highlighted the following issues

- Test cases and testing done on the initial MVP found the platform developed by JumpCo not to have any substantial functionality to warrant its re-use.
- Liferay, the technology stack used, though rated highly by Gartner, was not relevant for the requirements laid out by the JET team.

Below is an outline of the deliverables to be completed by JumpCo, who was contracted from 4 August 2021 to 31 October 2022 to develop the MVP, and the status of the deliverables when the contract ended.

Table 4: JumpCo's deliverables for MVP development and their status

Stage and deliverables	Status and comments
1. Inception • Inception report	The inception report was completed. It went through a number of iterations before the final version was accepted.
2. Functional requirements • Functional requirements document	Based on user journey engagements, JumpCo produced a: • High Level Functional Requirements Document • Detailed Decomposed Functional Requirements Document These documents informed the scope of the MVP, and from this scope a backlog was produced. The backlog was used to produce sprints that were aimed at providing a timeline of when items in the backlog would be developed.
3. Design • System design document • Prototype aligned to functional requirements	The system design document was incorporated into the detailed functional requirements specification through the detailing of user stories and system architecture. The development of the prototype was amended to be a 'Proof of Technology' for the Cloud environment which was tested and found to work and was thus also completed.
4. Develop and test • 8 sprints/review sessions • Test cases per released features and functions • Deployment-ready MVP	As per the contractual agreement, JumpCo would complete 11 development sprints. Although this was done, JumpCo did not manage to produce a deployable MVP. Reasons for this are discussed in sections that follow.
5. Deploy • MVP deployed to live environment • Draft user manual	Not completed due to lack of deployable MVP.
6. Handover • Documented source code • Final user manual • System walkthrough video	Not completed due to lack of deployable MVP. However, a concept video was produced for the DigiTrans conference. Currently some handover activities are taking place. A handover tracker responsible for ensuring JET-merSETA receive everything they need can be found here.
7. Support • Orientation training • Software maintenance training	Not completed due to lack of deployable MVP.

The reasons for the inability to produce a fully functional MVP according to JumpCo are summarised below:

- Scheduled client demos were missed due to more time spent on background research. Missing client demos resulted in project architecture decisions taking longer than anticipated.
- Extended inception meetings and workshops lead to the planned budget being exceeded, resulting in a reduction in the scope of work that could be undertaken.
- Access to merSETA data was delayed due to legal considerations and a delay in signing the nondisclosure agreement (NDA). Additional merSETA data was discovered late in the project, but could not be integrated at that stage. Similarly, access to National Skills Development Management System (NSDMS) data was granted too late for it to be integrated into the MVP.
- In addition to causing delays, the discussions with the merSETA on access to data reduced the amount of time available for MVP development work.
- Lack of partnerships meant that the MVP development team did not have access to the data required to realise the PSET CLOUD's vision and identified as being a priority for inclusion in the PSET CLOUD, in particular, real-time data related to job postings and opportunities. This hindered the achievement of the interoperability requirement and limited the successful development of the MVP. Prioritised items had to be moved into the backlog.
- The introduction of a conference shifted the focus from delivering the MVP to creating a tangible product to showcase at the conference, impacting both the quality and delivery of the final product.

As a result of the above, the JumpCo team depleted their budget, rendering them incapable of completing their assigned tasks.

Obtaining the data

As a means to gather the data required for the development of PSET CLOUD, JET initiated a string of engagements with various merSETA department heads. As a result of these engagements:

- A data requirements document was produced by JumpCo, which highlighted in detail what data was needed, how and where the data would be used and how it would be secured or protected.

- The merSETA highlighted that it did not own the NSDMS data and therefore could not share it without considering legal implications. The engagements with the merSETA legal team led to the amendment of the NDA initially signed by JumpCo and the merSETA.
- The merSETA shared a sample of three years of learner data from the NSDMS database. This data was used as the foundation to build the MVP. However:
    - the data included limited labour market and education and training opportunities;
    - the sample was too small to produce the insights originally conceptualised in the functional specifications; and
    - the merSETA did not have real-time data or job opportunity data at all, so at this point, efforts to use the data for visualisations were limited to static representations.

The limited sample led to the JumpCo team completing their sprints without the data that had they hoped to have.

With JumpCo not being able to complete their assigned tasks due to budgetary constraints and limited data, the PSET CLOUD platform was left with a backlog comprising the following items:

- Items that have no dependencies;
- Items that require third party integrations.

The items requiring third party integrations posed the greatest risk to the success of the project since these items depended on external stakeholder engagement in order to obtain access to the datasets needed to realise the full functionality of the PSET CLOUD. The datasets in question were mainly those linked to the labour market and PSET opportunities.

Although the data received from the merSETA included PSET opportunities and work-integrated learning opportunities, and a second dataset containing some opportunity data from the sector skills surveys was also received, the resulting dataset did not have sufficient coverage to generate usable insights nor create functional machine learning models. Furthermore, the dataset was not good enough to allow the PSET CLOUD to do a soft launch of the MVP.

Additionally, the dataset was transferred to the PSET CLOUD team via Excel. This is not a sustainable model of access and would cause additional work for both the merSETA and the PSET CLOUD team since to attain interoperability, data must be drawn down periodically from the merSETA system through application programming interfaces (APIs).

Lessons and recommendations

In conclusion, the following insights, learnings and recommendations can be drawn from the first MVP development process:

1. We need a firm legal document outlining the consent and permissions required by employers, individuals and institutions that wish to use and sign up for the PSET CLOUD.

2. We need a significant amount of labour market opportunities**,** enough to build relevant machine learning models around. The existing NDA grants the PSET CLOUD platform access to three years of data, and we would like to apply this to all data requests.

3. Considerations of sending out communiques to employers on the merSETA database seeking approval to share data with the developers is most relevant at this juncture, and employers can be requested to engage with the platform directly.

4. However, it is *not possible to draw on the merSETA data for work opportunities unless we can access employer information in addition to the above data.* In order to develop our ability to link students to work opportunities, we need to explore new options, which currently include:

   a. **Creating a parallel system that requires employers to capture their opportunities on the PSET CLOUD:** This may put us in direct competition with Employment Services South Africa (ESSA), the National Career Development Pathways Network and other job search websites. The functionality to do this has been developed but needs to be refined.

   b. **Drawing down from the merSETA's yearly sector skills data and providing some visualisations related to this:** This requires that we receive direct access – and noting that this is only a sample of institutions and opportunities, many of which may be closed or filled by the time we get the data. We could seek to onboard new SETAs and thus expand the information collected this way. Note that this is not real-time data, but annual data. NB: In order to add *job opportunity information* to the system, we need access to employer information. This would include the employer name, location, registration data, date of posting of opportunities, contact details of the individual receiving applications, etc. The

data cannot be anonymised.

   c. **Forming partnerships with existing system supports which seek to do this, such as the National Career Development Pathways Network and ESSA:** To this end, the team has met with Career Development Services and ESSA, and both have indicated that they are cooperating with the National Management Pathway Network and that the PSET CLOUD team requires approval from the Director General: DHET.

   d. **Deciding not to focus on this and merely redirecting learners to other platforms that are handling this, like YouthMOBI:** This would significantly shift our vision for the platform.

5. The same applies to education and training opportunities. We have a sample from the merSETA that was pulled from the NSDMS. This data has been ingested into the MVP; however, more data is needed to build on the current existing dataset. Currently the ingestion of data into the PSET CLOUD has been manual, and there is a need to pull data from the NSDMS using APIs to reduce workload and improve the interoperability of the information systems. We will need to access this data as often as it is uploaded to the merSETA's NSDMS. Furthermore, in order to optimise the system, the merSETA would have to develop APIs to allow them to 'ingest' the APIs developed by the PSET CLOUD so that we can regularly receive data directly from the NSDMS. It has been suggested that the budget for this development be allocated from the merSETA Ecosystem project 'alignment' line item.

6. In order to verify credentials on the system, the PSET CLOUD platform will need to be able to access the South African Qualifications Authority (SAQA) database and, with the explicit permission of individuals using the PSET CLOUD system, check for the existence of a specified credential linked to a specified individual in the database. In previous conversations, the merSETA stated that we cannot access this database through the merSETA because they do not own the data and cannot therefore give permission to access it. This partnership will need to be developed with SAQA. It has been suggested that, as a preliminary step, we should ask SAQA if we can 'test' our system using only our credentials for the proof of concept. From

the JumpCo/PSET CLOUD side, we will need to be explicit and explain how we will access the database without compromising data we do not have access to and what development may be necessary or required on both ends to do so.

The SSI component is considering an angle that would allow educational institutions to verify credentials as well, so this is another pathway we could consider, but one that comes with its own risks - for example, that educational institutions will have the time, energy, desire, personnel etc. to respond to requests in a timely fashion and/or will provide access to their databases. Perhaps both channels need to be considered. Ideally, this component of SSI may also allow employers or others to be engaged to verify work experiences, volunteer experiences, etc. in the next iteration of the platform.

Addressing the factors below could provide the impetus for realising a functional MVP:

1. Prioritising system integration between the merSETA's NSDMS and the PSET CLOUD through API functionality;
2. Prioritising POPIA compliance as a project deliverable to ensure data access issues are unblocked prior to initiating system development of the MVP2;
3. Exploring and deciding on alternative data access points for the MVP2, as a method of triangulation;
4. Elevating systems and data access to a deliverable status within Programme Phetogo, thereby identifying data champions for the MVP2 development.

A strong push for acquiring data linked to opportunities needs to take place. Failure to do this will result in the failure to deliver a fully functioning MVP. Furthermore, if data cannot be acquired through leveraging the merSETA ecosystem and through partnerships with external stakeholders, then alternative data gathering methods such as scraping need to be considered sooner rather than

later, and if the decision is to use such methods, a service provider skilled in web-scraping needs to be brought on board.

Furthermore, the partnership with SAQA is key to implementing the MVP's credential verification functionally. The Quality Council for Trades and Occupations (QCTO) has also agreed to come on board to verify occupational qualifications and a service-level agreement is being drafted for this purpose. Finally, other partnerships as early adopters are also under consideration currently. These include Siyavula, the South African Board for People Practices (SABPP), Association for Skills Development in South Africa (ASDSA), the Department of Social Development, and the United Nations Children's Fund (UNICEF). Discussions with each of these are ongoing.

MVP Take 2: Out of the starting blocks

A new specification for the MVP was developed in 2022 and early 2023 (see Annexure 3). The specification provides clear guidelines on how the MVP should be developed across the following focus areas:

- Mapping and visualisations of demand-side trends;
- Opportunity matching;
- Credential verification and recognition using the SSI technology;
- Development of recommended learning pathways; and
- Recognition of prior learning (RPL).

An important feature of the specifications is the integration of the SSI solution that was successfully completed in 2022.

Concluding note

Chapter 3 has provided an honest account of the work done up to March 2023. The process was not without obstacles, and many lessons were learnt during the development of the first MVP. We return to this in Chapter 5 when we explore how best the work can continue.

4 Looking from the outside in

Introduction

A rapid evaluation of the programme conducted in the middle of 2022 (DIG, 2022) concluded that partnerships had not been formalised to the point of signing formal agreements regarding interfacing and allowing interoperability of platforms between partners.

The evaluation further concluded that the lack of partnerships has negative implications for the finalisation of the MVP as this process relies on the strength of the partnerships established. (It needs to be noted that at the time of writing this report, one partnership agreement has since been concluded.)

Rapid evaluation findings

The rapid evaluation further concluded that there were some critical assumptions that the PSET CLOUD programme made which did not hold true in practice. These need to be unpacked and addressed to ensure the PSET CLOUD's operationalisation. The report went on to state that to answer the question of whether the programme design was still relevant to the context, an ecosystem assessment may need to be conducted to determine the PSET CLOUD's niche in the market.

The evaluation recommended that the platform be operationalised and taken to market. Further refinements and enhancements can be done when the programme is up and running. The evaluation found the concept to be very relevant and even 'brilliant'; however, it now needs to be rolled out.

The rapid evaluation made the following recommendations (DIG, 2022, 221–22):

1. PSET CLOUD to conduct an ecosystem assessment to determine what (similar) platforms exist and … partner with them to provide key services to enable PSET CLOUD to carry out its mandate. A situational analysis and reflection on the rationale for existence in the PSET sector would prove very beneficial for the programme.

2. There is a vast amount of available data. The PSET CLOUD needs to specify the data it needs, as this would allow for a formal exploration of who holds the data and how the PSET CLOUD can gain access to it. It is recommended that the partnerships management team at JET should focus on the purpose of the intended partnership with identified partners.

3. JET and the merSETA should deepen their collaboration, and data specifications must be in place to drive this. The merSETA's use of the platform as the early adopter could serve to inform further refinements and enhancements to the platform and demonstrate value to other stakeholders.

4. The need for a technical team at JET to drive this initiative is vital. Since the PSET CLOUD platform is intended to operate in a highly complex environment, it is important to have capacity that understands and can develop design specifications for the platform, can interact with the developers (especially for MVP2) and drive the engagement with the merSETA. It may be necessary for both JET and the merSETA to engage scrum teams and technical project managers.

5. Sufficient time should be allocated to ensure the development process and related sprints are fully funded. At the end of a contract phase, the developer should be able to hand over an acceptable product in line with the time and budget allocated, especially as the team moves to engaging a developer for MVP2

6. The goal, vision and value-add of the PSET CLOUD should be simplified by the advocacy team in order to communicate with and create demand for the system amongst its intended users. Interactive sessions could potentially be conducted on an ongoing basis for this purpose.

In terms of platform management/governance, the PSET CLOUD team could consider working as a consortium with partners such as other NPOs to learn how similar platforms are being managed. This would enable the PSET CLOUD to enhance its governance and leverage existing networks.

Considerations from the rapid evaluation

The following is a summary of the evaluation findings for consideration when moving implementation of the PSET CLOUD forward:

- Clearly developed design specifications for the MVP must be developed and less reliance placed on co-creating the solution with the development team. Attempts at co-creation impeded the development of the MVP1 as developers reportedly felt too much reliance was placed on them rather than on the product owners (i.e. the PSET CLOUD) for business decisions taken in relation to the MVP.
- Some of the assumptions that informed the development of the PSET CLOUD ToC may need to be reviewed. These include that real-time data would be readily available to test functionalities within the platform, that the process of creating APIs would be practical and doable, that the necessary partnerships would be in place during the development process and that co-creating with the software development team would yield positive results.
- The PSET CLOUD is built on the premise that users will be able to access real-time data to make informed decisions: essentially, data is the main underpinning of the PSET CLOUD. It is of the utmost importance that the programme team thoroughly unpacks the concept of real-time data, considering the challenges experienced in accessing data.
- Potential partners are willing to share data or allow for interoperability with the PSET CLOUD within the prescripts of the available Acts and legislation if and where they apply. Data sharing needs to be negotiated, meaning that the data sharing process is not guaranteed as it may be influenced by factors that are beyond potential partners' control, for example political factors. The PSET CLOUD needs to consider the laws, protocols and processes that have to be followed to access external partner data.
- Advocacy and communication of the PSET CLOUD's needs should be broken down into understandable language for the various stakeholders to ensure a targeted and overall understanding of the PSET CLOUD's vision and goals and ensure buy-in. Expectations must be clarified upfront with early adopters to avoid misalignment of expectations and roles to be played.
- Adequate time needs to be allocated to the process of developing the MVP.
- It is key that, in addition to the broader project team, JET retains the services of a purely technical team based at JET to manage the user design and development process.

Reflection sessions

Two quarterly reflection sessions were held. The last one, in March 2023, was evaluative in nature and tracked progress against output indicators. The following next steps were agreed on:

1. The Operations Manager and the MVP workstream team to finalise a draft security policy to be developed.
2. The MVP team, working with the Operations Manager, to confirm timelines for communicating with the relevant users about user requirements and test cases so that understanding of user requirements is in order.
3. Urgent steps need to be taken to address MVP target 1.3 that relates the finalisation of the security policy and data management.
4. The Data Innovators team to check with the Operations Manager regarding why social communications data is not uploaded on the dashboard.
5. The number of impressions (views), number of followers and number of subscribers need to be added to the dashboard.
6. The Data Innovators team continues engaging with each workstream lead on a 1:1 basis to deal with new developments and ideas emerging frequently.

Ongoing evaluation

A learning and accountability framework was completed in April 2022 by DIG as part of Phase 1 of their workplan and was signed off. The framework was intended to support the ongoing evaluation of progress towards the achievement of the PSET CLOUD outcomes. Some of the questions that guided the rapid evaluation – such as questions for stakeholder interviews, client/user survey questions and analysis of web statistics – were drawn from this framework. Whilst most of the recommendations from the rapid evaluation and the next steps identified during the evaluative reflection session have been actioned, outcome harvesting based on the framework should be used to follow up on those that are yet to be implemented and to assess the effectiveness with which those that have already been actioned are being managed.

As part of the DIG evaluation, the ToC developed during the inception phase in 2019 was reviewed. The DIG evaluation team refined the ToC and presented their proposals, first to the PSET CLOUD monitoring and evaluation (M&E) lead, who clarified areas that may not have been clear to the team and provided reflections on the refined ToC. The refined ToC was then presented and discussed with the rest of the project team. The feedback received was used by DIG to finalise the refined ToC, which is much more detailed and elaborate than the original (see Figure 6 overleaf).

Following the refinement of the ToC, DIG refined the logframe that had been developed during the PSET CLOUD's inception phase. The development of the logframe relied on both the ToC and on the M&E framework developed by the PEST CLOUD M&E lead prior to DIG's appointment, that is, some of the outputs and indicators in the revised logframe were a continuation of those that were already reflected in the M&E framework. Given the detailed work that DIG did in refining the ToC, the revised logframe is more extensive and comprehensive. DIG held one-on-one consultations with all workstream leads to confirm respective outputs, indicators, targets, means of verification and assumptions. Once those consultations were done, DIG finalised the draft logframe and presented it for inputs to the PSET CLOUD project team, after which the logframe was finalised.

A demo of the monitoring dashboard was developed by DIG and shared with the M&E lead in October 2022. After integrating feedback from the M&E lead, DIG presented the dashboard to the PSET CLOUD team at the beginning of November 2022 and worked on revising the dashboard based on comments received. A revised version was submitted towards the end of January 2023, and the final dashboard is accompanied by an indicator tracker.

An outcome harvesting process was conceptualised in early 2023. The revised ToC and logframe would serve as the basis for identifying and validating proposed components where outcomes harvesting would be relevant. As part of preliminary preparations, the evaluators identified the *innovations component* as potentially the most relevant at this stage as it includes concepts that are integrated into all the different workstreams. The evaluators identified potentially relevant workstreams as being:

MVP Development – User Journeys (UX): This aspect of the MVP development workstream focuses on the user experience and user journeys. Outcome harvesting and focus group discussions with users and user journey participants could be considered for evaluating this workstream.

Advocacy and Communications: There is a need to understand the contingencies and whether the outcomes can be evaluated at this stage. Relationships with trusted partners/potential partners have improved over time, as evidenced by the signing of two MOUs with potential partners as well as the ongoing engagements with other potential and trusted partners. This could denote a shift in sentiment, knowledge and understanding of the PSET CLOUD. The team (harvesters and harvest users) could explore aligning the outcomes harvesting to some of the immediate outcomes in the logframe.

Innovation: Based on a literature review, monitoring, evaluation, research and learning (MERL) researchers explored the criteria for assessing innovative components of the PSET CLOUD. Following critical inputs from the PSET CLOUD M&E lead, the paper was shared with the rest of the PSET CLOUD team for their comments, and sessions were arranged with the innovation component team lead before the document was finalised.

Figure 6: Refined PSET CLOUD theory of change

5 Rebooting the PSET CLOUD

Introduction

This report has attempted to provide a type of 'inventory' of the conceptualisation and development of the PSET CLOUD programme between 2017 and 2023. As stated at the outset, the report was written by the project team adopting a reflective process to ensure that the learnings thus far are captured and can be used as a basis for the next stage of development. The unfortunate and premature termination of the MVP in March 2023 places JET and the merSETA at a point where finding a satisfactory compromise may prove difficult. In this tension there also lies an opportunity.

The PSET CLOUD was always conceptualised as a public good, with JET and the merSETA as the founding organisations only. In this section, we briefly explore what the future of the PSET CLOUD could look like, considering that many questions remain unanswered, but also that the future, after nearly seven years of innovation and conceptual development, is pregnant with new possibilities.

The chapter is made up of a section that focuses on what worked, another on what did not work and a concluding section that looks to the future of the PSET CLOUD. We present this discussion acutely aware that as a project team we have an inherent bias, but also that we have always been open to being challenged. This attitude, in our view, is at the heart of innovation.

What worked

The PSET CLOUD has undoubtedly acted as a disruptor and catalyst for new ideas. From the early thinking on interoperability in 2017, which at the time was still a foreign concept, to linking credentialing systems to other national initiatives, such as the National Pathways Management Network (NPMN), new concepts have been developed and gained traction in different ways, in South Africa, regionally and internationally. We certainly do not claim to be the originators of the multiplicity of innovative concepts related to education, training and work, but we are certainly of the view that we have contributed to a number. The suspended work on developing a foundational taxonomy for skills and occupations in South Africa stands out as a task that needs to be completed.

The partnership between JET, an NPO, and the merSETA, a government agency, presented a useful combination of resources (financial and technical) and proximity to government and other public entities. Barring the complications in 2023, this relationship really worked well and provided a unique opportunity to innovate and challenge dominant paradigms from within the public system.

Placing the citizen at the centre remains an uncompromising feature of the PSET CLOUD. Starting with this principle strongly influenced thinking on both the technical and governance features of the PSET CLOUD to go beyond the current systems in South Africa. Developing the SSI Protocol was one outcome of this, and it remains 'low hanging fruit' for when the PSET CLOUD development continues in one form or another. The work of the Launch Group, including the PSET CLOUD NPC MOI, is another direct outcome that positions citizens as agents in their own right. Holding this 'citizen at the centre' feature may prove difficult going forward as the machinery of government may inevitably prove to be too powerful to resist.

Linking credentials to the digital platform also worked well. As can be seen from international developments, the nature of qualifications is changing, and bodies like the South African Qualifications Authority (SAQA), the Quality Council for Trades and Occupations (QCTO), Council on Higher Education (CHE) and Umalusi (Council for Quality Assurance in General and Further Education and Training) are impacted. In this regard, the PSET CLOUD has in some ways acted as a proxy experiment, closely watched by these entities while they are shielded from the risks of managing such a development themselves. Hopefully, the lessons learnt now provide SAQA and the quality councils with some confidence that at least parts of the PSET CLOUD are ready for mainstream development and implementation.

The collaboration between JET and the merSETA and a wide of range of local companies (e.g. CSIR, COOi Studios, DIG, DiDx, JumpCo, Reos partners, UCT DPRU, Kaitoma, etc.) demonstrated that South Africa has the technical and research capacity to develop interoperable platforms such as the PSET CLOUD. The involvement of these companies in local and international processes with some similarities to the PSET CLOUD certainly supports this point.

The relative ease with which the PSET CLOUD as an ecosystem was willing to convene and discuss issues of supply and demand was also a positive sign. The sector is clearly frustrated with the current bottlenecks and heavy bureaucracies, while it is very open to embracing new technologies. This conducive environment bodes well for new developments that are seen as credible and worth pursuing in the future.

The research linked to the PSET CLOUD has been well received internationally. Over the years, this research has resonated more and more with international developments, to the point that various project team members have been called upon to contribute to the work of the United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Children's Fund (UNICEF), the International Labour Organization (ILO), World Bank, African Union Commission, European Commission and the Organisation for Economic Co-operation and Development (OECD), to mention but a few. The presence of the PSET CLOUD inputs at the recent Groningen Declaration Network (GDN) conferences in 2021 and 2022 is important to acknowledge, as well the now direct link with Credential Engine in the United States.

What did not work

As we find ourselves at a pause in the development of the PSET CLOUD, there are undoubtedly quite a few things that have not worked. Digital transformative initiatives such as the PSET CLOUD fall into a category of projects that often fail many times, with only very few succeeding in becoming mainstream solutions. This categorisation is of little comfort to those people and entities involved in the pioneering work, but it can, at the very least, be claimed that each failed attempt moves the system closer to success.

The first MVP was clinically executed, but for various reasons the emerging technological solution remained incongruous with the vision of the PSET CLOUD for citizens to make informed decisions about their career paths. The technical capacity of the project team, or rather the lack thereof, was identified as one of the weaknesses that may have contributed to the failure. As the MVP was reconceptualised in March 2023 with a technically enhanced project team, activities had to be suspended, but the extra capacity was already showing great promise.

Progress related to the sustainability model of the PSET CLOUD remained out of reach. Some early thinking that started to emerge in 2023 – drawing on the three core principles of interoperability, credential fluency and SSI – led to some debates at the Launch Group level on non-fungible tokens (NFTs). The very fact that SAQA and the quality councils generated income from transactions that the PSET CLOUD could make free and instantaneous also raised concerns, while citizens and many demand-side actors were paying to access their own data, creating interest, at best, and scepticism, at worst. A common and agreed theme that did emerge was that the public good of education and training should be protected and that citizens should own their own data.

Enhancing the visibility of the PSET CLOUD included several activities, such as launching the website, convening the DigiTrans Conference in 2022, producing numerous publications and a video, and presenting at a number of local and international conferences. While the work on the brand identity was relatively successful, the PSET CLOUD simply did not reach the levels of visibility it should have. The idea of 'build it and they will come' was often voiced by the proponents of the PSET CLOUD, while the more sceptical wanted to avoid over-promising at a time when the MVP was not yet fully functional. This is certainly a key lesson when the work continues.

Collaboration with other national initiatives beyond the NQF family remained relatively weak during the seven years. The NPMN was in the process of identifying key partners and has become more prominent in recent years despite progress being slow. As the logical link between the NPMN and the PSET CLOUD was obvious, the appetite for such collaboration was just beginning to take shape when the PSET CLOUD programme was suddenly halted. While the focus of the NMPN is mainly stakeholders involved in the implementation of youth programmes with resultant and readily available datasets, the lack of a proof of concept for interoperability and how data privacy will be governed becomes obvious. At this stage, where the broader NPMN seems to be gathering momentum, the complementarity of the PSET CLOUD intellectual property could be considered, even if removed from its brand identity.

Rebooting the PSET CLOUD

The vision of the PSET CLOUD is larger than any one entity or person, and so the work of the PSET CLOUD should continue in one form or another. We end this report with some ideas.

First, we recommend that the Launch Group concludes its work as planned for by the end of 2023. As an independent advisory body, the Launch Group can be the custodian of the PSET CLOUD for the time being. The draft recommendation (see Annexure 1) should be deliberated on and finalised as planned.

Second, we propose that the process of establishing the PSET CLOUD NPO continues. The JET Board has committed to this process, and others may want to join. Having a formal governance structure in place will not be an expensive exercise and will allow for processes to take place in a structured manner.

Third, it is recommended that the PSET CLOUD moves towards a self-funded sustainability model.

While requiring startup funding, the PSET CLOUD could operate through a participatory subscription base that would not require hardware or software changes for suppliers and customers, but rather the implementation of protocols and standards to ensure the maximisation of data interoperability for the PSET CLOUD.

Fourth, the intellectual property that is the PSET CLOUD, and that we tried to capture in this report, must remain as open source access in the public domain. Where these ideas are taken up, with or without direct acknowledgement, is more important than the brand identity of the PSET CLOUD.

Fifth, the PSET CLOUD scenarios should be studied in light of the current situation. These scenarios provided a theoretical lens in 2021, but can now be used as a much more practical tool to navigate the current complexities.

Lastly, in our view, this moment of pause is also a moment of reflection and allows for a change in tactics and scope (Kraak, Isaacs, Stuart & Ford, 2025). We are of the view that SAQA, with the quality councils, are the best positioned entities to take the work forward, in close collaboration with the Presidency and the NPMN. This arrangement will ultimately ensure that the value proposition of the PSET CLOUD can be realised.

References and readings

Bailey, T. (2014). *The role and functions of higher education councils and commissions in Africa: A case study of the South African Council on Higher Education*. Cape Town: Centre for Higher Education Transformation.

Barth, K. (2014). 'Higher Education and Training Information System'. Presentation to the Research Colloquium on Post-School Education and Training. http://www.dhet.gov.za/ResearchNew/29.%20 Kirstin%20Barth%20HETIS_Presentation.pptx

Bashir, I. (2018). *Mastering blockchain: Distributed ledger technology, decentralization, and smart contracts explained*. Packt Publishing.

Bertoli, M. (2017). *React design patterns and best practices*. Packt Publishing.

Bhorat, H. & Kimani, M.E. (2017). *The role of post-school education and training institutions in predicting labour market outcomes*. HSRC LMIP Report 23. Pretoria: Human Sciences Research Council. https://psetresearchrepository.dhet.gov.za/show-pdf/407

Chakroun, B. & Keevy, J. (2023). 'The evolution of credentials: A call to action to rethink the education–training–work continuum'. In M. Carton & C. Hofmann (eds.), *NORRAG Special Issue 08: The education-training-work continuums: Pathways to socio-professional inclusion for youth and adults* (pp. 106–109). https://resources.norrag.org/resource/view/779/441

Colfer, L. & Baldwin, C.Y. (2016). *The mirroring hypothesis: Theory, evidence and exceptions*. Harvard Business School Finance Working Paper 10-058. Cambridge, MA: Harvard. https://www.hbs.edu/ris/Publication%20Files/16-124_7ae90679-0ce6-4d72-9e9d-828872c7af49.pdf

COOi Studios. (2020). 'Business case and an implementation plan for the establishment of the PSET CLOUD and its governance and/or institutional mechanisms'. Unpublished document.

Cordella, A. & Hesse, J. (2015). E-government in the making: An actor network perspective. *Transforming Government: People, Process and Policy*, 9(1): 104–125. http://dx.doi.org/10.1108/TG-02-2014-0006

CSIR (Council for Scientific and Industrial Research). (2019a). 'Feasibility analysis report on analysis, mapping and feasibility studies: National digital ecosystem for post-school education and training'. Unpublished project report. https://drive.google.com/file/d/1rROPsWr2TwrJp1xnTJRNcmzxpwSpivxL/view?usp=sharing

CSIR (Council for Scientific and Industrial Research). (2019b). 'Implementation roadmap and mapping of system: National digital ecosystem for post-school education and training'. Unpublished project report. https://drive.google.com/file/d/1sAtd4gh70AQ4qS0tQ4y8waLOkhFXFDxB/view?usp=share_link

CSIR (Council for Scientific and Industrial Research). (2019c). 'Situational analysis report on analysis, mapping and feasibility studies: National digital ecosystem for post-school education and training'. Unpublished project report. https://drive.google.com/file/d/1G_nlLJnq3Pf28HiN9j7ZKwqxvz9YEHrN/view?usp=sharing

Cupoli, P., Earley, S. & Henderson, D. (2017). *DAMA-DMBOK: Data management body of knowledge* (2nd Edition). DAMA International.

Dale-Jones, B. & Keevy, J. (2021). 'Digital credentials: Discussions on fluency, data privacy and the recognition of learning in higher education beyond COVID-19'. In M. Venter & S. Hattingh (eds.), *Learning for a better future: Perspectives on Higher education, cities, business & civil society* (pp. 193–209) (Centre for Local Economic Development: Topics in Local Development Volume 1). Cape Town: AOSIS. https://doi.org/10.4102/aosis.2021.BK214.09

Daniel, B.K. (2017). 'Big data in higher education: The big picture'. In B.K. Daniel (ed.), *Big data and learning analytics in higher education* (pp. 19–28). New York: Springer. https://www.researchgate.net/profile/Ben-Daniel/publication/307144621_Big_Data_in_Higher_Education_The_Big_Picture/links/5b019219aca2720ba097dd52/Big-Data-in-Higher-Education-The-Big-Picture.pdf

DHET (Department of Higher Education and Training). (2014). *White Paper for Post-School Education and Training*. https://www.gov.za/sites/default/files/gcis_document/201409/37229gon11.pdf

DHET (Department of Higher Education and Training). (2015). *Standard for the submission, processing and archiving of data submissions*. https://www.gov.za/sites/default/files/gcis_document/201508/39090709.pdf

DHET (Department of Higher Education and Training). (2021). *National Plan for Post-School Education and Training*. https://www.jet.org.za/resources/final-dhet-nppset_rev1-web.pdf

DHET (Department of Higher Education and Training). (2017a). *Specifications for load files for the Community Education and Training Management Information System (CETMIS)*. https://www.dhet.gov.za/REGISTER%20OF%20INFORMATION%20STANDARDS%20%20POLICY/DHET%20019%20CETMIS%20STANDARD.pdf

DHET (Department of Higher Education and Training). (2017b). *Specifications for load files for the Private College Education and Training Management Information System (PCETMIS)*. https://dhetwebapps.dhet.gov.za/PRIVATUS%20Documents/PCETMISFileSpecificationsVersionDraft20170118.pdf

DHET (Department of Higher Education and Training). (2017c). *Specifications for load files for the Technical and Vocational Education and Training Management Information System (TVETMIS)*. https://www.gov.za/sites/default/files/gcis_document/201502/38458gen83.pdf

DHET (Department of Higher Education and Training). (2018). *Specifications for load files for the Skills Education and Training Management Information System MR (SETMIS-MR)*. https://www.dhet.gov.za/Planning%20Monitoring%20and%20Evaluation%20Coordination/SETMISFileSpecificationsVersion00120180410.pdf

DHET (Department of Higher Education and Training). (2019a). 'Data dictionary of post-school education and training 2019'. Unpublished. https://www.dhet.gov.za/SiteAssets/DRAFT%20DATA%20DICTIONARY%20OF%20PSET.pdf

DHET (Department of Higher Education and Training). (2019b). *Post School Education and Training Information Policy*. https://www.dhet.gov.za/Policy%20Documents/PSET%20Information%20Policy,%202019.pdf

DHET (Department of Higher Education and Training). (2019c). *Post-School School Education and Training Monitor: Macro-indicator trend*s. https://www.dhet.gov.za/Planning%20Monitoring%20and%20Evaluation%20Coordination/Post-School%20Education%20and%20Training%20Monitor%20-%20Macro-Indicator%20Trends%20-%20March%202021.pdf

DHET (Department of Higher Education and Training). (2019d). *Skills planning for the post-school education and training system. Update 2018*. https://www.dhet.gov.za/SiteAssets/Skills%20Planning%20for%20the%20PSET%20System%20update%202018.pdf

DHET (Department of Higher Education and Training). (2019e). *Statistics on post-school education and training in South Africa 2017*. https://www.dhet.gov.za/SiteAssets/Statistics%20on%20Post-School%20Education%20and%20Training%20in%20South%20Africa%20%202017.pdf

DHET (Department of Higher Education and Training). (2019f). *The National Skills Development Plan 2030*. https://www.gov.za/sites/default/files/gcis_document/201903/42290gon375.pdf

DHET (Department of Higher Education and Training). (2020). *Strategic Plan 2020–2025*. https://www.dhet.gov.za/SiteAssets/DHET%20Strategic%20Plan%202020.pdf

DHET (Department of Higher Education and Training). (2021). *National Plan for Post-School Education and Training*. https://www.jet.org.za/resources/final-dhet-nppset_rev1-web.pdf

DIG (data Innovators Group). (2022). 'PSET CLOUD rapid design evaluation report'. Version 2. Unpublished. https://docs.google.com/document/d/1my5kZpVEax9lKStNe3bCPtkHTpP9p2oCnwF6_Rg5Wbs/edit

DNA Economics & Mzabalazo Advisory Services. (2016). *Consolidated report on the costing and financing of the white paper on PSET*. Pretoria: Government Technical Advisory Centre, National Treasury. https://www.gtac.gov.za/pepa/wp-content/uploads/2021/11/Volume-5-Post-School-Education-and-Training-Consolidated-report-Technical-Report.pdf

DOC (Department of Communications). (2008). 'Electronic Communications Act, 2005 (Act No. 36 of 2005). Broadcasting digital migration policy'. *Government Gazette*, 3148, 8 September 2008. https://gazettes.africa/archive/za/2008/za-government-gazette-dated-2008-09-08-no-31408.pdf

DOC (Department of Communications). (2013). 'South Africa Connect: Creating opportunity, ensuring inclusion. South Africa's broadband policy'. *Government Gazette*, 37119, 6 December 2013. https://wiki.lib.sun.ac.za/images/c/c7/Doc-bb-policy.pdf

Dos Santos, E.M. & Reinhard, N. (2012). 'Electronic government interoperability: Identifying the barriers for frameworks adoption'. *Social Science Computer Review*, 30(1): 71–82. http://dx.doi.org/10.1177/0894439310392196

DPSA (Department of Public Service Administration). (2001). *Electronic government: The digital future – A public service IT policy framework*. https://www.gov.za/sites/default/files/gcis_document/201409/it0.pdf

DPSA (Department of Public Service Administration). (2012). *Public Service Corporate Governance of Information and Communication Technology Policy Framework*. https://www.gov.za/sites/default/files/gcis_document/201409/cgictpolicyframework.pdf

DTPS (Department of Telecommunications and Postal Services). (2016). *National Integrated ICT Policy Whitepaper*. https://www.gov.za/sites/default/files/gcis_document/201610/40325gon1212.pdf

DTPS (Department of Telecommunications and Postal Services). (2017). 'Electronic Communications and Transactions Act (25/2002): National e-Strategy Digital Society South Africa'. *Government Gazette*, 41242, 10 November 2017. https://www.gov.za/sites/default/files/gcis_document/201711/41242gen887.pdf

Du, Y.Y. & Qin, X. (2014). 'Multi-strategy web service discovery for smart government'. *Applied Mechanics and Materials*, 536–537: 625–631. http://dx.doi.org/10.4028/www.scientific.net/AMM.536-537.625

Gabrielli, S., Kimani, S. & Catarci, T. (2017). *The design of microlearning experiences: A research agenda*. https://www.researchgate.net/publication/253150976_The_Design_of_MicroLearning_Experiences_A_Research_Agenda

Gil-Garcia, J.R., Chun, S.A. & Janssen, M. (2009). 'Government information sharing and integration: Combining the social and the technical'. *Information Polity*, 14(1, 2): 1–10. http://dx.doi.org/10.3233/IP-2009-0176

Gil-García, J.R., Schneider, C.A., Pardo, T.A. & Cresswell, A.M. (2005). 'Interorganizational information integration in the criminal justice Enterprise: Preliminary lessons from state and county initiatives'. *Proceedings of the 38th Hawaii International Conference on System Science*. Institute of Electrical and Electronics Engineers (IEEE). https://doi.org/10.1109/HICSS.2005.338

Gil-Garcia, J.R., Zhang, J. & Puron-Cid, G. (2016). 'Conceptualizing smartness in government: An integrative and multi-dimensional view'. *Government Information Quarterly*, 33. https://doi.org/10.1016/j.giq.2016.03.002

Gloss, A., Behrend, T., Blustein, D., Foster, L. & Chakroun, B. (2016). *Big data and ICTs for human capabilities*. http://dx.doi.org/10.13140/RG.2.2.14387.84001

Goldstein, E., Gasser, U. & Budish, B. (2018). 'Data commons version 1.0: A framework to build toward AI for good'. Berkman Klein Centre, 21 June 2018. https://medium.com/berkman-klein-center/data-commons-version-1-0-a-framework-to-build-toward-ai-for-good-73414d7e72be

Gqili, T.M.H. (2016). 'An analysis of the Occupational Qualifications Sub-Framework in South Africa'. MAdmin dissertation, University of Pretoria. https://repository.up.ac.za/handle/2263/57174

Grindley, P., Sherry, E. & Teece, D. (2017). *Standards of today: Innovation and interoperability*. Tusher Center for the Management of Intellectual Capital Working Paper Series No. 19. https://api.semanticscholar.org/CorpusID:35351374

GTAC (Government Technical Advisory Centre). (2022). *Funding and expenditure trends in Post-School Education and Training*. Pretoria: GTAC, National Treasury. https://www.dhet.gov.za/Planning%20Monitoring%20and%20Evaluation%20Coordination/Funding%20and%20expenditure%20trends%20in%20PSET%20Report%20-%20June%202022.pdf

Gutierrez, K. (2015). 'Numbers don't lie: Why bite-sized learning is better for your learners (and you too)' [Blog post]. Shift, 27 September 2017. https://www.shiftelearning.com/blog/numbers-dont-lie-why-bite-sized-learning-is-better-for-your-learners-and-you-too

Hilfert, T. & König, M. (2016). 'Low-cost virtual reality environment for engineering and construction'. *Visualization in Engineering*, 4(1): 2.

HRDC. (n.d). 'About us'. https://hrdcsa.org.za/about-us/

HRDC (Human Resource Development Council). (2017). *Draft Revised HRD Strategy: Towards 2030*. https://hrdcsa.org.za/wp-content/uploads/2017/07/Revised-HRD-Strategy-June-2017.pdf

Hughes, L., Dwivedi, Y.K., Misra, S.K., Rana, N.P., Raghavan, V. & Akella, V. (2019). 'Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda'. *International Journal of Information Management*, 49: 114–129. https://doi.org/10.1016/j.ijinfomgt.2019.02.005

Isdale, K., Reddy, V., Winnaar, L. & Zuze, T.L. (2018). *Exploring youth transitions: Five years of the South African Youth Panel Survey*. HSRC LIMP Report. Pretoria: Human Sciences Research Council. http://repository.hsrc.ac.za/handle/20.500.11910/13746

Jiménez, C.E., Solanas, A. & Falcone, F. (2014). 'E-government interoperability: Linking open and smart government'. *Computer*, 47(10): 22–24. https://doi.org/10.1109/MC.2014.281

Kaplan, A. & Garcia, F. (2019). 'Blockchain is the next step in democratizing education' [IBM Blockchain Blog post]. IBM, 30 September 2019. https://www.ibm.com/blogs/blockchain/2019/09/blockchain-is-the-next-step-in-democratizing-education/

Kaplan, A.D., Cruit, J., Endsley, M., Beers, S.M., Sawyer, B.D. & Hancock, P.A. (2020). 'The effects of virtual reality, augmented reality, and mixed reality as training enhancement methods: A meta-analysis'. *Human Factors*, 63(4): 706–726. https://doi.org/10.1177/0018720820904229

Karagiorgas, D.N. & Niemann, S. (2017). Gamification and game-based learning. *Journal of Educational Technology Systems*, 45(4): 499–519. https://doi.org/10.1177/0047239516665105

Karoudis, K. & Magoulas, G. (2018). 'User model interoperability in education: Sharing learner data using the experience API and distributed ledger technology'. In B.H. Khan, J.R. Corbeil & M.E. Corbeil (eds.), *Responsible analytics and data mining in education.* Abingdon, UK: Routledge.

Keevy, J. (2020). '(Un)recognising learning in our digital age'. Unpublished working paper. https://www.academia.edu/41515579/_Un_recognising_learning_in_our_digital_age_Working_Draft

Keevy, J. et al. (2022). *mzansi.citizensdatamatter: Reclaiming self-sovereignty for all South African citizens' data by 2030*. Johannesburg: JET Education Services and merSETA. https://www.jet.org.za/resources/mzansi-citizensdatamatter_d4.pdf/

Kraak, A., Isaacs, S., Stuart, M. & Ford, M. (2025). External Technical Review for the PSET CLOUD Project. Unpublished review commissioned by merSETA.

Lam, W. (2005). 'Barriers to e-government integration'. *Journal of Enterprise Information Management*, 18(5): 511–530. http://dx.doi.org/10.1108/17410390510623981

Lange, L. (2017). '20 years of higher education curriculum policy in South Africa'. *University of KwaZulu-Natal Journal of Education*, 68: 31–57. https://doi.org/10.17159/2520-9868/i68a01

Leo, E. (2020). 'Toward a contingent model of mirroring between product and organization: A knowledge management perspective'. *Journal of Product Innovation Management*, 37(1): 97–117. http://dx.doi.org/10.1111/jpim.12515

Lisboa, A. & Soares, D. (2014). 'E-government interoperability frameworks: A worldwide inventory'. *Procedia Technology*, 16: 638–648. https://doi.org/10.1016/j.protcy.2014.10.012

Lolwana, P. & Ngcwangu, S. (2016). *Understanding barriers to youth skills development and employment in South Africa*. NORRAG Synthesis Report. https://resources.norrag.org/resource/view/25/77

MacCormack, A., Baldwin, C. & Rusnak, J. (2012). 'Exploring the duality between product and organizational architectures: A test of the "mirroring" hypothesis'. *Research Policy*, 41(8)L: 1309–1324. https://doi.org/10.1016/j.respol.2012.04.011

MacCormack, A., Lagerstrom, R., Mocker, M. & Baldwin, C.Y. (2017). *Digital agility: The impact of software portfolio architecture on IT system evolution*. Harvard Business School Technology & Operations Mgt. Unit Working Paper 17-105. Cambridge, MA: Harvard. https://www.hbs.edu/ris/Publication%20Files/17-105_ad410701-4556-4c72-b6f7-16453064f6aa.pdf

Manda, M. & Backhouse, J. (2016). 'Towards a "Smart Society" through a connected and smart citizenry in South Africa: A review of the National Broadband Strategy and Policy'. *5th International Conference on Electronic Government and the Information Systems Perspective (EGOV)* (pp. 228–240). https://hal.inria.fr/hal-01636446

Markopoulos, A.P., Fragkou, A., Kasidiaris, P.D. & Davim, J.P. (2015). 'Gamification in engineering education and professional training'. I*nternational Journal of Mechanical Engineering Education*, 43(2): 118–131. http://dx.doi.org/10.1177/0306419015591324

Marr, B. (2020). 'The top five tech trends that will disrupt education in 2020'. Forbes, 20 January 2020. https://www.forbes.com/sites/bernardmarr/2020/01/20/the-top-5-tech-trends-that-will-disrupt-education-in-2020the-edtech-innovations-everyone-should-watch/#353f8b12c5b4

Mayne, J. (2015). 'Useful theory of change models'. *Canadian Journal of Program Evaluation*, 30(2), 119–142. http://dx.doi.org/10.3138/cjpe.30.2.142

McAlpine, M. (2005). 'E-portfolios and digital Identity: Some issues for discussion'. *E-Learning and Digital Media*, 2(4): 378–387. http://dx.doi.org/10.2304/elea.2005.2.4.378

McKinsey Global Institute. (2019). 'Digital identification: A key to inclusive growth'. McKinsey Digital, 17 April 2019. https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-identification-a-key-to-inclusive-growth

McManus, J. (2019). 'Conway's Law: A focus on information systems development'. *ITNOW*, 61(4): 50–51. http://dx.doi.org/10.1093/itnow/bwz112

merSETA. (2017). *Benchmarking study of models of training lay-off and retrenchment mitigation schemes*. Johannesburg: merSETA. https://www.merseta.org.za/wp-content/uploads/2021/05/FINAL-TLS-REPORT-NOV-2017.pdf

merSETA. (2018). 'Project concept format for MANCO approval'. Unpublished document.

Mohammed, G.S., Wakil, K. & Nawroly, S.S. (2018). 'The effectiveness of microlearning to improve students' learning ability'. *International Journal of Educational Research Review*, 3(3): 32–38. http://dx.doi.org/10.24331/ijere.415824

Moltudal, S., Høydal, K. & Krumsvik, R.J. (2020). 'Glimpses into real-life introduction of adaptive learning technology: A mixed methods research approach to personalised pupil learning'. *Designs for Learning*, 12(1): 13–28. http://dx.doi.org/10.16993/dfl.138

National Government of South Africa. (2019). 'Public service sector education and training authority (PSETA) – Overview'. https://nationalgovernment.co.za/units/view/271/public-service-sector-education-and-training-authority-pseta

National Treasury. (2007). *Framework for managing programme performance information*. https://www.dpme.gov.za/publications/Policy%20Framework/Framework%20for%20Managing%20Programme%20Performance%20Information.pdf .

NGI (Next Generation Internet). (2019). 'Next Generation Internet: For an internet of humans'. Next Generation Internet, European Commission. https://www.ngi.eu/news/2019/09/18/next-generation-internet-the-internet-of-humans/#:~:text=The%20Next%20Generation%20Internet%20(NGI,that%20we%20enjoy%20in%20Europe.

NIA (National Intelligence Agency). (2015). *National Cybersecurity Policy Framework*. https://www.gov.za/sites/default/files/gcis_document/201512/39475gon609.pdf

NPC (National Planning Commission). (2012). *Our future, make it work: National Development Plan 2030*. https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf

NPC (National Planning Commission). (2013). 'The National Development Plan: Vision 2030'. https://www.nationalplanningcommission.org.za/National_Development_Plan

NPC (National Planning Commission). (2020a). *Analysis of PSET trends towards NDP 2030*. https://www.nationalplanningcommission.org.za/assets/Documents/Post%20School%20Education%20and%20Training%20(PSET)%20Trends%20towards%202030.pdf

NPC (National Planning Commission). (2020b). *Digital futures: South Africa's readiness for the Fourth Industrial Revolution*. https://researchictafrica.net/wp/wp-content/uploads/2021/01/021220_Digital-Futures_SAs-Digital-Readiness-for-4IR_01.pdf

NSA (National Skills Authority). (2017). *National skills development implementation report 2015–2016: A five year analysis – Achievements, challenges and recommendations*. https://www.nationalskillsauthority.org.za/wp-content/uploads/2017/02/Implementation-report-2017-for-web.pdf

OECD (Organisation for Economic Cooperation and Development). (2019). *Community education and training in South Africa: Getting skills right*. Paris: OECD Publishing. https://doi.org/10.1787/25206125

OQLMS. (2019). *OQLMS user manual*. 14 May 2019.

Palfry, J. & Gasser, U. (2012). *Interoperability: The promise and perils of highly interconnected systems*. New York: Basic Books.

Pardo, T.A., Nam, T. & Burke, G.B. (2012). 'E-government interoperability: Interaction of policy, management, and technology dimensions'. *Social Science Computer Review*, 30(1): 7–23. https://doi.org/10.1177/0894439310392184

Penceliah, S., Konyana, S.V.M. & Maharaj, M. (2016). 'The choice of public universities in a restructured and transforming higher education landscape: A student perspective'. *Problems and Perspectives in Management*, 14(3): 276–282. http://dx.doi.org/10.21511/ppm.14(3-1).2016.14

Powell, M. & Reddy, V. (2016). *Roadmap for the implementation of a Skills Planning Unit*. HSRC LMIP Report 10. Pretoria: Human Sciences research Council. http://repository.hsrc.ac.za/handle/20.500.11910/13766

PSET CLOUD. (2022). 'Decentralised autonomous organisations (DAOs)'. November 2022. Unpublished. https://drive.google.com/file/d/1R8ExGhAPjaITAORe9kp3AK5rrIUHFE9m/view?usp=sharing

QCTO (Quality Council for Trades and Occupations). (2019a). *QCTO annual report 2018/2019*. http://www.qcto.org.za/images/reports/QCTO_Annual_Report_2019.pdf

QCTO (Quality Council for Trades and Occupations). (2019b). *Policy on the accreditation of skills development providers*. http://www.qcto.org.za/images/Policies/SDP_Accreditation_Policy_-_sgd.pdf

REAL (Centre for Researching Education and Labour). (n.d.). 'About REAL'. https://www.wits.ac.za/real/about/

Rajab, R. (2019). 'PSET CLOUD project cycle'. Presentation at the European Training Foundation Conference on Skills and Qualifications – Benefits for People, 6–7 November 2019, Turin, Italy.

Rajab, R. (2020). 'Self-organised, emergent collaboration for sustained impact and improving education in South Africa'. In L. Patil & M. Avelar (eds.), *NORRAG Special Issue 04: New philanthropy, disruption and other debatable trends* (pp. 113–117). https://resources.norrag.org/resource/view/592/343

Rajab, R., Nomvete, S., Manda, M. & 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://psetcloud.org.za/news/downloads/unlocking-the-power-of-data-final-web-nov2020-2.pdf

Rajab, R. and Ntuli, S. (2023). *A deep dive into governance mechanisms for interoperable digital platforms for work and learning*. Johannesburg: JET Education Services. https://www.jet.org.za/news/a-deep-dive-into-governance-mechanisms-for-interoperable-digital-platforms-for-work-and-learning

Reinholz, D.L. & Andrews, T.C. (2020). 'Change theory and theory of change: What's the difference anyway?' *International Journal of STEM Education*, 7(1): 1–12. https://doi.org/10.1186/s40594-020-0202-3

Reos Partners, JET Education Services & 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 & merSETA. https://psetcloud.org.za/news/downloads/jet-scenario_final_web_v2.pdf

RSA (Republic of South Africa). (1996). *Constitution of the Republic of South Africa*. https://www.justice.gov.za/legislation/constitution/SAConstitution-web-eng.pdf

RubyGarage. (2019). 'Best architecture for an MVP: Monolith, SOA, microservices, or serverless?' [Blog post]. https://rubygarage.org/blog/monolith-soa-microservices-serverless

Salau, A.O. (2017). 'The right of access to information and national security in the African regional human rights system'. *African Human Rights Law Journal*, 17(2): 367–389. http://dx.doi.org/10.17159/1996-2096/2017/v17n2a2

SAQA (South African Qualifications Authority). (n.d.). 'NLRD data suppliers'. https://www.saqa.org.za/category/nlrd-data-suppliers/

Scholl, H.J. & Al Awadhi, S. (2016). 'Smart governance as key to multi-jurisdictional smart city initiatives: The case of the eCityGov Alliance'. *Social Science Information*, 55(2): 255–277. http://dx.doi.org/10.1177/0539018416629230

Schwab, K. (2016). *The 4th industrial revolution*. Cologny, Switzerland: World Economic Forum. https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab.

Schwartz, B. (2019). 'Accreditation and quality assurance in education' [Blog post]. Stellenbosch Graduate Institute, 1 March 2019. https://www.sgi.co.za/blog/accreditation-quality-assurance-faq

Shikweni, S., Schurink, W. & Van Wyk, R. (2019). 'Talent management in the South African construction industry'. *SA Journal of Human Resource Management*, 17(1): 1–12. http://dx.doi.org/10.4102/sajhrm.v17i0.1094

Shiohira, K. & Dale-Jones, B. (2019). *Interoperable data ecosystems: An international review to inform a South African innovation*. Johannesburg: JET Education Services. https://www.jet.org.za/resources/interoperable-data-ecosystems.pdf

SIS-CC (Statistical Information System Collaborative Community). (n.d). Initiatives. https://siscc.org/initiatives/

StatsSA (Statistics South Africa). (2010). *South African Statistical Quality Assessment Framework (SASQF): Operational framework and guidelines*. http://www.statssa.gov.za/standardisation/SASQAF_OpsGuidelines_Edition_1.pdf

Steele, L. & Orrell, T. (2017). *The frontiers of data interoperability for sustainable development*. Bristol: Development Initiatives. http://devinit.org/wp-content/uploads/2018/02/The-frontiers-of-data-interoperability-for-sustainable-development.pdf

Sucich, K. (2019). 'The state of healthcare interoperability in 2019' [Blog post]. Dimensional Insight, 16 October 2019. https://www.dimins.com/blog/2019/10/16/healthcare-interoperability-2019/

The Presidency. (2007). *Policy framework for the government-wide monitoring and evaluation system*. https://www.dpme.gov.za/publications/Policy%20Framework/Policy%20Framework%20for%20the%20GWME%20system.pdf

Tiwana, A. (2013). *Platform ecosystems: Aligning architecture, governance, and strategy*. https://www.researchgate.net/publication/286345261_Platform_Ecosystems_Aligning_Architecture_Governance_and_Strategy

Umalusi (Council for Quality Assurance in General and Further Education and Training). (2019). *Annual report 2018/2019*. https://www.umalusi.org.za/wp-content/uploads/2020/02/Annual-Report-2018-2019.pdf

UCT DPRU (University of Cape Town Development Policy Research Unit). (2023). 'The development of a foundational taxonomy for the PSET CLOUD'. Unpublished.

UN (United Nations). (2015). *Fundamental principles of official statistics: Implementation guidelines* (Final draft). New York: UN. https://unstats.un.org/unsd/dnss/gp/Implementation_Guidelines_FINAL_without_edit.pdf

UN (United Nations). (2020). *E-government survey 2020: Digital government in the decade of Action for Sustainable Development with addendum on COVID-19 response*. New York: UN. https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2020

United States Department of Homeland Security. (2015). *Operational guide for the interoperability continuum: Lessons learned from RapidCom*. https://www.cisa.gov/sites/default/files/publications/Operational%20Guide%20for%20the%20Interoperability%20Continuum_0.pdf

Vally, S. & Motala, E. (eds). (2014). *Education, economy & society*. Pretoria: Unisa Press

Van Schalkwyk, F., Willmers, M. & Schonwetter, T. (2015). *Embedding open data practice: Developing indicators on the institutionalisation of open data practice in two African governments*. Cape Town: University of Cape Town Intellectual Property Unit. http://dx.doi.org/10.6084/m9.figshare.1528088

West, P.G. & Beukes, C.J. (2021). *Digital governance advisory note*. Johannesburg: JET Education Services and merSETA. https://psetcloud.org.za/news/downloads/pset_cloud-governance-note_final-web-v2.pdf

Whittaker, R., Keevy, J. & Rajab, R. (2020). 'Deep collaboration for deep change: The opportunity for collective vision setting through interdisciplinary disintermediation during and after COVID-19'. Unpublished draft.

Wikipedia contributors. (2020). 'Theory of change'. *Wikipedia, The Free Encyclopedia*. https://en.wikipedia.org/w/index.php?title=Theory_of_change&oldid=976085721

Williamson, B. (2016). 'Digital education governance: An introduction'. *European Educational Research Journal*, 15(1): 3–13. http://dx.doi.org/10.1177/1474904115616630

Yu, P.K. (2020). *'Beyond transparency and accountability: Three additional features algorithm designers should build into intelligent platforms'*. Legal Studies Research Paper Series No. 20-12. Fort Worth, TX: Texas A&M University School of Law. http://nulawreview.org/volume-13-issue-1-articles/yu

Annexure 1: Draft Launch Group Statement

The PSET CLOUD

1. The Post School Education and Training Collaboration and Learning Opportunities and Utilisation of Data (PSET CLOUD) is a platform that will enable users such as learners, government, industry, non-governmental organisations and education institutions to share and use data for planning and decision-making that promotes a more efficient and responsive post-school education system to the labour market.

2. The PSET CLOUD was initiated by the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA) and JET Education Services (JET). The building phase of the PSET CLOUD comprises a five-year programme that is currently in the fifth year of development. Several partners have been involved in the process to date, including the CSIR, DiDx, Kaitoma, JumpCo, UCT DPRU, COOi Studios, Reos Partners and others.

3. The impact, goal and outcomes of the PSET CLOUD are described in its theory of change. Extensive research and consultations are available at www.psetcloud.org.za.

This document

4. This document presents the recommendations from an interim governance structure, referred to as the 'Launch Group', of the PSET CLOUD programme. The recommendations have been formulated following an 18-month process during which the Launch Group deliberated on the most appropriate governance structure for the PSET CLOUD.

5. This document is made available for public consumption in an attempt to promote transparency and accountability of the PSET CLOUD programme as it moves from the conceptual to implementation stages.

Context and role of the Launch Group

6. The current PSET ecosystem in South Africa is challenged by fragmentation, and the complexity in implementing the PSET CLOUD programme is evident: it involves diverse role players and stakeholders with separate information management systems in addition to a range of different databases of varying quality. The realisation of the PSET CLOUD has significant implications for society broadly, and for the post school sector more specifically. In addition to the opportunities and risks platforms such as the PSET CLOUD could present in the future, there is a need for a governance framework that synthesises key issues that arise as the PSET CLOUD programme matures.

7. Phases 1 and 2 of the programme were completed between 2019 and 2021 and involved a situational analysis of the PSET sector, a mapping study, an international review of similar initiatives and a feasibility report.

8. Phase 3 of the programme commenced in 2021 and will conclude in 2023. This phase includes the following key activities:

   a. Developing a minimum viable product (MVP) and self-sovereign identity (SSI) solution for the PSET CLOUD;

   b. Developing a branding, communication and advocacy strategy as well as a website to update stakeholders on an ongoing basis as the platform is developed;

   c. Designing a suitable governance model for the PSET CLOUD (the focus of this note); and

   d. Readying the merSETA to be the early adopter of the PSET CLOUD.

9. At the outset in 2018, the PSET CLOUD programme established a *Steering Committee* comprising senior management from both partner organisations (merSETA and JET), which directed the planning and research phases that underpinned the initial theory of change. The Steering Committee meets quarterly for decision making, monitors progress and measures the level of identified risks on an ongoing basis.

10. A *Reference Group* was established in 2020 by invitation from the founding parties to provide expertise and advice. The Reference Group appointed independent legal facilitators to take to the DigiTrans 2022 conference (which presented and represented a wide range of stakeholders) to endorse the process of establishing a 'Launch Group' which would represent sectors and stakeholders, and which would take custody of the process of deciding on and setting up the formal legal structure to house and govern the PSET CLOUD.

11. Following a public nomination process agreed to at the DigiTrans Conference, a *Launch Group* was established in 2022 for a period of 18 months (i.e. until November 2023). The purpose of the Launch Group is to ensure that the PSET CLOUD adopts the values of trust building, inclusivity and transparency. The tasks of the Launch Group members are to:

   a. Participate in meetings, represent the groups from which they come and also bring their skills and independent judgement to contribute to debate and decision on the legal entity and governance structures to be established;

   b. Explore and investigate the type of legal entity, wider governance model, composition, systems, etc. for the PSET CLOUD legal entity, with the aim of recommending building something which is sustainable and also delivers on its mandate;

   c. Commission studies and reports and set up short term 'focus groups' to interrogate the detail of an issue/aspect;

   d. Provide inputs, contributions and recommendations related to the options and draft documents produced; and

   e. Commission and oversee the issuing of headline summaries/reports on progress to hold the attention of, provide updates to and continue to engage stakeholders.

Governance options for the PSET CLOUD

12. Discussions on the governance of the PSET CLOUD comprise the following, each of which is elaborated below:

   a. Governance principles: predefined procedures that permit the activities of the PSET CLOUD;

   b. Governance structure options: a vehicle with predetermined organs of execution for the PSET CLOUD.

13. Governance model principles

   a. From the outset, the PSET CLOUD has foregrounded the principle that *individual citizens control their own data*, based on agreed data privacy policies, and the functionality required of the platform for this principle to be realised.

   b. The second principle of the PSET CLOUD has been to *involve citizens and civil society in a decentralised form of a public-private partnership*, referred to as 'CC-PPP', with government and private actors. This model was explored by drawing on the design elements of a decentralised autonomous organisation (DAO).

   c. A third principle is the use of an *open and transparent architecture*, including:

      i. A publicly accessible governance framework;

      ii. The adoption of the open source code standards for the PSET CLOUD platform architecture as advocated by the Open Source Initiative (an example being the adoption and usage of the SSI protocol for the platform);

      iii. SSI protocol (the SSI protocol is an example of open source code adoption, and not separate from it – it is added here for emphasis due to its criticality in this data-driven PSET project)

      iv. Publicly accessible data management policy for the PSET CLOUD; and

      v. Standard taxonomy based on open source code with a common nomenclature that is aligned to the NQF and its sub-frameworks' coding schemas and able to be used across supply- and demand-sides of the PSET ecosystem.

d. A fourth principle is the tokenisation of knowledge, skills and competencies to enable citizens to manage access to their data and generate revenue from this.

14. Governance structure options

a. Based on the principles of the governance model outlined above, various options for the governance structure of the PSET CLOUD were explored. A non-profit company (NPC) which might include public and private sector data providers (individual and institutional), data users, data processors, open source developer stakeholders, credentialing institutions, credential-seekers and possibly also public and private sector employment providers was identified as a possible structure.

b. The NPC could consider incorporating a private, for-profit company that manages the operation, maintenance and future development of the PSET CLOUD platform, under contract to the NPC, in consideration for the NPC paying for such services. The assets of the company, including the intellectual property embodied in the system (the computer programs making up the system) and the intellectual property rights therein, will belong to and vest in the NPC.

c. Decision-making could be managed collectively, using the functionality of the PSET CLOUD platform and in accordance with an agreed rule set that serves to align incentives and common interests, such that no one entity has the capacity to create a single point of failure.

d. To manage collective decision-making, the PSET CLOUD platform could incorporate smart contracts and distributed ledger systems. The smart contracts will serve to automate processes and will be drawn up with a view to limiting centralised governance, enabling participants to govern cooperatively and enabling multi-party interactions, preferably largely without human involvement. The distributed ledger systems will be prepared to ensure data immutability and persistence.

e. The PSET CLOUD platform could be programmed to implement the characteristics of a DAO, such as decentralisation, transparency and independence, thereby 'hard-wiring' these characteristics into the governance model, essentially as the founding principles of the PSET CLOUD governance structure.

Recommendations

Having completed its term, the Launch Group recommends the following for consideration by the Steering Committee and the various partners involved in the PSET CLOUD:

General

15. The Launch Group reiterates its commitment to this process and the realisation of the long-term outcomes of the PSET CLOUD:

a. PSET stakeholders utilise real-time data and deliver their mandates based on high quality plans and programmes.

b. Citizens and learners demand easy access to their credentials while government and other

c. agencies facilitate access through the PSET CLOUD.

d. Increased identification of policy gaps with key partners (policy makers) and commitments/plans made to improve on the gaps.

e. Stronger buy-in to enable data sharing and use of the PSET CLOUD platform.

16. The development of the MVP, including the integration of the existing SSI protocol, in 2023 provides an opportunity for the PSET CLOUD to be realised following four years of planning and foundational work.

Governance model

17. The governance model of the PSET CLOUD platform should utilise decentralised infrastructure to reinforce the decentralised nature of the governance model in order to avoid exploitation by entities with computing capacity sufficient to compromise the decentralised nature of the governance model.

18. The involvement of citizens, civil society, government and the private sector in the governance structures of the PSET CLOUD should be aspired to, but may need to be established in a phased manner.

Governance structure

19. The PSET CLOUD Steering Committee should draft and consult on a memorandum of incorporation (MOI) that will form the basis for the establishment of the PSET CLOUD NPC (the company). The following principles should be considered in the MOI:

    a. JET and merSETA are the founders of the company.

    b. Members of the company are all in a single class, being voting members, each of whom has an equal vote.

    c. Members of the company are drawn from four equally weighted constituencies, being citizens, civil society, government and the private sector.

    d. The company will utilise decentralised infrastructure, such as smart contracts and principles of a DAO, to manage collective decision making.

    e. The PSET CLOUD platform will be wholly owned by the company.

20. The following transition process is recommended:

    a. The Steering Committee should oversee the development of the MVP and will remain in place as long as the merSETA and JET collaborate to support the further development of the PSET CLOUD platform. The Steering Committee may be expanded with additional funding partners that contribute to the development of the platform.

    b. MOUs with early adopters should be signed with the Steering Committee until such a time that the PSET CLOUD NPC is established.

    c. Following the finalisation of the MOI for the PSET CLOUD NPC, the Steering Committee should organise a first annual general meeting (AGM), during which the members will be confirmed and a Board elected, based on the principles outlined in this document.

With this task completed, the Launch Group is formally disbanded.

Annexure 2: Draft PSET CLOUD Non-Profit Company (NPC) Memorandum of Incorporation (MOI)

**COMPANIES AND INTELLECTUAL PROPERTIES COMMISSION
REPUBLIC OF SOUTH AFRICA**

In accordance with s 13(1)(a)(ii)

MEMORANDUM OF INCORPORATION OF

PSET CLOUD NPC

('the Company')

Recognising:

- the profound disconnect in South Africa between the world of post-school learning and the world of work, and

- the need to bridge this gap to enable citizens to access support and opportunities and to forge a path out of poverty and dependency,

the Manufacturing Engineering Related Sector Education and Training Authority (merSETA) and JET Education Services NPC 2000/007541/08 (JET) committed themselves to a process of collaboration to establish an interoperable digital ecosystem (the PSET CLOUD) that would strengthen, coordinate and improve efficiencies in the governance and management of the postschool education and training (PSET) system.

The work having reached a juncture at which wider collaboration and the involvement of other parties is sought**,** the Company is established as a non-profit company with members, built on a foundation of citizen-civil–public-private partnership and with the following objective:

Connecting citizens, educators, students and employers to each other and to shared information through the PSET CLOUD which will aim to, *inter alia*:

- Lead to a better understanding of and improved access to education and opportunities for students and citizens;

- Help individuals and institutions make more informed decisions about education, training and the world of work;

- Allow post-school education and training institutions to quickly adjust to changing needs in the country;

- Support school leavers and others not in employment with centralised, accessible information about study and training as well as career paths and opportunities and direct connections to training and education providers;

- Independently, efficiently and credibly verify accreditations, experience and qualifications;

- Enable informal and non-formal learning to be integrated and recognised as valid parts of qualifications and credentials; and

- Enable state institutions and organs of government to better serve citizens and their education and training needs.

ADOPTION OF MEMORANDUM OF INCORPORATION

This Memorandum of Incorporation ('MOI') was adopted by the incorporators of the Company, in accordance with section 13(1) of the Companies Act, 2008 ('the Act'), as evidenced by the following signatures made by them, or on their behalf:

Name of incorporator	Signature	Date

In this MOI:

a)   A reference to a section by number refers to the corresponding section of the Act;

b)   A reference to a clause by number refers to the corresponding clause in this MOI; and

c)   Words that are defined in the Act bear the same meaning in this MOI as in the Act.

1. Incorporation

1.1.   The Company is incorporated as a non-profit company, as defined in the Act.

1.2.   The Company is incorporated in accordance with, and is governed by:

1.2.1.   the unalterable provisions of the Act that are applicable to non-profit companies;

1.2.2.   the alterable provisions of the Act that are applicable to non-profit companies, subject to any limitation, extension, variation or substitution set out in this MOI; and

1.2.3.   the provisions of this MOI.

2. Object and powers of the Company

2.1.   The object of the Company is as set out on the first page of this MOI and describes the ambit and types of the public benefit activities (as defined in the Ninth Schedule to the Income Tax Act 58 of 1962, as amended ["the Income Tax Act"]) which the Company intends to carry out.

2.2.   The Company shall have all the legal powers and capacity of an individual:

2.2.1.   except to the extent necessarily implied by its stated object;

2.2.2.   except to the extent that a juristic person is incapable of exercising such a power or having such a capacity; and

2.2.3.   subject to the restrictive conditions (as contemplated in section 15(2)(b)) and other limitations or qualifications, as are contained in this MOI.

2.3.   The powers of the Company may only be executed in accordance with the main object of the Company.

2.4.   The Company may not:

2.4.1. amalgamate or merge with, or convert to, a profit company; or

2.4.2. dispose of any part of its assets, undertaking or business to a profit company, other than for fair value, except to the extent that the disposal of an asset occurs in the ordinary course of the activities of the Company; or

2.4.3. knowingly become a party to, or knowingly permit itself to be used as part of any tax avoidance scheme, being any transaction, operation or scheme of which the sole or main purpose is or was the reduction, postponement or avoidance of liability for any tax duty or levy which would have been or would have become payable by any person under the Income Tax Act or any other Act Administered by the Commissioner for the South African Revenue Services.

2.5. All of the public benefit activities of the Company shall be carried out in a non-profit manner and with an altruistic or philanthropic intent and no public benefit activities shall be intended to directly or indirectly promote the economic self-interest of any director, officer or employee of the Company, other than by way of reasonable remuneration payable to that director, officer or employee.

3. Members of the Company

3.1. As contemplated in Item 4(1) of Schedule 1 of the Act, the Company has members who are in either of two classes, being voting and non-voting members, respectively.

3.2. The members of the Company shall be the persons or bodies which support the objectives of the Company and/or participate in the work of the Company as may apply for and be accepted as members in terms of this MOI and the membership policies adopted by the Company from time to time.

3.3. Members of the Company may be natural or juristic persons.

3.4. A member of the Company shall cease to be a member if:

3.4.1. the member resigns in writing addressed to the Chairperson of the Company or to its secretary at its registered office;

3.4.2. a resolution of members of the Company deprives the person of their membership;

3.4.3. the member fails to adhere to the Company's code of conduct for members and is removed by the Board or by a committee of the Board in terms of the procedures of the Company;

3.4.4. the member's nomination by the body which the member represents is revoked in writing addressed to the Chairperson of the Company or its secretary at its registered office;

3.4.5. the member, being a natural person, or, if a juristic person, business rescue, insolvency, voluntary winding up or deregistration proceedings have begun in respect of that member.

3.5. The Company shall maintain and keep up to date, in one of the official languages of South Africa, a physical and/or electronic register of the members of the Company, and members shall have the right to inspect and copy the information contained in the members' register.

4. Members voting

4.1. The voting members shall exercise their voting powers by electronic voting, using the technology and protocols to be adopted by the Company from time to time.

4.2. Proposed resolutions shall be electronically submitted to voting members for consideration and electronic voting by members and:

4.2.1. for a vote to be validly taken, at least 25% of the total number of voting members must participate in the voting process;

4.2.2. voting shall close 20 business days after each call for votes in accordance with section 60 of the Act;

4.2.3. for a resolution to be adopted it must be supported by:

4.2.3.1. more than 50% of the votes cast in the case of an ordinary resolution; or
4.2.3.2. at least 75% of the votes cast in the case of a special resolution; and

4.2.4. the results of the voting shall be communicated to all members within 20 business days of the close of the voting period

4.3. A special resolution of members is only required for those matters set out in section 65(11) and which are applicable to non-profit companies, being resolutions to :

4.3.1. amend the Company's MOI to the extent required by section 16(1)(c) and section 36(2)(a);

4.3.2. ratify a considered revision of the Company's MOI, as contemplated in section 18(1)(b);

4.3.3. ratify actions by the Company or directors in excess of their authority, as contemplated in section 20(2);

4.3.4. approve the voluntary winding up of the Company, as contemplated in section 80(1);

4.3.5. approve the winding up of a company in the circumstances contemplated in section 81(1);

4.3.6. approve an application to transfer the registration of the Company to a foreign jurisdiction as contemplated in section 82(5); or

4.3.7. approve any proposed fundamental transaction to the extent required by Part A of Chapter 5 including amalgamating or merging with another non-profit company or disposing of all or a greater part of the assets of the Company.

4.4. An ordinary resolution of members is required for the election or removal of directors, the appointment and removal of auditors, and all other matters which fall to be decided by the members and which are not special resolutions.

4.5. The Company will not routinely conduct its business through meetings, but, in the case that a meeting of the members is required, the meeting shall be conducted entirely by electronic communication, and the electronic communication facility employed will be one which ordinarily enables all persons participating in that meeting to communicate concurrently with each other without an intermediary and to participate effectively in the meeting. The quorum requirements at any such meeting shall be 25% of voting members participating and voting requirements shall be as set out in 4.2.3. Meetings shall be chaired by the Chairperson of the Board, unless the members shall vote to be chaired by and elect another member to chair that meeting.

5. Composition of the Board of Directors

5.1. The Board of directors shall consist of at least six and no more than 12 persons, at least three of whom are not 'connected persons' (as defined in the Income Tax Act) in relation to one another. No single person shall, directly or indirectly, control the decision-making powers of the Company.

5.2. The Board shall be made up as follows:

5.2.1. more than half of the Board shall be independent, non-executive directors who are elected to office by the voting members;

5.2.2. the .... and the .... of the Company shall serve as directors of the Company, ex officio; and

5.2.3. the balance of the Board shall consist of persons having expertise and skills relevant and useful to the work of the Company, who may be co-opted to the Board by the existing directors from time to time.

5.3. Elected and co-opted directors shall serve terms of three years each, beginning from the date of their appointment, and shall retire at the meeting of directors following the expiry of each term of office, provided that the terms of office of elected directors shall be staggered so that the terms of office of at least one third of the elected directors ends each year.

5.4. Directors whose terms of office end in terms of clause 5.3 shall be eligible for re-appointment for a maximum of one further (two total) consecutive terms of office, but once this maximum is reached, must then take a sabbatical of at least one year before they may be re-appointed as directors.

5.5. Once a year, in good time before the expiry of terms of office of the relevant directors, electronic notification shall be issued to members indicating which directors' terms will end, which may be elected for a further term of office and if any other of the directors has ceased or will cease to serve. The notice shall include a call for nominations. A committee appointed by members or an organ of

the Company to whom the members have delegated this power shall vet the nominees for eligibility to serve and shall issue to voting members a shortlist of nominees for voting.

5.6.   If the number of directors falls below the minimum required by clause 5.1 at any time, the remaining directors in office shall be empowered to continue to make decisions and govern the Company while replacement directors are appointed to meet the requirements.

5.7.   The office of a director shall *ipso facto* be vacated if:

5.7.1.   the director's term of office ends and they are not or may not be re-appointed to office;

5.7.2.   by one month's written notice to the Company, the director resigns from office;

5.7.3.   the director ceases to be eligible to be a director or is disqualified from being a director by virtue of the Act;

5.7.4.   the director is a director ex officio and ceases to occupy the relevant position or office;

5.7.5.   the director is directly or indirectly interested in any contract or proposed contract with the Company and fails to declare their interest and the nature thereof in the manner required by the Act;

5.7.6.   the director is removed from office by ordinary resolution of the members in accordance with section 71 of the Act, provided that before the members may consider the resolution, the director concerned shall be given notice of the electronic meeting, and the resolution and the director shall be given a reasonable opportunity to make a presentation, in person or through a representative, to the meeting before the resolution is put to a vote.

6. Authority, values and duties of the Board of Directors

6.1.   The authority of the Company's Board of directors to lead and direct the business and affairs of the Company, as set out in section 66 (1) is limited or restricted to the extent that the powers of the Company are limited in this MOI.

6.2.   A central intention of the Company is to be responsive to and focused on the needs of its ultimate beneficiaries, who are the citizens of South Africa. The Board will carry out its duties with this in mind and will actively drive the creation of processes and systems which support and enable:

6.2.1.   simple, attractive and widely promoted sign-up processes for members and the ongoing expansion of the member-base;

6.2.2.   easily accessible participation by members in the work of the Company; and

6.2.3.   the progressive integration of members into the decision-making processes of the Company, to be embedded and articulated in policies and in future versions of the MOI.

6.3.   The Board will each year issue a report to members in this regard, setting out the progress already made and the plans and timelines for future adaptations.

6.4.   In accordance with legal requirements, each of the directors shall exercise their powers:

6.4.1.   in good faith and for the purpose for which they were conferred;

6.4.2.   in the best interests of the Company; and

6.4.3.   with the degree of care, skill and diligence that may reasonably be expected of a person:

6.4.3.1.   carrying out the functions of a director; and
6.4.3.2.   having the general knowledge, skill and experience of that director.

6.5.   The directors shall exercise their powers and carry out the object of the Company in accordance with the following fundamental values:

6.5.1.   innovation and agility to lead the Company as it anticipates, creates and adapts to changes in society, science, technology, legislation and the economic climate. The directors will operate efficiently and to anticipate and respond to changes effectively.

6.5.2. collaboration - people need to be drawn to, to trust and to commit to participate in PSET CLOUD for the PSET CLOUD to function effectively and to have the impact intended. The Board and structures of the Company will allow involvement from multiple sectors and all levels of society in order to achieve maximum positive impact as fast as possible.

6.5.3. individual data-sovereignty - citizen data ownership and protection is a core component of the work and Self-sovereign Identity that allows citizens to operate and interact with the virtual world with the same level of trust and transparency as they would with the offline world will be embedded in all processes and applications.

6.5.4. ultimate citizen ownership (CC-PPP) – driving real participation on all levels. No profiteering is to be permitted, and there will be no one sector which is the 'owner' of any part of the PSET CLOUD. Transparent governance and clear and accurate communications will build fair, equal and mutually beneficial relationships.

6.6. The duties of the directors shall include (but not be limited to) the following:

6.6.1. contributing meaningfully and effectively to devising and overseeing the implementation of the medium and long-term strategy of the Company;

6.6.2. keeping the planning, strategy and work of the Company aligned with the objectives of the Company and being familiar with the fundamentals of the PSET CLOUD and the Company projects and programmes to enhance its impact and reach;

6.6.3. keeping up to date with developments and improvements in the PSET CLOUD and always being open-minded and forward-looking;

6.6.4. monitoring the organisational affairs, policies and compliance environment of the Company;

6.6.5. acting in a manner that demonstrates an understanding of the stakeholders and role-players in the PSET CLOUD and the Boards' accountability to stakeholders;

6.6.6. interrogating the financial statements and determining the financial performance of the Company, including its solvency and liquidity;

6.6.7. overseeing the Company's risk management policy and the implementation and the ongoing monitoring of risk management;

6.6.8. overseeing stakeholder policy implementation and reporting to funders and other stakeholders;

6.6.9. responding to strategic challenges in a creative, proactive and constructive manner; and

6.6.10. interacting with fellow Board members and management in a manner that is beneficial to the work of the Company.

7. Board of Directors meetings

7.1. The Company's Board of directors may consider a matter other than at a meeting, and the directors may, instead of voting to make a decision at a meeting, adopt a decision by written consent of the majority of directors, given in person or by electronic communication, provided that each director has received notice of the matter to be decided upon. A decision so made shall have the same effect as if it had been approved at a meeting.

7.2. The Board shall schedule their meetings in advance, by discussion and agreement at meetings of the Board. For additional/ unplanned meetings of the Board, it shall be required that no fewer than 25% of the directors (or at least two directors, whichever is greater) shall be required to call an unplanned meeting of the Board.

7.3. The minimum period of notice required to hold a Board meeting is 10 business days from the date on which the notice is issued. The notice must specify the date, time and place of the meeting and the general nature of the business to be discussed. The notice shall be in writing or by electronic communication.

7.4. The Company's Board of directors may conduct a meeting entirely by electronic communication, or provide for participation in a meeting by electronic communication, so long as the electronic

communication facility employed ordinarily enables all persons participating in that meeting to communicate concurrently with each other without an intermediary and to participate effectively in the meeting.

7.5. The Board of directors may proceed with a meeting despite a failure or defect in giving notice of the meeting, if all of the directors of the Company:

7.5.1. acknowledge actual receipt of the notice;

7.5.2. are present at a meeting; or

7.5.3. waive notice of the meeting.

7.6. The directors shall appoint a Chairperson. The Chairperson shall be a non-executive director who is also independent (having no interest, position, association or relationship which is likely to influence unduly or cause bias in decision-making regarding the Company). The Chairperson shall remain in office for a maximum term of three consecutive years If no Chairperson is elected, or if the Chairperson is not present at a meeting within 15 minutes after the time appointed for holding it, the directors present may choose one of their number to preside at that meeting

7.7. At a meeting at least once a year, the directors shall disclose any ongoing or current conflict of interests to the other directors. The Chairperson shall facilitate a discussion by the directors of any conflicts so declared and:

7.7.1. each director who declares a conflict shall absent themselves from the meeting during the time that the conflict is discussed by the other directors;

7.7.2. the other directors shall consider whether the extent and nature of the conflict is adequately dealt with by the relevant director following the procedure in 7.9 OR whether the director should be requested or required to leave office for the duration of the conflict of interest; and

7.7.3. the minutes shall note the conflicts declared and decisions made by the directors.

7.8. The rules for directors' meetings are as follows:

7.8.1. the directors shall meet together not less often than four times per year for the dispatch of business, but shall otherwise regulate their meetings as they think fit;

7.8.2. the quorum necessary for the transacting of business of the Board shall be three directors or half plus one of the total number of directors, whichever is greater;

7.8.3. each director shall have one vote on a matter before the Board, except as provided in 7.9;

7.8.4. the directors will endeavour to govern by consensus, but where consensus cannot be reached, a vote will be taken and a majority of the votes cast on a resolution will be sufficient to approve that resolution; and

7.8.5. in the case of a tied vote, the matter being voted on shall fail.

7.9. If a matter in which any director (or any person in relation to whom a director is a 'connected person' as defined in the Income Tax Act), has a personal financial interest is placed upon the agenda of a meeting or arises during the course of meetings or correspondence of directors, the relevant director shall:

7.9.1. immediately and in advance of the matter being dealt with, disclose the fact and nature of the personal financial interest;

7.9.2. inform the relevant meeting or electronic communication group or email mailing list of material information and answer questions concerning the personal financial interest;

7.9.3. not take part in any consideration of any matter, and leave the relevant meeting/electronic group/email list after disclosure concerning the personal financial interest; and

7.9.4. not be entitled to vote on or sign any document in relation to the matter in which the personal financial interest arises.

7.10. The Company shall keep minutes of the meetings of the Board and any of its committees and include in the minutes:

7.10.1. any declaration given by notice or made by a director as required by section 7.9 with reference to the personal financial interests of the director, whether it be an advance declaration of interests, or a specific declaration with reference to a specific matter; and

7.10.2. every resolution adopted by the Board, which resolutions shall be dated, sequentially numbered, and will be effective from the date of the resolution, unless the resolution states otherwise.

7.11. Copies of the minutes of every meeting shall be dispatched by the person appointed by the Board from time to time to all directors within one month of the holding of the meeting.

8. Officers, committees and stakeholders

8.1. The Board of directors may appoint any officers it considers necessary to better achieve the objectives of the Company.

8.2. The Board of directors may appoint any executives and managers as required to manage the day to day affairs and business of the Company, and these persons shall have delegated to them the powers needed in order to fulfil their duties, subject to limits approved by the Board from time to time.

8.3. The Board of directors may appoint committees of directors and delegate to any committee any of the authority of the Board and/or include in any committee persons who are not directors.

8.4. The authority of a committee appointed by the Company's Board, as set out in section 72(2)(b) and (c) is limited and restricted to the extent that the powers of the Company are limited by this MOI.

8.5. The Board of directors, may in its discretion, invite certain stakeholders, partners and interested parties as it sees fit to form an advisory council of the Company. The Board may consult with the advisory council on matters of vision, policy and other matters which concern the stakeholders, partners and interested parties represented by the council from time to time.

9. Optional provisions of the Act: Audit and others

9.1. The Company elects, in terms of section 34(2), to comply voluntarily with some of the provisions of Chapter 3 of the Act, in that the members of the Company will appoint an auditor in terms of sections 90 and 93.

10. Accounting records, banking and receipt of donations

10.1. The directors shall cause accurate and complete records to be kept which enable the Company to satisfy all legal requirements and prepare financial statements.

10.2. The accounting records shall be securely stored and accessible to the directors from the registered office of the Company through any method or platform as the directors agree from time to time.

10.3. The financial transactions of the Company shall be administered via one or more bank accounts which shall be opened in the name of the Company.

10.4. The Company shall be entitled to accept revocable and conditional donations, provided that:

10.4.1. the Company may only accept donations including revocable donations where the reason for the revocation is:

10.4.1.1. a material failure to conform to the designated purposes and conditions of the donation; or

10.4.1.2. any misrepresentation with regard to the tax deductibility thereof in terms of section 18A of the Income Tax Act;

10.4.1.3. a donor (other than a donor that is an approved public benefit organisation or an institution or body which is exempt from tax in terms of section 10(1)(cA)(i) of the Income Tax Act, which has as its sole or principal object the carrying on of any public benefit activity) may not impose conditions that could enable the donor or any connected person in relation to the donor to derive some direct or indirect benefit from the application of the donation.

11. Expenditure and use of resources

11.1. The income and property of the Company, however derived, shall be applied solely towards the promotion of its main objective or invested, and no funds will be distributed to any person other than in the course of undertaking any 'public benefit activity' (as defined in the Income Tax Act), and no portion of the income or assets of the Company may be paid or transferred, directly or indirectly, to the directors or persons appointing directors of the Company, provided that this shall not prevent:

11.1.1. payment in good faith of reasonable remuneration to any officer or servant of the Company for any services rendered to the Company;

11.1.2. payment of an amount due and payable by the Company in terms of a bona fide agreement between the Company and that person or another;

11.1.3. payment in respect of any rights of that person, to the extent that the rights are administered by the Company in order to advance a stated objective of the Company; or

11.1.4. payment in respect of any legal obligation binding on the Company.

11.2. Remuneration (as defined in the Fourth Schedule to the Income Tax Act) may be paid to any employee, office bearer, director or other person in keeping with the policy of the Company from time to time, provided that:

11.2.1. no remuneration may be paid if it is excessive, having regard to what is generally considered reasonable in the appropriate sector and in relation to the service rendered;

11.2.2. no person shall be economically benefited in any way which is not consistent with the objectives of the Company; and

11.2.3. the provisions of clause 7.9 shall apply to any decision taken regarding remuneration for directors, officers or their connected persons.

11.3. The Company shall not provide a loan to, secure a debt or obligation for or otherwise provide direct or indirect financial assistance to a director of the Company or of a related or inter-related Company, or to a person related to any director, unless it:

11.3.1. is in the ordinary course of the Company's business and for fair value;

11.3.2. constitutes an accountable advance to meet:

11.3.2.1. legal expenses in relation to a matter concerning the Company; or
11.3.2.2. anticipated expenses to be incurred by the person on behalf of the Company;

11.3.3. is to defray the person's expenses for removal at the Company's request; or

11.3.4. is in terms of an employee benefit scheme generally available to all employees or a specific class of employees.

11.4. The Company shall not use its resources, directly or indirectly, to support, advance or oppose any political party.

11.5. No expenditure shall be incurred by or on behalf of the Company except on authority of the Board or of the person or persons to whom the Board has generally or specifically delegated the power to authorise expenditure.

12. Annual financial statements and returns

12.1. The directors shall, in accordance with sections 29 and 30 of the Act, cause to be prepared and laid before the members of the Company the annual financial statements as are referred to in those sections, which annual financial statements shall:

12.1.1. be prepared within six months of the end of each financial year;

12.1.2. be audited voluntarily, as provided in this MOI;

12.1.3. include an auditor's report;

12.1.4. include a report by the directors as to the activities and financial state of the Company; and

12.1.5. be approved by the directors of the Company and signed by an authorised director.

12.2. A copy of the annual financial statements shall, at least 15 days prior to the relevant meeting, be sent to every member of the Company.

12.3. The Company shall file annual returns:

12.3.1. with the Companies and Intellectual Property Commission within 30 business days of each anniversary of its date of incorporation; and

12.3.2. for income tax, with the Commissioner for South African Revenue Services, along with the payment, documents and information which may be required from time to time.

13. Indemnification of Directors

13.1. If directors or officers of the Company or members of any committee of the Company:

13.1.1. defend any legal proceedings, whether civil or criminal, for any liability or charge arising from their position in or authorised actions on behalf of the Company; and

13.1.2. judgment is given in their favour, or they are acquitted, or the proceedings are abandoned, or the proceedings are in connection with any application under Section 77(9) of the Act and relief is granted to them by the Court,

they shall be indemnified by the Company against costs arising from the defence of the proceedings, and the Company may advance to the director funds to cover the legal costs of defending these proceedings.

13.2. The Company will indemnify directors, officers or employees of the Company against personal liability for:

13.2.1. loss or expense incurred by the Company through the insufficiency or deficiency of any security in or upon which any of the funds of the Company are invested;

13.2.2. loss or damage arising from the bankruptcy, insolvency or delictual acts of any persons with whom monies, securities or effects are deposited; or

13.2.3. loss or damage occasioned by any error of judgment or oversight on their part; or

13.2.4. other loss, damage or misfortune whatsoever which happens in the execution of the duties of their office or in relation thereto, unless the loss, damage or expense:

13.2.4.1. happened through their own gross negligence, gross default, gross breach of duty or wilful misconduct or wilful breach of trust; or

13.2.4.2. is a fine arising from conviction for an offence (provided that the Company will indemnify against fines imposed in circumstances where there is no wrongful conduct by the director, officer or employee, but the fine is imposed by law purely because of the officer's position in the Company).

14.   Changing Memorandum of Incorporation

14.1. This MOI of the Company may be altered or amended in the manner set out in sections 16, 17, 60 or 152(6)(b), provided that any amendment under section 16 shall require the following:

14.1.1. if the Company is exempted from payment of normal tax, a copy of any amendment shall be sent to the Commissioner for the South African Revenue Service or their authorised representative;

14.1.2. if the Company is registered as a Non-Profit Organisation, then a copy of any amendments shall be sent to the Directorate of Non-Profit Organisations.

14.2. The Company shall publish a notice of any alteration of the MOI made in terms of section 17(1) to correct a patent error in spelling, punctuation, reference, grammar or similar defect by delivering a copy of these changes to each member by electronic mail, provided that the members concerned have consented to the delivery of the communication by electronic mail.

15. Winding up, de-registration or dissolution

15.1. Upon its winding up, de-registration or dissolution, no past or present member or director of the Company or person appointing a director of the Company is entitled to any part of the net value of the Company, but the assets of the Company remaining after the satisfaction of all its liabilities shall be given or transferred to some other organisation (or organisations) to be determined by the members of the Company at or before the time of its dissolution, or failing determination, by a court, and which:

15.1.1. is non-profit,

15.1.2. has objectives similar to the Company's main objectives;

15.1.3. if the Company is so registered, is registered in terms of the Non-profit Organisations Act, 1997; and

15.1.4. if the Company is exempt from income tax, donations tax and estate duty under the relevant laws of the country and is:

15.1.4.1. a public benefit organisation, approved in terms of section 30 of the Income Tax Act; or

15.1.4.2. an institution, board or body contemplated in section 10(1)(cA)(i), of the Income Tax Act; and

shall be required to use the assets solely for the purpose of carrying on public benefit activities similar to those of the Company.

Annexure 3: Draft specifications for Minimum Viable Product 2 (MVP2)

The service provider will be furnished with high level functional requirements along with a prototype of three (3) user journeys, namely, the learner, employer and the education and training provider. The service provider is expected to use both the prototype and functional requirements to produce a backlog which will inform the first set of sprints to be developed. With the functional requirements being high level, the service provider must elicit further requirements which will cover all five (5) focus areas of Phase 3 of the PSET CLOUD and add those to the backlog and sprints.

Furthermore, the service provider will be furnished with an admin portal that is intended for the management of these three (3) user interfaces, along with the overall management of the system. This admin portal is blockchain based and makes use of self-sovereign identity (SSI). The service provider is required to integrate the admin portal with the three (3) user interfaces along with the other features to be developed; it is thus mandatory that the potential service provider has experience working with the technology stack used to develop the admin portal. Specifics of the technology stack can be seen in the section Self Sovereign Identity Integration below.

The proposed PSET CLOUD platform has a number of key focus areas:

- Mapping and visualisations of demand-side trends;
- Opportunity matching;
- Credential verification and recognition - using the SSI technology;
- The development of recommended learning pathways; and
- The recognition of prior learning (RPL).

The SSI project is working with some aspects of credential recognition and the development of recommended learning pathways, and a long-term vision for the platform is also to provide solutions for the recognition of informal and non-formal learning. The MVP service provider is expected to leverage these efforts as well as develop advanced solutions for these components to create a full solution in these areas.

The MVP service provider should provide a fully functional MVP that leverages ideal as well as actual solutions, for example, what can be achieved once interoperability and integration of systems is complete. The MVP should include elements such as direct access to trusted third-party data; the verification of credentials (see the SSI component) as well as the storage, retrieval and sharing of verified credentials; detailed trends mapping (for an example of the kinds of trends and insights we are looking to demonstrate see the skills OVATE portal in Europe); and recommended education and work opportunities based on both user profiles and current industry trends (for example, we would ideally want to be able to inform PSET CLOUD members working in or training to be in the automotive sector that there is a trend towards demand for hybrid vehicles and recommend courses that can train them on this). Due to the complexity of the project, the development of the MVP will be an iterative process using agile methodology; thus it is important for the service provider to be familiar with this methodology.

In the MVP development process, there may be limitations around data and system capability of potential partners. It is therefore expected that the incoming service provider will consider alternatives that will serve the purpose of a functional MVP. For example, we do not currently have real-time data or direct data access to Application Programming Interfaces (APIs), so the MVP will leverage the available data of partner organisations such as the merSETA, which includes skills requirements data collected annually and data on learnerships, to build the supply and demand insights. Where necessary, dummy data can be used to test various functionalities (for example, opportunities matching): in this case, sufficient quantities of dummy data should be used to demonstrate the system. Currently, data is ingested into the system manually and this needs to be expanded. Ideally, the system should have multiple ways of ingesting data into it, such as:

- APIs;
- Message brokers;
- Bulk uploads;
- Web scraping;

The primary objective is to ensure that the MVP is launch-ready and has all the required functionalities: Real-time trends analysis; Opportunity matching; Recognition/verification/storage and retrieval of credentials including informal learning credentials; and Development of learning pathways. This will encourage citizens, higher education institutions and employers to join and contribute their own data to the system. This contributed data must then feed back into the insights we are able to provide on the system. We are looking for a full, launchable solution that includes all aspects necessary to interact with the platform, including User Interface/ User Experience (UX/UI). For an overview of the proposed MVP platform, please click The PSET CLOUD platform to watch a short video.

The MVP development stages are detailed in Section 1 below.

SECTION 1

Stage 1: Inception

The successful service provider will be furnished with the following materials, which they are expected to become thoroughly acquainted with in order to commence with the development of the PSET CLOUD MVP:

- Research outcomes from Phase 1, 2 and 3;
- User journey outcomes;
- Specification document;
- User and admin manual of the MVP and SSI admin portal;
- Bitbucket repositories from previous developers;
- Swagger documentation;
- SSI prototype (three [3] user interfaces);
- SSI admin portal;
- Integration document (National Skills Development Management System [NSDMS]).

As part of the inception phase and throughout the duration of the project, the service provider will be requested as JET and the merSETA deem necessary to attend some meetings and/or workshops. It is important that the service provider prepares for this and factors adequate touch points with both JET and the larger project into the proposed budget. Short weekly meetings with the project team, sprint review meetings, periodic alignment meetings with other developers, and contributions to the broader team meetings held monthly with at least one developer and the project manager can be expected. Close-out meetings at the conclusion of the project with both JET and the merSETA should also be factored into the project budget.

Key deliverables

1. A brief inception report with a detailed work plan that spells out the approach, timelines aligned to the brief, deliverables, risks and mitigation strategies, budget and key resources;
2. A revised/agreed functional specification document which outlines the work to be completed during the contract.

Stage 2: Functional requirements specification

Initial high level requirements have been drafted for the MVP and can be accessed here; however, these are not exhaustive. The service provider will be required to elicit and document the requirements for the rest of the critical components to be developed for the MVP.

A significant amount of ground has been covered in focus area 2: Capturing requirements for the opportunity matching component, so the focus areas for this work will be: 1: Mapping and visualisations of demand-side trends; 3: Credential recognition and verification; 4: Development of recommended learning pathways; and 5: Recognition of prior learning (RPL). The functional requirements must then be demonstrated through the development of an MVP which showcases how the requirements translate into a functioning MVP for the project team to engage with. Once the project team is happy with the MVP, the requirements can be signed off.

Signed off functional requirements document.

Stage 3: MVP prototype design review and report

On completion of the development of the functional requirements, the service provider might need to improve the current design of the prototype by including the new identified functionalities from the functional requirements that are not covered in the current prototype. During the inception phase, the service provider, together with the JET and the merSETA team, will flesh out all possibilities for prototyping these additional requirements in line with project deliverables and timelines.

An important consideration at this stage is that feedback from the JET-merSETA team as well as end users is considered, and revisions to the platform reflect the inputs received during sprint sessions. Under no circumstance should the service provider develop features or functions without the approval of the JET-merSETA team.

Key deliverable

A development delivery roadmap for all signed-off specifications which translates the reviewed requirements into a delivery sprint schedule (work breakdown structure) document that is agreed to and signed off by the JET-merSETA team.

Stage 4: Taxonomy

The PSET CLOUD team is currently researching taxonomies best suited for the MVP to allow for 1) demand-supply-side opportunity matching and 2) development of recommended learning pathways.

A service provider has already been appointed for the taxonomy development work, and touchpoint engagements are expected for alignment and implementation purposes. The outcomes of this research will have a bearing on the underlying opportunity matching logic of the PSET CLOUD language used for distilling skills, competencies, knowledge and attributes that can be mapped towards qualifications. The service provider will need to seamlessly incorporate these taxonomies into the MVP. The full scope of work can be found here.

Key deliverable

An integration roadmap using the taxonomy framework developed by the University of Cape Town Development Policy Research Unit (UCT DPRU) translated into system and functional requirements which incorporate the coding schema into the opportunity matching capability of the PSET CLOUD MVP.

Stage 5: Agile development - develop, test and deploy

The required agile development approach is illustrated below and will assist not only in streamlining the development process, but also in speeding up the develop-to-market of the MVP platform. Each sprint will ensure that there is a ready-to-test-and-demo feature.

Functional Decomposition	Sprints	Test	Deploy
• Group into Features	• Build each feature per spirint	• Review & Test each developed feature	• Deploy into live environment and demo
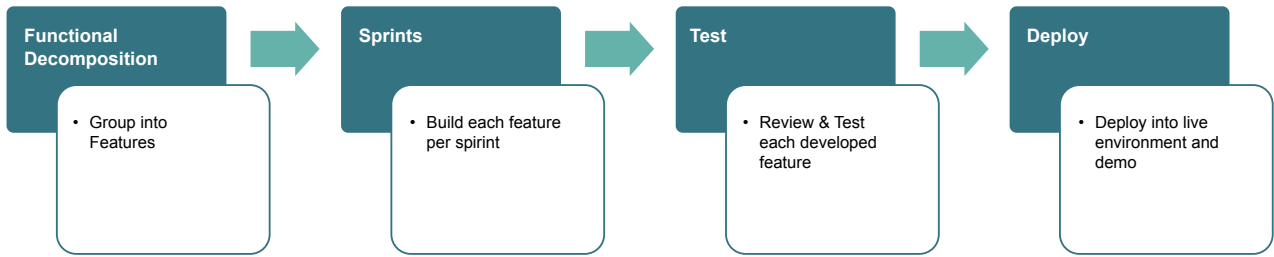
The development of the MVP should be carried out in sprints, with sprint reviews taking place in order to showcase progress made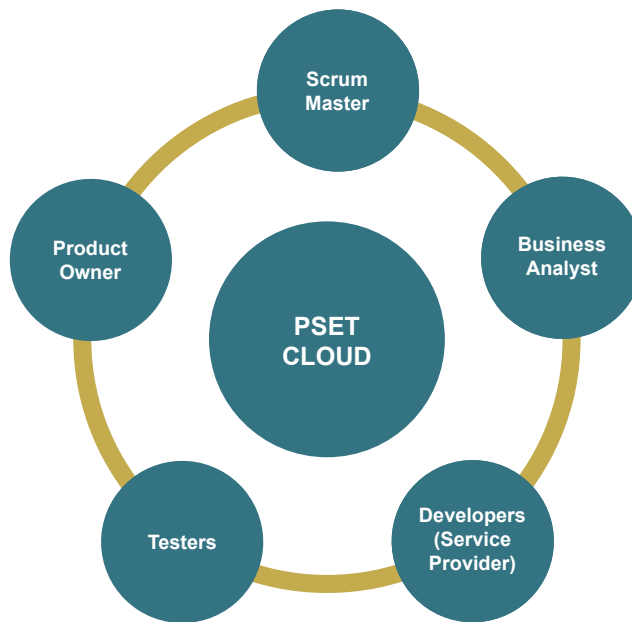 in the development of new features of the system. The agile development process (scrum) should follow a standard iterative pattern, with sprint planning, execution, review and retrospective stages. Tentative sprint review dates have been specified in Stage 7 in this document, although these dates are subject to review by the service provider in agreement with the JET technical lead. Final dates are to be included in the inception report that the service provider is to produce as the first deliverable.

Development, testing and deployment should be carried out iteratively, with a recurring feedback loop available for the JET-merSETA project team, together with relevant stakeholders/beta-testers to give feedback. The service provider must provide a test plan that will detail how and when new features will be tested. Furthermore, the test plan must cater for feedback from the users (meaning a select group of beneficiaries of the system as well as initial 'trusted partners' within government and related entities) and show how the feedback will be factored into development of the MVP. JET will facilitate access to these groups, but review sessions and access should be coordinated by the service provider in conjunction with the JET technical lead. In this iterative development and testing cycle, the final output will be a functional, complete set of MVP features, with each feature deployed after the sprint review and having passed all tests (system, user acceptance tests [UATs], integration).

At the core of the agile development approach for the MVP is ensuring that the completion of each sprint brings forth a functional and complete feature of the MVP platform that is ready for demonstration.

An example of team composition and responsibilities for implementation of the agile development process are depicted below.

Team composition

Scrum Master	Product Owner	Business Analyst	Testers	Developers	Project Management
• Oversees the development provess • Provides team with required resources. • Ensures product development aligns with business requirements.	• Takes authority and decisions on product-related tech issues. • Approves & signs-off each Sprint and final product.	• Documents user stories to be developed • Documents progress of Sprints. • Creates test cases for Sprint sessions, and the report thereof.	• Tests product after every sprint. • Provides feedback, through surveys, interviews and workshops.	• Develops the solution according to the user stories provided.	• Oversee service provider contract. • Report project progress to program. • Feedback from governance structures.

Team responsibilities

Key deliverables

1. Proposed team composition and responsibilities;

2. Proposed development, test and deployment plan;

3. Detailed test plan (system, integration, UAT) with test cases per released features and functions; and

4. An approved MVP ready for deployment - complete and consolidated list of developed features built during each sprint in the agile/iterative process.

Stage 6: Deployment and hosting infrastructure

Locally deploy the MVP through a JET-merSETA designated internet service/cloud provider. The MVP platform is envisaged to be hosted on the current JET-merSETA Amazon Web Services (AWS) account, hence the incumbent service provider is expected to have a thorough understanding of the AWS platform. Hosting of the MVP will be payable by the service provider.

The service provider is expected to follow standard software development server environment partitioning processes by creating separate and interlinked environments for code development, quality assurance and a live environment. The code should be moved into the relevant environment as and when required (programming, testing and demonstrating). At each stage of the code migration process, a reputable and secure version control tool should be used to commit and backup each version of the code.

Furthermore, in the event that more stakeholders are onboarded to the PSET CLOUD, the service provider is expected to help with adding those stakeholders onto the MVP and to also test the MVP with newly-added as well pre-existing stakeholders. Should bugs be found during testing, the service provider is expected to address them in a timely manner or within a time period acceptable to the JET-merSETA team. Lastly, in preparation for the handover, the service provider must work closely with the merSETA team to make sure handover is gradual and engagement/use/outcomes are well-understood. Upon deployment, the service provider should conduct relevant unit testing and integration testing and include notes in the coding in line with development best practices.

Key deliverables

1. A detailed outline of the different server environments created and the code migration process to be followed;

2. Successful deployment of the MVP from a sandbox environment to a live environment; and

3. Draft user manual and administrator manual.

Stage 7: Handover

During handover of the documented source code, user and administrator manuals, access details and account details related to the development of the MVP must be given to the PSET CLOUD MVP technical team. All documents must be delivered electronically in a format specified by the MVP lead. JET-merSETA will retain the ownership of the copyrights of all documentation delivered under the contract.

Key deliverables

1. Technical documentation (Documented source code, Swagger documentation, Testing and testing results, Architecture and maintenance documentation);
2. User manual and administrator manual;
3. Hosting platform credentials;
4. Administrator access details to the MVP;
5. Data dictionary;
6. Consolidated sprints reviews report; and
7. Consolidated sprints testing report.

Stage 8: Change management plan and support

The service provider is expected to hold workshops for demoing the MVP platform to the whole PSET team as well as to train select members from the project team (approx. four to five persons) on administering and using the system. The user manual should be made available by the service provider as a help file through an online application or knowledge-base so that the users can refer to the manual as and when needed, potentially as part of the PSET CLOUD website or as part of the MVP. Furthermore, the service provider is expected to provide system support for at least six months after handing over the software. The support should be in person, telephonic and via email, as and when necessary. Support might include additional development work for improvement to the system.

Key deliverables

1. High-level support service level plan;
2. Change management plan; and
3. Orientation training for select members of the project team.

SECTION 2

Self-sovereign identity integration

In parallel with the development of the PSET CLOUD MVP, the development of an SSI solution that integrates seamlessly with the MVP should take place. The incoming service provider is expected to work closely with the previously appointed service provider (DiDx) responsible for the development of the SSI solution to ensure alignment without overlaps between the SSI component and the MVP. Below is an outline of the SSI and admin portal.
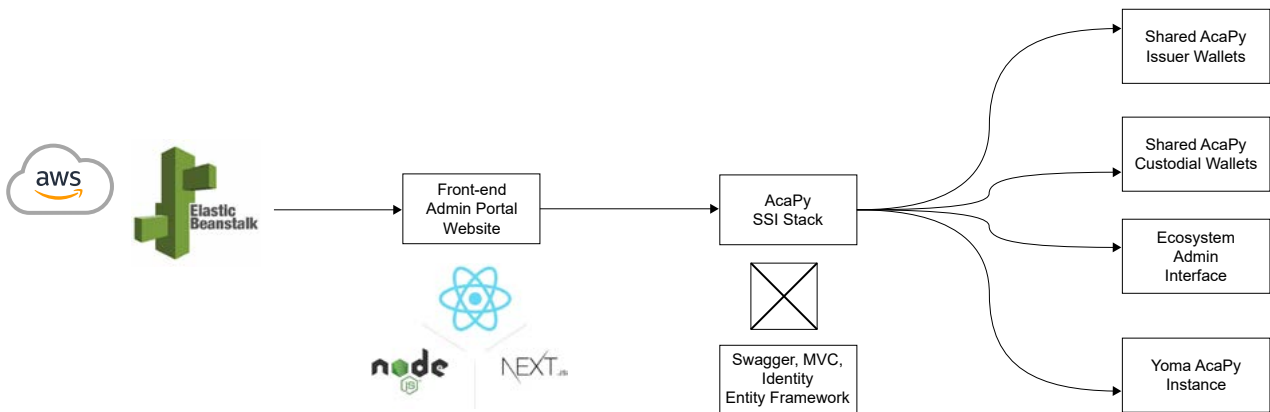
This admin portal will provide trusted SSI stack maintainers the ability to manage their SSI ecosystem. The super admin portal allows SSI ecosystem maintainers to perform the following functions:

1. Manage trust ecosystem schemas;
2. Manage tenants (custodial wallets);
3. View trust registry participants;
4. Make connections between tenants;
5. Manage messaging between tenants;
6. Issue credentials;
7. Request credential proofs; and
8. Verify credentials.

The credential service uses Next-Auth technology for NextJS, which assists the session manager at the server-side rendering (SSR) level, making the service safer and more secure.

DiDx SAP technology stack:

• Next.js (React) typescript;
• Server-side rendering (SSR) & client-side rendering (CSR);
• Typescript;
• Material UI version 5 (MUI);
• Docker; and
• MongoDB.

> ### *Key deliverable*
>
> Demonstrated and documented integration of the PSET CLOUD MVP with the SSI component.

Onboarding new stakeholders

From the success of the DigiTrans 2022 conference and the strategic partnership engagements that have been taking place, interest from external stakeholders to join the PSET CLOUD as early adopters has increased. Together with merSETA as the first early adopter, the PSET CLOUD seeks to onboard new stakeholders to expand the pool of early adopters.

Lessons learned and processes followed to integrate merSETA as the early adopter to the PSET CLOUD need to be applied when onboarding new stakeholders. For this reason, an onboarding document together with lessons learnt and an Integration Requirements document is being developed to help streamline the onboarding and integration of stakeholders into the PSET CLOUD.

Important considerations

1. Sprint grooming needs to take place with the JET-merSETA team before work on the sprints commences as there are items in the backlog that the JET-merSETA team and the service provider need to align on.
2. Sprint reviews are to take place as per the schedule agreed between the service provider and JET-merSETA. Under no circumstances are sprint reviews to be missed. Missed reviews resulting in delays in the project will not be the responsibility of JET-merSETA and will be at the cost of the service provider. Any delays must be recorded on a log sheet with reasons provided.
3. System architecture must follow an architecture that will allow for a prolonged system uptime, scalability, security, maintainability and efficiency of the overall MVP.
4. Open source applications are preferred.
5. The less subscriptions required, the better.
6. Fees for any software, subscriptions or licences will be payable by the service provider and must be communicated in writing to the MVP team.
7. The Protection of Personal Information Act (POPIA) must be adhered to by ensuring that the MVP is hosted locally as it will hold private national data.
8. Development of the MVP must make use of agile methodology, which the service provider must develop and test using an iterative process.
9. The prospective service provider should adhere to various local and international standards to ensure that the project management, software development life cycle and ultimately the MVP platform is not only of a high quality, but follows local and international governance, regulatory and compliance requirements. Some of the standards that the incumbent service provider should adhere to are listed below and are to be considered as part of the MVP development process:

    a. ISO 27001:2013 - Information Security, Cybersecurity
    b. ISO 22301:2019 - Business Continuity Management Systems
    c. ISO 31000 - Risk Management
    d. ISO 12207 - Software life cycle processes
    e. ISO 29119 - Software Testing
    f. ISO 9001:2015 - Quality Management Systems

Key competencies and team composition

1. The service provider should demonstrate an understanding of labour market intelligence and of the PSET Industry.
2. The service provider must have a balanced team that has key competencies to cater for the various components of the project.
3. A good ratio of senior to junior developers is important.
4. The team must have demonstrable prior experience in executing a project of this size and technical complexity and must comprise, at minimum, members with the following technical competencies:

   a. Front-end (UI/UX) and Back-end Development;
   b. Artificial Intelligence (Machine Learning);
   c. Data Integration/Enterprise Application Integration;
   d. Blockchain Development (specific focus on SSI);
   e. Quality Assurance Automation Engineering;
   f. DevOps Engineering;
   g. Cloud Infrastructure Engineering (AWS);
   h. Agile Project Management.

5. We are cognisant that one company may not have all these competencies; in such a case, should the service provider opt to enter into a joint venture or similar arrangement, compliance documents must be furnished for every company proposed to be involved in said arrangement. To expand on the availability of expertise, we are opening the development of the MVP to international service providers that have the requisite competencies.

Proposed architecture and technology

Application architecture
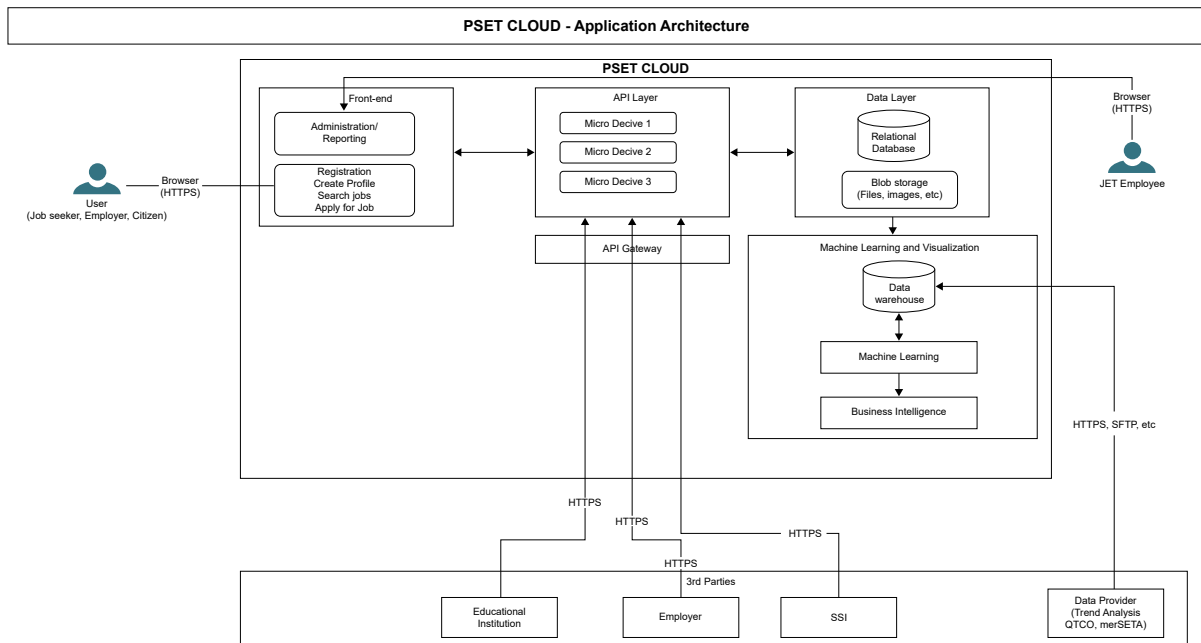
Business context

The following diagram outlines the context within which the MVP will be deployed. Relevant stakeholders and entities (jobseeker, learner, employer etc.) and their envisaged interaction with the platform are used to provide this context and understanding.
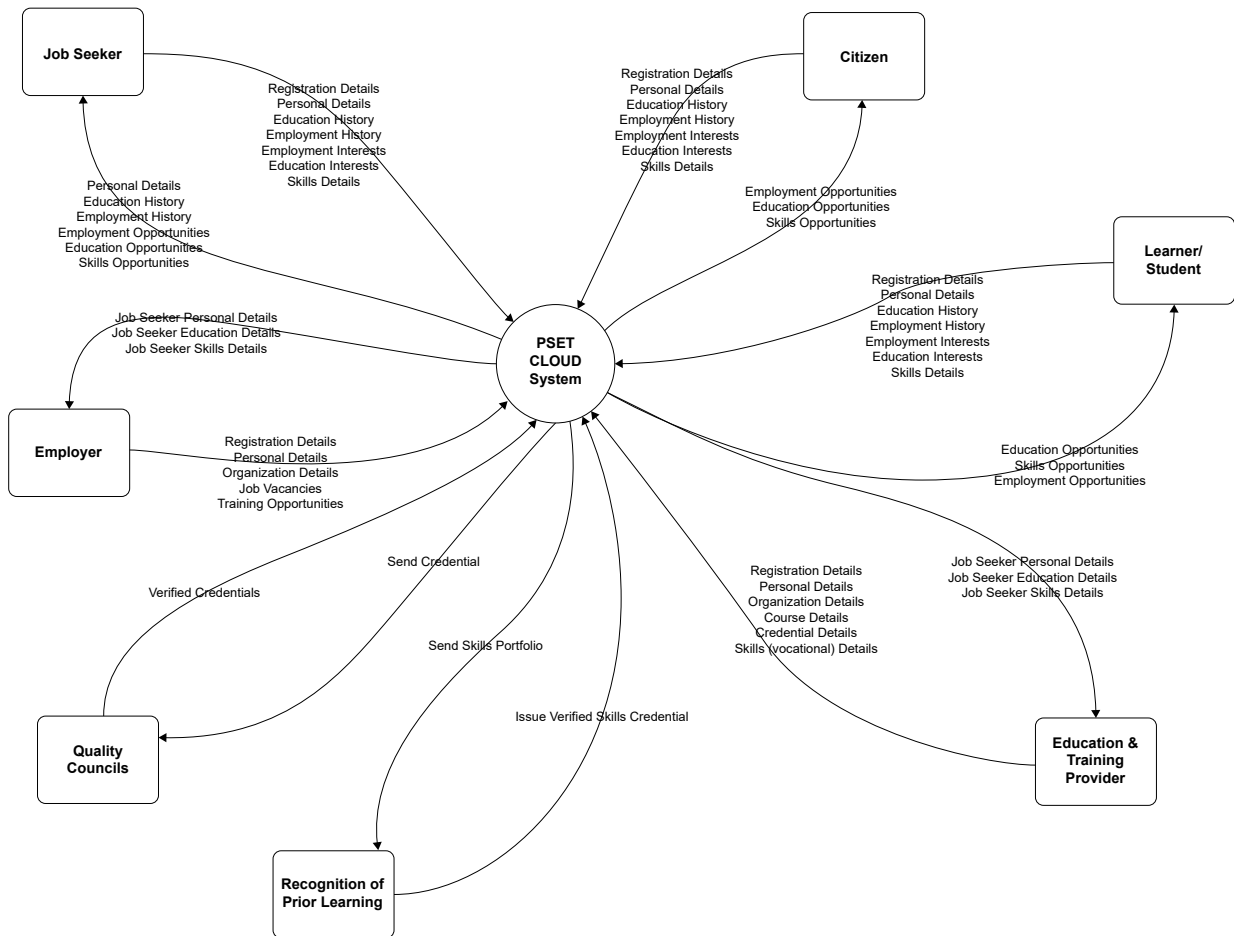
Data architecture

The MVP platform is data intensive, since a large amount of data will be sourced from various sources and then manipulated to provide feedback for analysis and insights. Below is a conceptual view of how the journey of this data is envisaged:
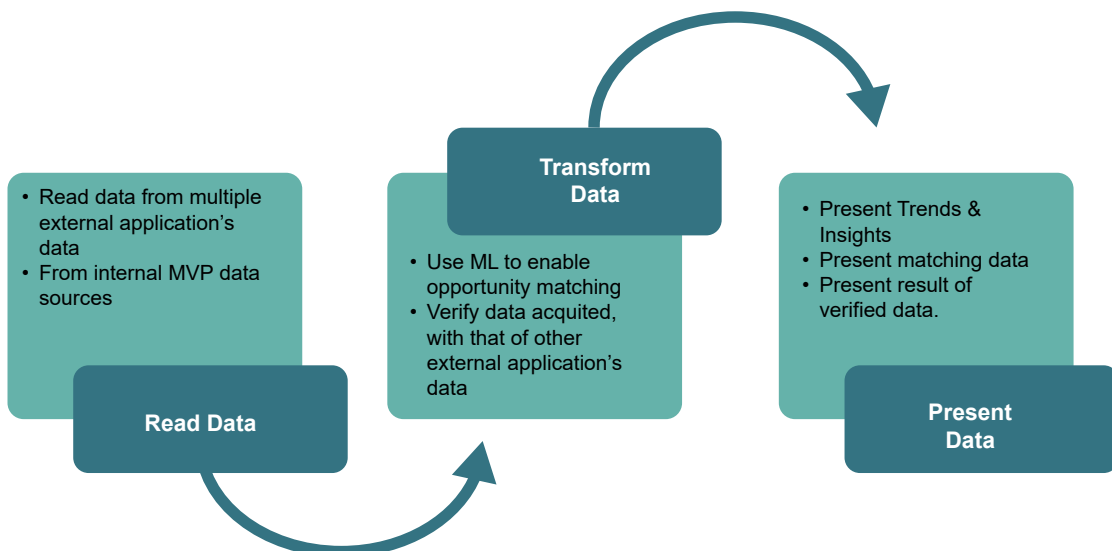
Application integration and interoperability

At the core of the MVP value proposition is the interoperability of the MVP with various external applications so that data can be sourced and transformed into valuable insights for the different stakeholders of the platform.

The prospective service provider should ensure that the MVP platform will not only be able to interoperate with early adopter applications, but will also be ready to plug into future applications to enable this interoperability.

The key technologies envisaged for this purpose involve APIs and message brokers. The service provider should adopt currently used technologies in the open-source community as well as those available on the AWS platform.

Technology stack

The technology stack outlined in the table below is the one envisaged for the building of the MVP platform. The criteria for choosing the technologies in the stack are, in order: 1) open-source; 2) the technology's availability on the AWS stack; 3) the technology's relevance to the implementation of the requirements; and finally, 3) the technology's popularity and extended community reach.

Component	Tech Stack	Rationale
Frontend Framework (libraries)	React (Node.JS) [mern]	
Programming Languages	Javascript (Node.JS)	
Services	Analytics, ML, Big Data, Web Scaping	Tech services used by MVP
Backend Framework	Django (Python)	Allows for building ML modules.
Middleware & Web Server	APIs, message brokers, - Apache	Open-Source & Ubiquitous
Database	MongoDB, mySQL, Neo4J (noSQL)	Open-Source & AWS subscription
Machine Learning	Python Machine Learning Libraries	Python Libraries (Open-Source)
Messaging/Communication	RabbitMQ, Apache Kafka (streaming), AmazonMQ	Open-Source & AWS subscription
Version Control	Github, Beanstalk	Open-Source & AWS subscription
Infrastructure & OS	AWS - Linux	AWS subscription
Development methodology	Agile (with DevOps Pipeline)	Dev-to deployment approach

Annexure 4: Draft Data Governance and Management Policy

1. Definitions

i. **Accounting Authority** means the body appointed by Founding Partners, which is charged with the strategy, governance and direction of the PSET CLOUD.

ii. **Authoritative Data Source** means a cohesive set of data assets that provide trusted, timely, and secure information to support a business process, and the information is visible, accessible, understandable and credible to information users.

iii. **Business Owner** means the individual accountable for performing processes and realising process objectives, driving process improvement and approving process changes.

iv. **Business Process Model** means a graphic and descriptive representation of business processes or value chains that cut across functions and organisations. The model may be expressed in different levels of detail, including decomposition into successively lower levels of activities.

v. **Business Rule** means a statement expressing a policy or condition that governs business actions and establishes data integrity guidelines.

vi. **Business Term** means a word, phrase or expression that has a meaning to the organisation.

vii. **Chief Executive Officer** means the executive of the PSET CLOUD that is appointed by the Board of Directors to fulfil the mandate of the PSET CLOUD.

viii. **Chief Information Officer** means a member of the Senior Management of the PSET CLOUD who is responsible for ICT strategy and policies.

ix. **Data** means the interpretable representation of facts or figures in a formalised manner suitable for communication, interpretation or processing.

x. **Data Cleansing** means a data error correction process to correct data errors in a collection of data to bring the level of quality to an acceptable level to meet the information and data stakeholder needs.

xi. **Data Completeness** for the purpose of data management means the quality of a data set in respect of the content being all that is necessary for an intended purpose.

xii. **Data Dictionary** means a repository of information (metadata) defining and describing the data resource or repository containing metadata.

xiii. **Data Governance** means development and enforcement of policies related to the use and management of data.

xiv. **Data Management** means the management and control of data as an organisational asset that includes strategic information on data planning, establishing data-related standards, policies, procedures and data modelling and data architecture.

xv. **Data Manager** means the person who establishes plans for data quality improvement in an organisation, provides a capability to trace and correct data across the information systems or organisation and maintains data consistency in individual information systems through the organisation-wide data architecture.

xvi. **Data Model** means a logical map or representation of real-world objects and events representing the inherent properties of the data independently of software, hardware or machine performance consideration.

xvii. **Data Provenance Record** means the record of the ultimate derivation and passage of a piece of data through its various users and stewards.

xviii. **Data Quality** means the degree to which data consistently meets the requirements and expectations of the employees in performing their jobs, the fitness for use of data and statistical information, i.e. the degree to which a set of inherent characteristics in the data fulfils user requirements, measured in terms of the prerequisites and eight dimensions of quality, namely, relevance, accuracy, timeliness, accessibility, interpretability, comparability and coherence, methodological soundness, and integrity

xix. **Data Redundancy** means a condition created within a database or data storage technology in which the same piece of data is held in two separate places.

xx. **Data Steward** means a person delegated the responsibility for managing a specific set of data resources or a business subject-matter expert designated and accountable for overseeing some parts of data definition for a collection of data for the organisation,

xxi. **Data Transformation** means the process of defining and applying algorithms to change data from one form to another form in a target data architecture to improve its value and usability for the data stakeholders.

xxii. **Enterprise Data** means the data of an organisation or corporation owned by the organisation and managed by a business area. Characteristics of enterprise data are that it is essential to run the organisation and/or is shared by more than one organisational unit within the organisation.

xxiii. **Entity** means an organisation legally established in terms of relevant establishment laws such as the Companies Act, various education legislation, Non-Profit Organisation Act No. 71 of 1997, Public Service Act No. 103 of 1994 ('Public Service Act') and the Constitution of the Republic ('Constitution') of South Africa 1996.

xxiv. **Evaluation** means a time-bound and periodic exercise that seeks to provide credible and useful information to answer specific questions to guide decision making by staff, managers and policymakers.

xxv. **Information** means all data presented in a context so that it can be applied or used, including records and knowledge in electronic or any other format which forms part of the intellectual capital used, transformed or produced by the organisation.

xxvi. **Information System** means a collection of computer hardware, computer programs, databases, bases, procedures and knowledge workers that work together to perform a related group of services or business processes.

xxvii. **Information Systems Architecture** means a graphic representation of a system showing the process, data, hardware, software and communications components of the system.

xxviii. **Information, Communication and Technology** means information or data, electronic communications, hardware devices, networking components, applications, protocols and systems that combine to allow people and organisations to interact in the digital world.

xxix. **Interoperability** means the ability of computer systems or software to exchange and make use of data.

xxx. **Knowledge** means the result of analysing information connections and links to other information items to facilitate critical thinking and reasoning.

xxxi. **Master Data** means reference data that is, or should be, standardised, common to and shared by multiple business units and application systems.

xxxii. **Metadata** means data used to define all the characteristics that need to be known about data elements to support data or information producers and users.

xxxiii. **Monitoring** means the process of collecting, analysing and reporting data on inputs, activities, outputs, outcomes and impacts as well as external factors in a way that supports effective management.

xxxiv. **Validation** for the purpose of this data management policy means confirmation that data or information satisfies its intended use or is fit for purpose through the provision of objective evidence.

xxxv. **Verification** for the purpose of this data management policy means confirmation that data or information meets specified requirements through the provision of objective evidence.

2. Purpose

The purpose of this data governance policy is to establish a framework for managing and protecting data assets within the PSET CLOUD. The policy defines the principles, processes and guidelines for data governance, with the goal of ensuring that data is accurate, complete, secure and compliant with applicable laws and regulations.

The policy aims to achieve the following objectives:

1. Improve data quality: By defining standards for data quality, data classification and data management processes, the policy aims to improve the accuracy, completeness and consistency of data within the PSET CLOUD.

2. Enhance data security and privacy: The policy establishes guidelines for data security and privacy, including data access controls, interoperability, data encryption, data masking and data retention policies. These measures aim to protect sensitive and confidential data from unauthorised access, disclosure or misuse.

3. Ensure regulatory compliance: The policy ensures that data governance practices comply with applicable laws, regulations, and industry standards, such as the Protection of Personal Information Act (POPIA), Electronic Communications and Transactions Act (ECTA), and Promotion of Access to Information Act (PAIA). Compliance with these standards reduces the risk of legal and financial penalties and protects the organisation's reputation.

4. Foster data-driven decision making: The policy promotes the use of data to inform business decisions and strategic planning. By ensuring that data is reliable, accurate and accessible, the policy aims to enable stakeholders to make informed decisions based on data insights.

5. Establish accountability and ownership: The policy assigns roles and responsibilities for data governance. This accountability ensures that data governance practices are transparent and that data is managed in a responsible and ethical manner.

6. Overall, the purpose of this data governance policy is to create a culture of data stewardship, where data is treated as a valuable asset for the PSET CLOUD and is managed with care and diligence. By adhering to this policy, the PSET CLOUD can realise the full potential of interoperable data assets and minimise the risks associated with poor data management practices.

3. Policy statement

The PSET CLOUD recognises the critical role that data plays in supporting our mission, strategy and operations. As such, we are committed to establishing and maintaining a comprehensive data governance framework that ensures interoperability with accuracy, completeness, security, privacy and compliance of our data assets.

Our data governance policy applies to all data that is accessed, collected, processed, stored and shared though the PSET CLOUD, regardless of format or location. The policy defines the principles, processes and guidelines for data governance and assigns roles and responsibilities for ensuring compliance with the policy.

We adhere to the following data governance principles:

1. Accuracy: We will strive to ensure that data is accurate, complete and consistent and that it reflects the reality of our ecosystem.

2. Security: We will implement measures to protect data from unauthorised access, disclosure or misuse and ensure that data is stored and transmitted securely.

3. Privacy: We will endeavour to respect individual privacy rights and implement appropriate measures using self-sovereign identity (SSI) principles to protect personal and sensitive data from unauthorised access, disclosure or misuse.

4. Compliance: We will comply with applicable laws, regulations and industry standards related to data governance, including POPIA, ECTA and PAIA.

5. Accessibility: We will ensure that data is easily accessible to authorised users and stakeholders and that access controls are in place to prevent unauthorised access.

6. Accountability: We will assign roles and responsibilities for data governance and ensure that data governance practices are transparent, ethical and aligned with the PSET CLOUD's core values.

Our data governance policy establishes the following processes and guidelines:

1. Data Management: We will establish procedures for managing the lifecycle of data, including data acquisition, data storage, data processing, data quality, data retention and data disposal.

2. Data Standards: We will define standards for data quality, data classification, data labelling, data encryption, data backup and recovery, data retention policies and other data management practices.

3. Data Access and Interoperability: We will establish guidelines for accessing and sharing data within and outside of the PSET CLOUD in an interoperable manner, including data access policies, data sharing agreements, data access controls and data sharing protocols.

4. Data Governance Monitoring and Enforcement: We will establish processes for monitoring and enforcing data governance policies, including data quality audits, data usage monitoring, data governance reviews and data compliance assessments.

5. Training and Awareness: We will provide training and awareness programmes for employees and stakeholders on data governance principles, processes and policies.

Our data governance policy will be reviewed and updated periodically to ensure that it remains relevant and effective in the face of changing needs, technologies and regulatory requirements.

By adhering to this data governance policy, we wish to demonstrate our commitment to responsible and ethical data management practices and ensure that public data assets are leveraged for maximum value within the ecosystem, while minimising risks to all stakeholders.

4. Scope

This data governance policy applies to all data assets accessed, collected, processed, stored and shared through the PSET CLOUD, regardless of format or location. The policy applies to all employees, contractors, vendors, partners and stakeholders who access or manage our data assets.

The policy applies to all data categories, including but not limited to:

1. Personal and sensitive data, such as employee data, customer data, financial data, health data and other personally identifiable information;

2. Research data, such as performance data, experimental data and other data generated through research activities.

The policy applies to all data interoperability and processing activities, including but not limited to:

1. Data collection, such as data capture, data entry and data ingestion;
2. Data storage, such as database management, data warehousing and cloud storage;
3. Data processing, such as data manipulation, data transformation and data analysis;
4. Data sharing, such as data transfer, data exchange and data collaboration.

The policy applies to all data assets owned or controlled through the PSET CLOUD, including but not limited to:

1. Data stored on our own servers, networks and devices;
2. Data stored on third-party servers, networks and devices;
3. Data stored on cloud platforms, such as AWS.
4. Data stored on mobile devices, laptops and other personal devices.

The policy applies to all business units, departments and teams within the PSET CLOUD structure. The policy applies to all locations where our organisation operates, including but not limited to:

1. Head Office;
2. Remote and telecommuting work locations;
3. Partner and vendor locations;
4. Data centres and cloud service providers.

By establishing a comprehensive scope of application for our data governance policy, we ensure that all data assets and activities within the PSET CLOUD are subject to the same principles, processes and guidelines for responsible and ethical data management.

5. Authority and governance (data governance monitoring and enforcement)

5.1 The Accounting Authority (AA)

Notwithstanding the stipulations below, all Corporate Governance of Information and Data must be in line with the provisions of the PSET CLOUD's Memorandum of Incorporation (MOI). The AA remains accountable for its defined statutory fiduciary and strategy obligations and responsibilities concerning data governance. The AA is accountable for the frequency and quality of systems responsible for producing and utilising data and information.

5.2 Chief Executive Officer (CEO)

The CEO is accountable for data management at the PSET CLOUD. The CEO is responsible for establishing the internal control system designed to counter the risks that the organisation faces related to the use of data and information.

5.3 Management Committee (MANCO)

MANCO has the following responsibilities:

1. Set the overall strategy and direction for data management with specific outcomes;
2. Provide visible management support for information and data initiatives;
3. Recommend data management policies to the AA; and
4. Approve data management procedures.
5. The MANCO is responsible for strategic data management, technology, and information systems stewardship.

The MANCO is accountable for:

1. Ensuring that technology and information systems are integrated and interoperable in support of organisational statistical and performance data;
2. Ensuring the integrity of shareable databases, information technology and integrated information systems implementation;
3. Establishing data profiling methodologies, processes and tools;
4. Ensuring that the interoperable relationships between stakeholder systems are documented in the PSET CLOUD's Information Systems Architecture;
5. Designing and implementing a coherent and comprehensive suite of information security controls; and
6. Ensuring that legal and regulatory requirements for data archiving and retention are met.
7. The MANCO must oversee the governance of data and information.
8. The MANCO must ensure compliance, risk management and recommendation of policies to the AA.

5.4 Data Steward Committee

Stewards representing each business area have the following responsibilities:

1. Resolve cross-functional information related issues about enterprise data;
2. Provide support and knowledge transfer among business data stewards;
3. Propose, discuss and agree on data standards and committee activities;
4. Report activities and decisions of the committee to the ICT Steering Committee;
5. Ensure that stakeholders' interests are represented;
6. Work cross-functionally across lines of business to ensure all business unit data is managed and understood.
7. Every MANCO member is a Data Steward accountable in their area of responsibility accountable for:

a. Establishing and maintaining systems for collecting, capturing, verifying and using data and information;

b. Defining data elements, business rules and valid values;

c. Ensuring the quality of data produced by the process they oversee;

d. Ensuring the definition and integrity of the business process;

e. Implementing and ensuring compliance with this policy within their areas of responsibility;

f. Developing plans that drive data development that are consistent with the business and information architecture;

g. Authorising access to secured data in line with security classification; and

h. Communicating this policy and providing education and training in data management principles to employees.

5.5 Information, Communication and Technology (ICT) Steering Committee

a. The ICT Steering Committee Champions Corporate Governance of the Information Communication and Technology (CGICT) and assists the MANCO with ensuring that the Corporate Governance of ICT is effectively institutionalised and sustained;

b. The ICT Steering Committee membership is composed of managers within the stakeholders from the CC-PPP;

c. The ICT Steering Committee assists the MANCO with data management and is responsible for:

    i. Championing the work of the Data Stewards;

    ii. Eliminating barriers between business units;

    iii. Providing support for the time spent on governance efforts;

    iv. Holding the Data Steward Committee accountable for timelines and outcomes.

5.6. Manager: Information Systems

The Manager: Information Systems is:

1. Assigned the role of the Manager: Data;

2. Responsible for compliance with data reporting requirements of various regulatory and government authorities;

3. Responsible for the data and information architecture stewardship;

4. Accountable for the structural quality of information infrastructure and data models;

5. Accountable for data standards and data dictionary for data definition;

6. Responsible for facilitating data definition across the PSET CLOUD;

7. Responsible for normalisation of databases to reduce the risk of anomalies;

8. Managing the availability of critical data to ensure operational continuity;

9. Employees.

Every employee is responsible for:

1. The quality, accuracy and completeness of all data they create or update execution of their duties because others depend on the data;

2. Using data wisely to support clients and stakeholders and protecting users' data;

3. Using data and information, while upholding policies and procedures;

4. Legislative and regulatory requirements.

This policy derives its authority from:

1. The Constitution of the Republic of South Africa Act No. 108 of 1996;

2. Public Finance Management Act, No. 1 of 1999, as amended, and related Regulations, Instruction Notes and Guides;

3. Skills Development Act, No. 97 of 1998, as amended;

4. Public Service Regulations, 2016 as amended;

5. Promotion of Access to Information Act, No. 2 of 2000;

6. Protection of Personal Information Act, No. 4 of 2013;

7. Policy Framework for the Government-wide Monitoring and Evaluation System, The Presidency, 2007;

8. South African Statistical Quality Assessment Framework (SASQAF), Statistics South Africa, 2010;

9. Corporate Governance of ICT Policy Framework, DPSA, 2012;

10. COBIT 2019 Framework for Information and Technology Governance and Management, 2019;

11. Post-School Education and Training Information Policy, DHET, 2019;

12. ISO 8000-1:2011 Data quality, ISO, 2011;

13. ISO 38500:2015 Information Technology - Governance of IT for the organisation, ISO, 2015;

14. ISO/IEC 27001:2013 Information Technology-Security techniques – Information security management systems – Requirements, ISO, 2013;

15. Government-Wide Enterprise Architecture (GWEA), Government Information Technology

16. Officer's Council, 2009;

17. The Open Group Architecture Framework, 9.2, The Open Group, 2018.

6. Principles of the policy

6.1 Data management

1. Data is an asset that has value to the organisation and must be managed accordingly.

2. Data must be classified for essentiality as:

   a. Organisation essential.
   b. Business unit essential; or
   c. Nonessential.

4. Organisation and business unit data must be managed as organisational resources.

5. Data must be shared across business units.

6. Organisation essential data must be modelled, named and defined consistently across business units.

7. Data must be stored and maintained in a consistent form across databases.

6.2 Data architecture

1. The MANCO must oversee the development of organisational Data Architecture in accordance with the South African Statistical Quality Assessment Framework (SASQAF) and The Open Group Architecture Framework (TOGAF) standards. The Data Architecture must define the major types and sources of data necessary to support the organisation in an understandable way and provide a complete view of the organisation's data entities.

2. The Data Architecture must deliver the following outputs:

   a. Business data model.

   b. Logical data model.

   c. Data management process models.

   d. Data entity/business function matrix; and

   e. Data interoperability requirements.

3. Data Stewardship

   a. Each data element must have a steward accountable for data quality.

   b. Business owners must be data stewards.

   c. Data stewardship must be established to achieve the following objectives:

      i. Business accountability for data quality;

      ii. Business ownership of data definition;

      iii. Establish a data conflict resolution mechanism;

      iv. Improve business and ICT partnership.

4. The MANCO must establish Data Stewardship guidelines that must address the following topics:
    a. The purpose of stewardship;
    b. Role and responsibility descriptions;
    c. Support resources;
    d. Guidelines for data definition;
    e. Data quality standard setting;
    f. Data access classification.

6.3 Common vocabulary and data definitions

1. Data must be defined consistently throughout the organisation, and the definitions must be understandable and available to all users.
2. The MANCO must ensure that the PSET CLOUD establishes a corporate glossary termed Dictionary of Terminology Guideline, defining business terms with an initial common vocabulary. These business term definitions will be used uniformly throughout the organisation.
3. The Manager: Data must coordinate data definition and reconciliation with the corporate glossary termed Dictionary of Terminology Guideline of data descriptions.
4. Data elements must have a single accepted enterprise-wide definition.
5. MANCO: Strategic Planning must assure the quality and consistency of the corporate glossary termed Dictionary of Terminology Guideline.

6.4 Data sharing

1. Users must have access to necessary data according to professional need, responsibility, and authority.
2. The MANCO must develop a common set of procedures and standards governing data management and establish a shared environment for accessing data.
3. Only the most accurate and timely data must be relied upon for decision-making. Shared data must become the organisation-wide 'virtual single source' of data.
4. The Manager: Data must develop a standard business process model, data models, data elements and other metadata that defines this shared environment and develop a repository system for storing this metadata to make it accessible.
5. The Manager: Data must maintain the data provenance record of the data residing in the shared environment or presented in reports or extracts.
6. The PSET CLOUD must adopt common methods and tools for creating, maintaining and accessing the data shared across the organisation.
7. The data sharing principle must not cause confidential data to be compromised under any circumstances.
8. All users of data must rely upon shared data to execute their respective tasks.
9. Users must not withhold or hoard data in a manner that may compromise the effective functioning of the organisation, except where such data is classified and can compromise the security of the organisation.

6.5 Data security

1. Data or information sharing and disclosure must be made following relevant legislation and associated PSET CLOUD policies.
2. Personally identifiable information must be handled in compliance with the POPI Act.
3. The MANCO must ensure that information systems, data and technologies are protected from unauthorised access and manipulation.
4. The MANCO must examine the organisation's data and information security risks, taking account of the threats, vulnerabilities and impacts.
5. Employees must prevent unauthenticated and unauthorised access to sensitive information.

6.6 Data quality

1. Data must be created and maintained as close to the source as feasible.
2. Data must be transcribed or captured as accurately and completely as possible.
3. Employees who discover errors or missing facts must update the master data or record of reference or communicate these to a person who can do so.
4. Data redundancy without business justification must not be permitted.
5. Data quality must be managed actively to approved quality levels.
6. Data in all forms must be safeguarded and secured, based upon requirements.

6.7 Data quality assessment

1. The MANCO must ensure that the data definition and data architecture quality are assessed. The assessment shall determine the following:
   a. The extent to which the quality of data definition meets the requirements of employees to know what they need to know and to understand the meaning of the data they require;
   b. The stability, flexibility, and reusability of data models in database and data warehouse designs;
   c. The extent to which the data meets SASQAF quality dimensions of relevance, accuracy, timeliness, accessibility, interpretability, comparability and coherence, methodological soundness and integrity.
   d. Non-quality information costs and risks; and
   e. The MANCO must report on the data profiling and data quality assessment findings.

6.8 Data cleansing

1. Data re-engineering and cleansing is the responsibility of Business Data Stewards.
2. Business Data Stewards must establish procedures to conduct data correction projects.
3. Business Data Stewards must:
   a. Assess business processes and business rules that cause defective data definition, data content or data presentation.
   b. Improve the processes to prevent the recurrence of the defects having to be corrected and information scrap and rework.
   c. Document and communicate the improved business process models.
   d. Ensure data stored in systems are accurate, complete, valid, and current.

6.9 Data access

1. Data shall be readily accessible to all authorised users.
2. Employees must take caution not to misinterpret data. Access to data does not constitute an understanding of the data.
3. Access to data does not necessarily grant the user access rights to modify or disclose the data.

6.10. Data management continuous improvement

1. The PSET CLOUD must create and sustain an environment for organisation performance excellence and the habit of continuous improvement of the Data Management practice.
2. The MANCO shall perform a Data Management maturity assessment annually.
3. The MANCO must prepare a Data Management continuous improvement plan based on the results of the Maturity Assessment.

6.11 Policy review

The policy will be reviewed every five (5) years.

Annexure 5: Draft cost estimation for development of PSET CLOUD MVP2 web application

Introduction

It is useful to create an MVP because it enables testing powerful features of the app and can be used to gather end user feedback on those features. End user input can then be considered before a final product is created, contributing to the likelihood of being able to launch a flawless application. The co-founder of Intelevita, Tuhib Bhatt cited (Published on March 15, 2022) that a typical cost of a mobile app MVP can range from R91 913,25 to R919 132,50 while Max, CEO of SPD Load[1] suggests that the cost of developing an app can range from R735 306,00 to R5 514 795,00 and up (SPD Load, 2023). This shows that the cost of developing an MVP can vary extensively. Moreover, many factors must be considered when evaluating the cost of MVP development.

MVP development factors

The MVP cost would depend on the complexity of MVP features and below we discuss the factors that influences MVP development and how they influence product cost. It is cited by Sudeep Srivastava of Appinventiv[2] (2022) that, when pricing the MVP, different teams or developers will provide different costs for the same project description. This happens because there are a number of variables that determine the cost of developing the MVP.

Application type

The complexity of the application is one of the factors that influences the cost of the MVP greatly. The simpler the product, the less the development cost, and *vice versa*. Listing the required features before undertaking budget framing is highly advised. The PSET CLOUD MVP, with a high number of factors such as blockchain, taxonomies and the requirement to be interoperable, is considered a highly complex application type in the high development cost range.

Designing

The PSET CLOUD MVP should be created with careful consideration of UI/UX, wireframes and expertise. It is estimated that this feature will contribution most to the cost of the MVP development. With a robust UI/UX design, the PSET CLOUD can create a substantial brand identity in the MVP stage itself. While the wireframe holds the complete application, be it the MVP stage or the finished product, it is important to structure the application thoroughly to show the structure and the flow of the development project.

Development team

Development teams are mainly of four types: in-house, freelancers, locals and outsourced. The table below shows an overall summary of the average costs of hiring different kinds of development teams:

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1   https://spdload.com/
2   https://appinventiv.com/

Type of team	MVP development costs (approx.)
In-House	R2 423 031,60 – R2 848 582,25
Freelancers	R73 511,80 – R275 515,50
Local teams	R2 938 832,00 – R3 306 186,00
Outsourcing	R566 069,50 – R661 639,68

The cost of local teams similar to the type identified as needed for the PSET CLOUD ranges from around R2 938 832,00 – R3 306 186,00.

In-house team for MVP development

When built in-house, there are several expenses incorporated in the MVP development process. These expenses consist of the developer salaries, IT infrastructure setup fees, hardware and software, technology training cost, benefits and overhead costs.

The MVP estimate cost for an internal team setup is around R2 741 008,50.

Variable	Cost of in-house development (approx.)
Cost per hire	R63 956,87 – R82 197,45
Overall team salary	R2 191 932,00 – R2 556 456,00
IT expenses	R365,21 – R913,02
IT system	R21 900,96 – R36 501,60
Technology training	R14 600,64 – R27 376,20
Paid benefits	R109 491,06 – R127 739,57
Software license	R4 562,13 – R5 474,55 per person
Total	R2 404 361,07 – R2 834 617,08

Freelancers

Using freelancer MVP development services does save money; however, the challenge faced is the level of expertise of the freelancer developers. In addition, lack of communication has been identified as a challenge when using a freelancer team. Overall, a freelancer would typically charge between R72 986,60 and R273 699,75 to create MVP software. Their knowledge, experience, and dedication have a strong influence on how the project will turn out.

Local teams

A local team option is also a consideration for businesses that have no in-house team. A local MVP development company could be used. This would save on costs such as infrastructure and hardware/software; however, it is still more expensive compared to outsourcing an offshore app development team. The average cost of a local team is around R2 736,63 – R3 648,84 per hour. If you consider the average cost of R2 736,63 and hire a team of five members, the final cost for developing the PSET CLOUD MVP can range between R2 919 380,80 and R3 284 303,40.

Outsourcing MVP development

Due to its viability, MVP outsourcing is the preferred option (Singh, 2022). Statistics show that in 2021, 78% of business owners have been happy with their outsourced partners (Dautovic, 2023). When outsourcing, many companies prefer an offshore product development firm that can employ a focused team to build their MVP. See the table below for outsourced expenses incurred for a team of five developers, including designers and project managers.

Variable	Cost of outsourcing development to India (approx.)
Cost per hire	R14 596,90 – R18 241,24
Overall team salary	R547 237,20 – R638 443,40
IT expenses	No expenses
IT system	No expenses
Technology training	No expenses
Paid benefits	No expenses
Software license	No expenses
Total	R562 063,04 – R656 956,80

Depending on the living conditions in each country, the price will also vary, for the reason that R1 823,57 in the US is not the same as R1 823,57 in South Africa. Here is an estimate of hourly rates in different areas:

Region	Hourly costs (approx..)
Western Europe	R2 005,92 – R3 647,13
Eastern Europe	R365,03 – R912,57
North America	R2 737,70 – R4 197,80
South America	R547,44 – R912,57
Africa	R364,96 – R729,93
Australia	R1 824,79 – R3 284,62
Asia	R273,57 – R729,93

The salary of a developer will also depend on their expertise and experience. Developers are typically split into three groups, based on their level of experience:

•   Juniors (up to 3 years)
•   Middle (between 3 and 5 years), and
•   Seniors (5 years and above)

The price may also vary depending on whether special experience or abilities are required.

Type of contract

The type of contract and contractual obligations are significant determinants of MVP pricing. The most commonly used is the Time and Material contract, which follows the actual payment per-hour policy. It allows for flexible working and covers the minimum payable amount for MVP app development. Other contracts like Fixed Price contracts are also available, but not as regularly used since they have drawbacks, including the requirement for prior accurate scoping and a list of developer duties. Making changes while a project is being developed is a difficult method.

Post development factors that affect MVP app development costs

• Marketing – Advertising and marketing costs will come out to be roughly R182 813,20, on average. The marketing cost will vary depending on the type of marketing approach selected. Some options to explore included advertising through social media promotions, sponsored ads, or corporate events.

• Sales – The right sales pitch is needed to get the MVP to the right customers and help them use it meaningfully. On average, it costs R91 396,75 and R182 813,20 to conceptualise an idea that promotes the MVP.

• Maintenance – As an estimate, the cost of maintenance is nearly 20% of the initial MVP development budget. This will include the cost of server and integrations, along with APIs that help with interactions. The overall maintenance cost will eventually depend on the location of the team and the complexity of the MVP app.

PSET CLOUD MVP rates per role

Hourly rates per role were determined based on the South African Market.

Role	Hourly rate
Business Analyst	R600,00
Senior Developer	R650,00
Solutions Architect	R650,00
DevOps Engineer	R650,00
Senior Python Developer	R650,00
Intermediate Python Developer	R550,00
Graphic Designer	R500,00
Webmaster UI/UX	R500,00
PM	R700,00
Senior Tester	R550,00
Junior Tester	R400,00
Scrum Master	R700,00
System Analyst	R700,00
Service Delivery Manager	R650,00

Each role spends different time on the project. The time was determined by calculating total time spent on the project on different sprints and/or milestones. Different hours spent by each role on different activities are added together to make up the total hours spent per role during the project. During development of the PSET CLOUD MVP, the highest number of hours spent by a role is 1 208, and the lowest time spent is 288 hours.

Role	Hourly rate
Business Analyst	1208
Senior Developer	800
Solutions Architect	1208
DevOps Engineer	1208
Senior Python Developer	800
Intermediate Python Developer	650

Role	Hourly rate
Graphic Designer	928
Webmaster UI/UX	928
PM	1208
Senior Tester	604
Junior Tester	288
Scrum Master	1208
System Analyst	800
Service Delivery Manager	1208

There are multiple factors that make the development of an MVP considered to be simple, moderate or complex, and the PSET CLOUD is considered to be complex s it has the features common to Complex MVP Development, where the Complex MVP development takes an average of seven to wright months to complete.

A total estimate of 150 working days in between 16 May – 15 December were found to be equal to 1 200 planned hours needed to complete the development of PSET CLOUD MVP2 App project. IT must be understood that the total time (150 days) for developing and completing the PSET CLOUD MVP project is not the same as the total amount of time spent by roles. The total time of the various roles (507 days) is high by comparison.

Thus, the estimated 150 working days is equivalent to 7,5 months, which correlates with the period of 15 May – 15 December, from inception to completion of onboarding activities. This also aligns with the concept of eight months that is considered a common project duration for a complex MVP App development.

As seen on the project timeline below, the projected amount of R6 574 000,00 is the hourly rate, multiplied by the total time taken by specific roles in developing the PSET CLOUD MVP2 App, and this is considered as a final estimate for this exercise.

Conclusion

The choice of the type of development team has a high impact on MVP development as it is based on dynamics such as location and qualifications that vary from region to region. Our estimations suggest R6 574 000,00 as a cost to build the PSET CLOUD MVP using a local team. This conclusion comes after evaluating all other teams considered able to develop a complex MVP for a company that has no in-house resources.

References

Dautovic, G. (2023). 'Must-know outsourcing statistics for 2023'. Fortunly, 4 July. https://fortunly.com/statistics/outsourcing-statistics/

SPD Load. (2023). 'How much does it cost to develop an app in 2023? Cost breakdown' [Blog post]. https://spdload.com/blog/app-development-cost/

Singh, S. (2022). 'Employing "Outsource Development" as an effective project collaboration tools for a successful startup' [Blog post]. Appinventiv, 23 May. https://appinventiv.com/blog/outsource-development-brilliant-tool-startups/