A deep dive into governance mechanisms for interoperable digital platforms for work and learning

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Contents

Acronyms and abbreviations

AI	artificial intelligence
API	application programming interface
ARUCC	Association of Registrars of the Universities and Colleges of Canada
DAO	decentralised autonomous organisation
EBP	European Blockchain Partnership
EBSI	European Blockchain Services Infrastructure
EMSI	Economic Modelling Specialists Inc.
GDPR	General Data Protection Regulations
ILO	International Labour Organization
IT	information technology
JET	JET Education Services
LMIS	Labour Market Intelligence Systems
merSETA	Manufacturing, Engineering and Related Services Sector Education and Training Authority
PbD	privacy by design
POPIA	Protection of Personal Information Act
PSET CLOUD	Post-School Education and Training Collaboration and Learning Opportunities and Utilisation of Data
SSI	self-sovereign identity

Preamble

With the surge of technological developments, the use of digital platforms with related innovations, such as cloud computing, big data, algorithms and artificial intelligence, has been expanding rapidly in the last few years. The ability to exchange large amounts of data and information swiftly has laid the foundations for the rise of the digital economy and digital labour platforms (ILO, 2021a). While Labour Market Information Systems (LMIS) have traditionally been the commitment of governments – for obvious reasons – the increasing availability of data has seen a rise in the number of private players that gather and integrate economic, labour market, demographic, education, profile and job posting data from dozens of governments and private-sector sources. The importance of this shift is seen in the International Labour Organization (ILO) being at the forefront of promoting the use of LMIS by providing technical assistance as well as technology access through its ILOSTAT service (ILO, 2021b).

In many instances, such government-led initiatives see ownership and governance reside within ministries responsible for employment and education and training. Where such digital platforms are developed as a service offering by private entities, ownership resides with the developers. How these digital platforms are governed is not very apparent. It is evident from the literature that more research is required to explore the governance mechanisms of digital platforms that are interoperable and developed specifically to bring the labour market, learning and job placements closer together (Fay, 2019). These platforms are multisided and involve several stakeholders that are connected digitally and, therefore, require specific rules of engagement with shared roles and responsibilities towards common goals. Hence, the overall question for this study – Is there a common governance mechanism or framework for interoperable digital platforms for work and learning? – is highly pertinent. A common approach could aim to create a conducive environment for collaboration, efficiency and effectiveness in the integration of work and learning through digital platforms, especially since in the current age of information technology, the governance of digital platforms has become a critical issue due to their central role in the economy.

Using an exploratory research design as a set of comprehensive and conceptually integrated comparative case studies of similar digital platforms that focus on lifelong learning and the awarding of digital credentials, workplaces and the labour market, this study takes a deep dive into current governance mechanisms that exist in the work and learning space globally. The study makes a meaningful contribution to current research on governance frameworks, provides recommendations for the future planning of similar platforms and offers some key principles for the governance of digital platforms in work and learning. Developing a universally accepted governance framework can go a long way in addressing issues of trust amongst the users of digital platforms. Finally, the study also proposes areas for new research that will enhance the understanding of how rapid advances in technological developments can be better governed.

Developing a universally accepted governance framework can go a long way in addressing issues of trust amongst the users of digital platforms.

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About JET Education Services

JET Education Services is an independent non-governmental organisation in South Africa that works with government, the private sector, international development agencies and education institutions to improve the quality of education and the relationship between education, skills development and the world of work.

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Rooksana is a specialist consultant in organisational development and systems change with a human-centric approach. She focuses on innovation and governance to lead effectively and work collaboratively to drive results for change through research and developing strategies for efficiency, transparency and accountability.

She works with a diverse range of clients, including government agencies, non-profit organisations and private corporations, to foster collaborative partnerships within specific ecosystems. Her academic career flowed into executive positions within the corporate market and her passion for the work and learning space has been the underpinning trajectory in all her efforts. Most recently, she has been a lead consultant and programme manager for JET Education Services in the development of an interoperable digital platform for post-school education in South Africa (PSET CLOUD) and has assisted the Teaching Council of Zambia to develop a Teacher Education Framework for Technology-Enabled Learning.

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Glossary

Algorithms	A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer (Thomason, Bernhardt and Kansara, 2019).
Application programming interface (API)	A set of definitions and protocols for building and integrating application software (Red Hat, 2022).
Artificial intelligence (AI)	A branch of computer science that focuses on creating machines or systems capable of performing tasks that typically require human-like intelligence, reasoning and adaptability. AI encompasses a wide range of sub-disciplines, including machine learning, natural language processing, speech recognition, computer vision, robotics and expert systems (Mazer Dev, 2023).
Big data	Extremely large data sets that may be analysed computationally to reveal patterns, trends and associations (Yeoman, 2019).
Blockchain	A distributed database or ledger that is shared among the nodes of a computer network (The Economic Times, 2023).
Cloud computing	The practice of using a network of remote servers hosted on the internet to store, manage and process data, rather than using a local server or a personal computer (Dryfhout and Hewer, 2019).
Credentials	A qualification, achievement, quality or aspect of a person's background, especially when used to indicate their suitability for something (AEA, 2023).
Digital platforms	The infrastructure and rules for a marketplace that enable and ease interactions between producers and consumers (IGI Global, 2021).
Data sovereignty	A reference to a group or individual's right to control and maintain their own data however they see fit, which includes the collection, storage and interpretation of their data (Purdue University, 2022).
Decentralised autonomous organisation (DAO)	An emerging form of legal structure that has no central governing body and whose members share a common goal to act in the best interest of the entity. Popularised through cryptocurrency enthusiasts and blockchain technology, DAOs are used to make decisions in a bottom-up management approach (Reiff, 2023).
European Blockchain Services Infrastructure (EBSI)	A network of distributed blockchain nodes across Europe. It is the first EU-wide blockchain infrastructure, driven by the public sector, in full respect of European values and regulations (European Commission, 2023b).

Freemium	Freemium is a business model in which a company offers basic or limited features to users at no cost and then charges a premium for supplemental or advanced features (Segal, 2022).
General Data Protection Regulation (GDPR)	A law that sets guidelines for the collection and processing of personal information from individuals (Frankenfield, 2020).
Governance framework	Directs how people interact with the organisation, regulators and stakeholders to guide and monitor operations closely (Mcmenemy, 2023).
Interoperability	The functionality of different programs to exchange information, share files and use the same protocols (Lewis, 2019).
Metadata	A set of data that describes and gives information about other data (Eliaçık, 2022).
Machine learning	The use and development of computer systems that are able to learn and adapt without following explicit instructions by using algorithms and statistical models to analyse and draw inferences from patterns in data (IBM, 2022).
Protection of Personal Information Act (POPIA) No. 4 of 2013	An act of Parliament that aims to promote the protection of personal information processed by public and private bodies (Republic of South Africa, 2013).
PSET CLOUD	A digital platform aimed at establishing a digital environment that will strengthen, integrate, coordinate, improve efficiencies and solve challenges in the governance and management of the post-school education and training (PSET) system.
Privacy by design (PbD)	A framework based on proactively embedding privacy into the design and operation of IT systems, networked infrastructure and business practices (Deloitte, 2023).
Pseudonymisation	Replacing any identifying characteristics of data with a pseudonym, or, in other words, a value that does not allow the data subject to be directly identified (JOIC, 2023).
Smart contracts	Programs stored on a blockchain that run when predetermined conditions are met (IBM, 2023).
Techno-solutionism	The idea that anything can be solved with technology (Morozov, 2014).

1. Introduction

With the surge of technological developments, the use of digital platforms with related innovations, such as cloud computing, big data, algorithms and artificial intelligence, has been expanding rapidly in the last few years. The ability to exchange large amounts of data and information swiftly has laid the foundations for the rise of the digital economy and digital labour platforms (ILO, 2021a). While Labour Market Information Systems (LMIS) have traditionally been the commitment of governments – for obvious reasons – the increasing availability of data has seen a rise in the number of private players that gather and integrate economic, labour market, demographic, education, profile and job posting data from dozens of governments and private-sector sources. The importance of this shift is seen in the International Labour Organization (ILO) being at the forefront of promoting the use of LMIS by providing technical assistance as well as technology access through its ILOSTAT service (ILO, 2021b).

In many instances, such government-led initiatives see ownership and governance reside within ministries responsible for employment, and education and training. Where such digital platforms are developed as a service offering by private entities, ownership resides with the developers. How these digital platforms are governed is not very apparent. It is evident from the literature (Fay, 2019) that more research is required to explore the governance mechanisms of digital platforms that are interoperable and developed specifically to bring the labour market, learning and job placements closer together. These platforms are multisided and involve several stakeholders that are connected digitally and, therefore, require specific rules of engagement with shared roles and responsibilities towards common goals. Hence, the overall question for this study – Is there a common governance mechanism or framework for interoperable digital platforms for work and learning? – is highly pertinent. A common approach could aim to create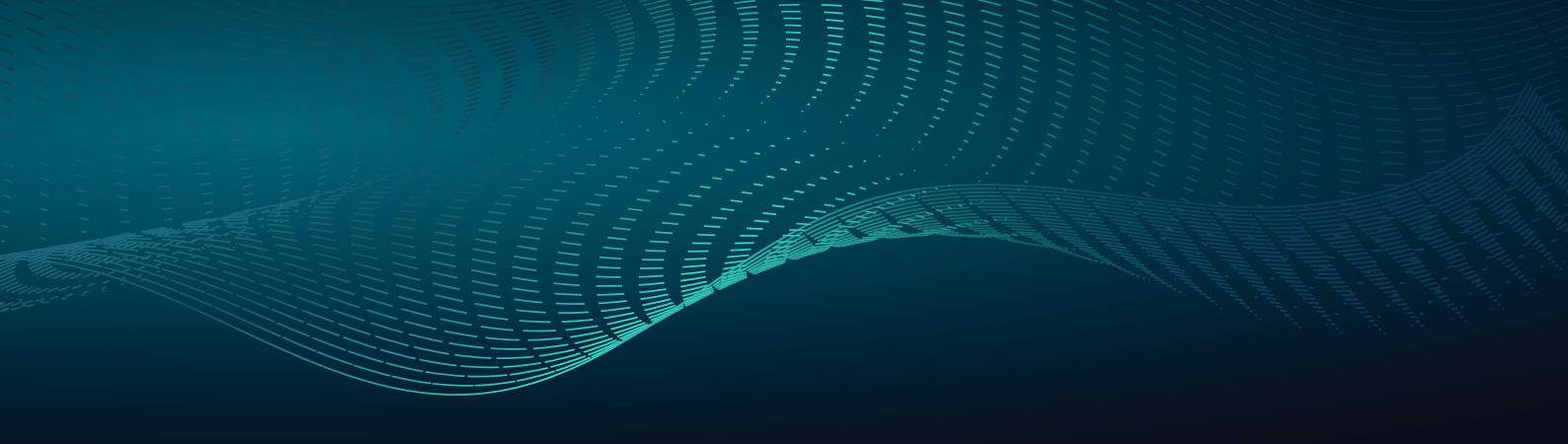 a conducive environment for collaboration, efficiency and effectiveness in the integration of work and learning through digital platforms.

According to a landscape review undertaken by Fhi360 (2016), 'effective partnerships underpin the governance of LMIS'. The review further identified three typologies of LMIS according to their capabilities, system participants and outputs (Sorensen and Mas, 2016):

- Basic systems comprise few public actors and can only generate statistics on the labour market based on survey data.

- Intermediate systems involve more public actors and integrate services that create value for some users beyond data production.

- Advanced systems see private-sector firms actively contributing to the system – not because they are obliged to, but because their participation leads to economic gains.

It is therefore apparent that to establish an advanced system, it is crucial to have top-level government support for a comprehensive vision that fosters collaboration across ministries and sectors to share information that benefits employers and workers. This may necessitate the development of new institutional arrangements that embed the planning, management and governance of LMIS within a collaborative structure involving public- and private-sector labour market intermediaries. However, it remains uncertain whether there is a standard governance mechanism or framework for interoperable digital platforms that serve work and learning purposes.

In the age of information technology (IT), the governance of digital platforms has become a critical issue due to their central role in the economy. As they connect economic agents, including consumers and producers, they have become crucial intermediaries in value chains for work and learning. These platforms connect employers with the necessary

skills and learning institutions that provide those skills. However, learners must navigate fragmented systems. These platforms also handle large amounts of data, posing a risk to individual privacy and data sovereignty. Therefore, it is important to ensure that all parties are protected while regulating their activities to prevent harm to society or individuals.

Abebe et al. (2021) stress that the value of a platform governance approach would be to:

- Provide a framework through which to connect a wide range of social, economic and democratic challenges and risks;

- Bring together siloed public policy areas and issues into a comprehensive governance agenda; and

- Provide a framework for stakeholders to learn from and coordinate with each other in order to ensure efficiency in the system.

In South Africa, JET Education Services (JET), a non-governmental organisation, and the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA), a parastatal, partnered to launch the PSET CLOUD (Post-School Education and Training Collaboration and Learning Opportunities and Utilisation of Data) program in South Africa. This program is based on an interoperable national digital ecosystem that facilitates effective skills planning and provisioning, empowering citizens and other stakeholders to make informed decisions about education and training. The initiative arose from the fragmentation and isolation of data sets and the long-standing divide between learning providers and the world of work.

Given the fragmentation that has been deep seated over a substantial period of time, at the inception of the five-year initiative, the priority was to thoroughly understand the post-school ecosystem and map out the legislative and governance imperatives that were embedded amongst the plethora of stakeholders.

While partnerships and collaboration between stakeholders from a broader post-school ecosystem are crucial to achieving interoperability, issues of governance, transparency and trust arose. Initial research on governance for the PSET CLOUD resulted in the *Digital Governance Advisory Note* (West and Beukes, 2021), and its key recommendation of establishing a citizen-civil–public-private partnership (CC-PPP) governance structure was taken up.

At the same time, the PSET CLOUD project team had established good relationships with international colleagues working in the same space, making it easy to approach individuals actively involved with digital platforms and to explore issues of institutional form and structure, governance, policy implementation and sustainability. The ad hoc and incomplete governance across the scale of digital platform activities has been identified as a significant problem by Fay (2019), which underscores the need for explicit rules for engagement and advocacy of governance frameworks. This pointed towards taking a deep dive into existing platform governance models and the study therefore uses an exploratory research design, consisting of comprehensive and conceptually integrated comparative case studies of similar platforms globally, to analyse how interoperable digital platforms are managed and governed.

This research report provides a road map of the study, starting with a literature review of interoperable digital platforms and a discussion of governance models in the context of digital platforms. Section 2 outlines the study's approach and criteria for selecting case studies, while Section 3 elaborates on key concepts. Section 4 analyses the cases according to pre-identified areas of study and links the knowledge gained to questions asked and observations made during interviews. Finally, Section 5 offers recommendations and considerations for future research on governance frameworks for digital platforms in education and draws final conclusions.

2. Formulating the approach

For a holistic in-depth investigation of several digital platforms, a case study approach was an ideal methodology (Feagin, Orum and Sjoberg, 1991).

The research was framed within a multifaceted approach that included a literature review, an environmental scan of similar types of interoperable digital platforms and a review of websites of identified organisations. The authors were motivated by a curiosity around the governance of digital platforms and by the ambiguity surrounding their conceptualisation, as noted in an insightful literature review conducted by Asadullah, Faik and Kankanhalli (2018).

The main source of data collection was qualitative, consisting of seven in-depth interviews that focused mainly on governance systems but also included questions about administration, management and sustainability. The criteria for selecting the case studies were aligned to whether the platforms addressed labour market needs, offered portability and progression of credentials and/or provided career advisory services. The digital platforms chosen as cases, therefore, are similar in their intent and purpose in knitting together learning, credentials and job placements.

Setting the tone for deeper discussions, all interviews started with a common theme of establishing the reasons why the platforms were developed in the first place. The interviews then progressed to their evolution, from inception to a startup phase, and

whether the platforms were government funded and 'owned' or whether public-private partnerships were in place, and how the organisations managing the platforms were subsequently structured.

Identifying similar platforms enabled close examination of governance mechanisms within a specific context, and the research team, having conducted seven qualitative in-depth interviews, could then reflect on, compare and draw out key principles of governance. Although criteria for selection were based on the main functions and purpose of the identified platforms more specifically, similarities among the platforms included that they were:

1. Established to address labour market needs by job-matching supply and demand;

2. Developed for portability and progression of individuals through recognition of stackable credentials and lifelong learning; and

3. Offered career advisory services or referral mechanisms in addition to criteria 1 and 2 listed above.

All three criteria, together or separately, relate to multistakeholder platforms designed and developed to address needs in education, training and lifelong learning to improve employability and career progression. Table 1 lists the cases included in this study, their place of origin and where to locate them online.
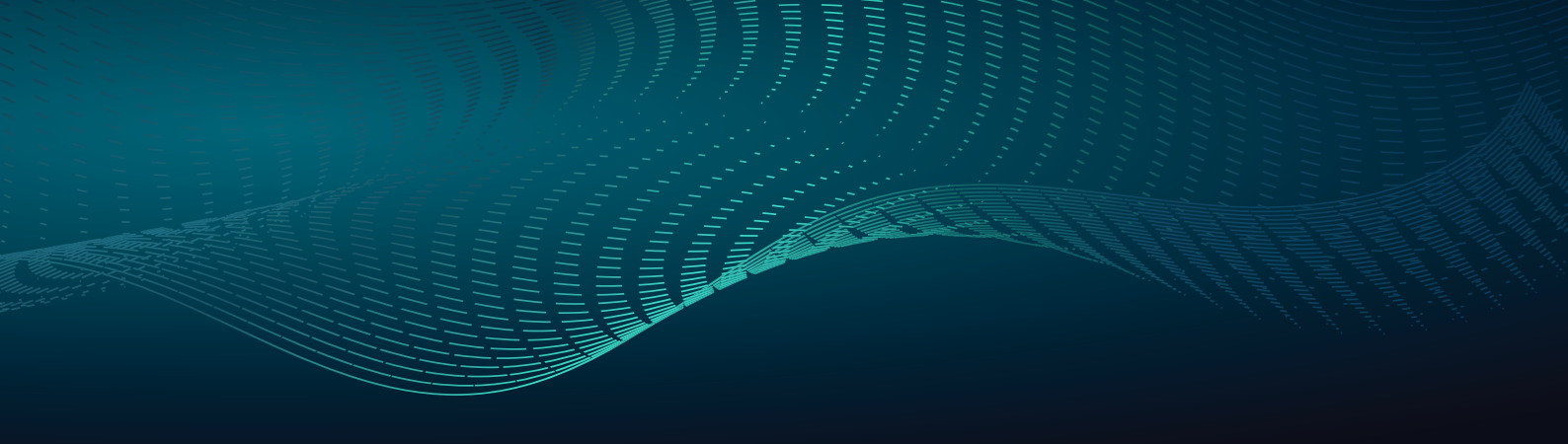
Table 1: Cases studies, their place of origin and online locations

No.	Digital platform	Origin	URL
1	**European Blockchain Services Infrastructure**	Europe	https://ec.europa.eu/digital-building-blocks/wikis/display/EBSI/Home
2	**Credential Engine**	USA	https://credentialengine.org/
3	**MyCreds**	Canada	https://mycreds.ca/
4	**YoMobi**	South Africa	https://yomobi.org/
5	**Yoma**	South Africa	https://www.yoma.africa/
6	**National Skills Development Corporation**	India	https://nsdcindia.org/
7	**Case Study 7***	Global presence	

* The interviewee in Case Study 7 has requested to remain anonymous.

3. Key concepts

This section illuminates concepts essential to delve into when examining governance. The selection of these particular concepts over others stems from the recognition of their significance and their direct relevance to the research topic. Explaining key concepts holds immense importance as it provides a solid foundation for understanding the complex landscape of governance. For example, by elucidating the concepts of data privacy, different types of governance and governance models, we aim to equip researchers and readers with the knowledge and insights necessary for navigating this field effectively.
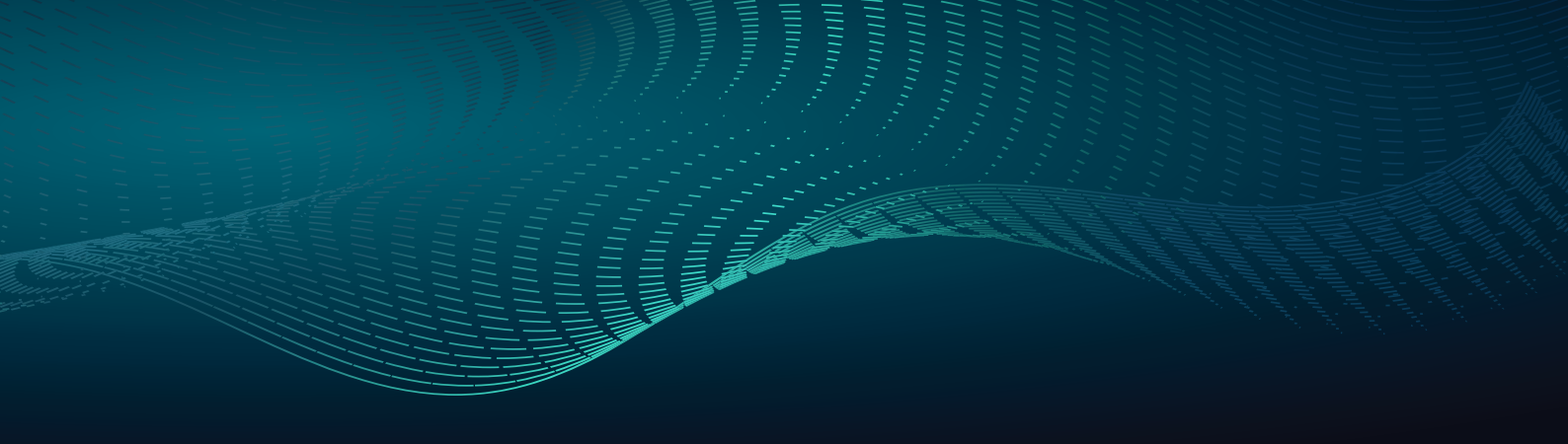
3.1 Data privacy

Data privacy is a pivotal concept, chosen because of its increasing prominence in today's interconnected world. As individuals and organisations generate and exchange vast amounts of data, safeguarding the privacy and security of personal information becomes paramount. Understanding the intricacies of data privacy empowers researchers to assess its impact on governance practices, enabling the development of effective policies and regulations to protect individuals' rights.

The surge of digital platforms in education, specifically to offer online learning during the recent pandemic, has also brought attention on a large scale to issues of data privacy, respecting individual rights and the right to privacy and security of learners. Countries have developed legislation for the protection of citizens' rights in response to the governance surrounding data privacy issues. Despite data legislation and regulatory frameworks coming into effect, it has been difficult for governments to monitor compliance. With data privacy under the spotlight, and with regulations such as the European Union's General Data Protection Regulations (GDPR) and South Africa's Protection of Personal Information Act (POPIA) evolving across the globe, data-driven organisations are getting more strategic about their data governance. They are putting data governance policies and strategies in place that will inform how data is managed within their organisation.

Automation also plays a key role in dealing with data compliance. Automation assists organisations in streamlining their governance tasks – such as adding business terms to glossaries, aligning teams on shared definitions, tracking data lineage so users can see data's origin and transformation, using machine learning to increase the speed and accuracy of metadata capturing and categorisation, which adds context to data for effective 'hands-free' governance (Rushin, 2021). Furthermore, automated data governance tools make data governance cost effective compared to conventional ways of managing data.

Platform developers have also had to review their practices when developing data-centred systems. 'Privacy by design' (PbD) has become the focal point of all software development projects. It is a proactive measure that aims to embed the concept of privacy in all data-processing activities from the outset. PbD

is not a reactive measure or countermeasure taken in response to a breach, rather it ensures that privacy is firmly established across the assessment, design and operations of an organisation's tech culture and, as such, is not limited to software or a product (Saraswat, Venkata and Shukla, 2021). PbD has seven foundational principles (Cavoukian, 2011):

1. Proactive not reactive – preventative not remedial;

2. Privacy as the default setting;

3. Privacy embedded into design;

4. Full functionality — positive-sum, not zero-sum;

5. End-to-end security — full lifecycle protection;

6. Visibility and transparency — keep it open; and

7. Respect for user privacy — keep it user-centric.

These principles are embodied within another important framework for digital governance, namely self-sovereign identity (SSI), which allows individuals to control their identity information as well as their verifiable credentials. SSI is one of the few new ways in which developers are making sure that PbD is implemented when developing data-centred systems. SSI encompasses the principles of PbD and expands on them to include key principles such as decentralisation, portability, equality and participation, making SSI software developers' go-to model for data privacy and managing digital identities. It has also encouraged organisations that adopt SSI as a model for data privacy to include foundational principles of PbD in their governance frameworks, provided they are in line with the legal requirements of their jurisdiction.

Subsequent to PbD, Article 25 of the GDPR stipulates the requirement of 'data protection by design and by default', which goes hand in hand with PbD. Data protection by design and by default requires that a data control system must, both at the time it determines the method for processing and at the time of the processing itself, implement appropriate technical and organisational measures (such as pseudonymisation) that are designed to implement data-protection principles (such as data minimisation) in an effective manner and to integrate the necessary safeguards into the processing in order to meet the requirements of this data protection regulation and protect the rights of data subjects (Intersoft Consulting, 2018). Together the principles and guidelines articulated in the GDPR in relation to 'privacy by design' and 'data protection by design and by default' provide solid guidelines that should inform data governance frameworks and policies, ensuring compliance with international and local standards and regulations.

However, in terms of data privacy, citizens often lack awareness of their rights, and there is a significant lack of advocacy for legislation addressing this issue. The Open Society Foundations found that there was a lack of good GDPR compliance advice in the public domain, especially advice tailored to non-profits. Recognising this, the European Commission established a dedicated budget-line so that national data-protection authorities could assist small and medium-sized enterprises in understanding and complying with the GDPR (Franz, Hayes and Hannah, 2020).

Further efforts are required to empower individuals to exercise their right to refuse the sharing of their personal data without consent. This highlights the importance of implementing governance frameworks on digital interoperable platforms to ensure that the collection, sharing, access and monetisation of data is transparent to all citizens.

3.2 Governance in context

Exploring different types of governance broadens the scope of analysis and fosters a comprehensive understanding of governance mechanisms across diverse contexts. In most instances, the governance focus is on a single owner of a digital platform, who becomes responsible for the governance mechanisms of that platform. Where there are multiple stakeholders involved within an ecosystem, governance mechanisms become complex.

There are many interpretations of governance, and a comparison of how governance is defined in the literature is worth interrogating. The Institute on Governance defines governance as the process whereby societies or organisations make their important decisions, determine who has a voice, who is engaged in the process and how account is rendered . On the other hand, Governance Today explains that governance is a system and process, not a single activity; because the process of understanding our changing world does not happen by chance, it requires leadership, commitment and resources from a governing body to establish and maintain such a system within the organisation. Good governance offers stakeholders confidence in how organisations are led and managed.

Interoperability governance

According to Digital Health Europe, interoperability governance refers to the ownership, definition, development, maintenance, monitoring, promoting and implementing of interoperability frameworks in the context of multiple organisations working together to provide services. The goal of interoperability governance is to ensure that data is shared seamlessly, accurately and securely between different systems regardless of their underlying technologies, platforms or data formats. Interoperability governance allows for the integration of different platforms, which provides for an improved user experience. Users are able to switch between platforms without having to worry about compatibility issues or data loss.

Importantly, Schoentgen and Wilkinson (2021) caution that while technology has great potential for positive change, it also presents ethical and social challenges. Governing bodies should therefore consider the broader implications of their technology initiatives and take steps to minimise negative impacts while maximising positive outcomes. Interoperability governance can be complex, requiring coordination between different stakeholders, including businesses, regulators and users, making it difficult to implement and enforce policies and standards effectively.

Interoperability governance can also reduce platform differentiation, posing challenges for digital platforms to distinguish themselves from their competitors, potentially leading to market consolidation.

Security risks can become an issue as interoperability governance requires different digital platforms to share data and information with each other. If not properly secured, data breaches or other cyber threats can occur.

While interoperability governance can promote innovation, it can also stifle it. If standards are too prescriptive, they could limit the flexibility and creativity of developers, making it more difficult for them to innovate. Given that interoperable digital platforms are designed to foster collaboration and partnerships between organisations and individuals, governance bodies should encourage and facilitate these partnerships, to ensure that they are aligned with the platform's goals and objectives. A well planned and implemented collaborative approach is therefore imperative.

Collaborative governance in the context of digital interoperable platforms involving multiple stakeholders as users presents its own set of challenges. The process can be complex and challenging due to the varying interests and perspectives among users, including beneficiaries and donors. According to Emerson and Nabatchi (2010), common challenges include managing the conflicting interests of government, businesses and community organisations. Such complexity means that collaborative governance can be a time-consuming initiative, resulting in limited power and the risk of stalemate.

Collaborative governance should be inclusive and transparent. As such, it offers many advantages, including increased stakeholder engagement, improved decision-making and enhanced implementation (Ansell and Gash, 2008). Policy-makers need to carefully weigh up these factors to determine whether collaborative governance is the best approach for a particular context.

Iden et al. (2021) provide a helpful and comprehensive description of governance mechanisms in the context of digital platform ecosystems that aids in understanding the advantages and disadvantages of both interoperability and collaborative governance approaches. Digital platform ecosystems are described as 'open, adaptive, self-organising, not fully hierarchically controlled, meta organisation where actors' activities are coordinated by social-technical structures, such as a digital platform and governance mechanisms'. Governance mechanisms are seen as the roles, structures, processes and technologies that are necessary for the forming and sustained use of a digital platform ecosystem to serve its purpose (Iden et al., 2021).

But what do social-technical systems in the context of digital platforms mean? We see the socio-technical system as two separate but important facets of an interoperable digital platform – one of technology and the other of people – coming together for the core business of delivering a service for which the platform was developed originally. Having established that the technology is a tool and an enabler, the authors of a recent publication by UNESCO and the Commonwealth of Learning (Grech, Balaji and Miao, 2022) highlight that policy-makers and decision-makers must avoid technology-first approaches, known as 'techno-solutionism'. Instead, they should ensure that human capacities are genuinely enhanced and human agency defended before deciding whether any technology – including blockchain – should be adopted. Furthermore, they should also consider how technology can make a positive contribution to the context in which it is potentially being introduced. This means that, when establishing a suitable governance framework, the decision path for every organisation will have to be nuanced to suit the needs of the specific ecosystem within which the technology solution is being developed.

3.3 Social-technical structures

In the context of digital platforms, social-technical structures refer to the combination of technical and social elements that form the underlying infrastructure of an interoperable digital platform. Social-technical structures are the ways in which technical and social systems are intertwined to support the operation and governance of the platform. In terms of governance, social-technical structures refer to the combination of social and technical systems that govern the behaviour of platform users and the functioning of the platform itself (Bijker, Hughes and Pinch, 2012).

Social structures in this context refer to the social norms, rules and practices that govern how people interact with each other on the platform. These can include things like community guidelines, terms of service and user policies, as well as informal norms around acceptable behaviour, communication styles and forms of content. *Technical* structures refer to the design and architecture of the digital platform itself, including its algorithms, user interface and features. These structures influence the way people interact with each other and the platform, shaping user behaviour by creating incentives or constraints.

Together, social and technical structures can create a complex web of interactions and incentives that shape the way people use digital platforms. For example, a platform's recommendation algorithm can influence the types of content that users see and engage with,

which in turn can reinforce particular norms and behaviours. Similarly, community guidelines and user policies can help to shape the norms and values of a platform's user community, while technical features such as reporting tools and moderation systems can help to enforce those norms and ensure the platform remains a safe and welcoming space for all users.

The social-technical structures in an interoperable digital platform can have a significant impact on the success and sustainability of the platform, as well as on the trust and confidence of its users. It is important for the governance framework to consider these structures in order to ensure the platform is governed in a transparent, accountable and inclusive manner. Social-technical structures highlight the importance of considering both technical and social elements in the design and governance of interoperable digital platforms, and the need for a multistakeholder approach, to ensure the transparency, accountability and inclusiveness of these platforms (Kitchen, 2014).

3.4 Types of governance models

Digital platforms have become integral to modern society, influencing various aspects of our lives, including communication, commerce and social interactions. Understanding the different governance models employed by these platforms is crucial for assessing their impact on users, ensuring fair and equitable practices and promoting responsible and ethical digital environments. Investigating governance models provides valuable insights into the frameworks and structures that guide decision-making processes and ensure accountability. By comprehensively exploring governance models for digital platforms, we also gain valuable insights into the structures, mechanisms and decision-making processes that shape their operations. Hence, the researchers embarked on an in-depth review of decentralised, centralised and hybrid governance models and the benefits and drawbacks of each. These observations were instrumental in formulating this report's recommendations.

Centralised governance models

Centralised governance models are characterised by a single centralised body that has complete control over the system and its operations. Centralised models are often simpler to design and manage in comparison to other options and can offer better performance in terms of speed and efficiency. Processing all transactions and decisions through a single entity reduces the complexity of the system and eliminates the need for coordination between multiple players.

However, centralised models have several drawbacks, especially in terms of scalability, security and reliability. As the number of users and transactions increases, centralised systems can become overwhelmed, leading to performance bottlenecks. In addition to being vulnerable to single points of failure, centralised systems are also susceptible to attacks.

Decentralised governance models

Decentralised governance models, on the other hand, distribute control and decision-making power among multiple entities, enhancing their scalability, security and reliability in comparison to centralised systems. Decentralised systems can handle a large number of transactions and users and are less susceptible to single points of failure or attacks.

Additionally, decentralised systems allow for the distribution of risk among multiple entities, reducing the overall risk to the system.

However, decentralised models have their own drawbacks, such as complexity and coordination issues. Often more complex to design and manage, decentralised systems require coordination

between multiple entities to ensure they operate effectively. Additionally, transactions and decisions are processed by multiple entities in decentralised systems, which can lead to increased network latency and inefficiency.

In an evolving technological world, governance mechanisms must consider many possible applications while maintaining transparency, for example the use of smart contracts that can automatically enforce the terms of a contract between parties. Stored on a blockchain, a smart contract is a digital agreement designed to facilitate, verify and enforce the negotiation or performance of a contract. A smart contract's code is written in a programming language and stored on a blockchain, which acts as a decentralised and secure platform for executing the contract. When the conditions specified in the contract are met, the smart contract automatically executes the terms of the agreement without the need for intermediaries or third-party enforcement (Marr, 2018). In summary, smart contracts are a powerful tool for automating and enforcing agreements in a way that is secure, transparent and efficient, without the need for intermediaries or centralised authorities.

Hybrid governance models

Both centralised and decentralised governance models have benefits and drawbacks, and the choice of governance model depends on the specific requirements and constraints of the system in question. For example, decentralised systems may be more suitable for systems with large numbers of users or high security requirements while centralised systems may be more suitable for systems with lower security requirements or a smaller number of users (Chen, Li and Wang, 2020).

The hybrid governance model seems to offer the best of both worlds by combining elements of both centralised and decentralised systems. A hybrid model can take advantage of the benefits of centralised and decentralised models while mitigating their drawbacks.

One advantage of a hybrid governance model is that it can provide a balance between scalability, security and reliability. For example, a hybrid model can centralise critical components that need to be tightly controlled while decentralising less critical components that require more flexibility. This can help to ensure the system remains secure and reliable while allowing for scalability and flexibility.

Another advantage is that a hybrid governance model can facilitate innovation and experimentation.

By allowing for some decentralised components, a hybrid model can provide a space for experimentation and innovation, which can help drive the development and evolution of the system.

Several academic studies have explored the benefits of hybrid governance models. For example, the paper 'The rise of hybrid governance' (Khanna, 2012) explores the rise of hybrid governance in the 21st century, which can be adapted through further research to implement such approaches for work and learning ecosystems.

In conclusion, a hybrid governance model can provide a balance between scalability, security and reliability, and can facilitate innovation and experimentation. The choice of a hybrid governance model depends on the specific requirements and constraints of the system in question, and the balance between centralised and decentralised components will vary depending on the specific context. There is no one size fits all and the appropriate governance model and structure must be best suited for the ecosystem within which the interoperable digital platform is developed in line with its purpose and long-term vision. Perhaps what we can consider for now is more dialogue amongst ecosystem stakeholders and begin to develop principles for common approaches in developing governance frameworks.

"*Governance mechanisms must consider many possible applications while maintaining transparency.*"

4. Case studies

To initiate discussion during the interviews, the case study participants were asked the following general questions:

- When was the platform established?

- How was the platform established (private or public funding, or partnership)? If public, what is the role of the public entity?

- What problem is the initiative addressing and why?

- Who are the users of the platform (employers, learners, education and training providers)?

These preliminary questions were designed to solicit deep insight into what the digital platforms do, how they started and what purpose they serve. Responses were insightful and gave the researchers a good idea of how the platforms were conceptualised, established and structured. A summary of each case below offers a general overview. The reporting lines that show the relationship between management and the governing structure for each entity are crucial. The overall stakeholder groupings, or 'actors', within each ecosystem are also detailed.

These preliminary questions were designed to solicit deep insight into what the digital platforms do, how they started and what purpose they serve.

4.1 Case study governance in relation to their structure

Case Study 1 – European Blockchain Services Infrastructure

The focus of the European Blockchain Services Infrastructure (EBSI) is to leverage blockchain technology to accelerate the creation of cross-border services for public administrations and their ecosystems with the purpose of verifying credentials and making services more trustworthy. The European Union (EU) region needed a digital identity and digitally verifiable credentials system that could make it easier for EU citizens to move from one member state to another without the administrative burden for them or their governments.

The EBSI was established in 2018 by the European Blockchain Partnership (EBP), a collaboration between the European Commission and and all EU member states (27) plus Liechtenstein and Norway (European Commission 2021a). Initially financed through the Connecting Europe Facility programme, the EBSI is now funded by the Digital Europe Programme, which is a new EU funding programme focused on bringing digital technology to businesses, citizens and public administrations. Both funding vehicles are public initiatives implemented by the European Commission. The platform has been developed as a public good that is able to support education and lifelong learning within multiple business domains for users such as universities and students, and for businesses that require the service of verifying the credentials attained by students.

The governance of the EBSI platform is organised by a community of users, producers and consumers. The platform is governed by the EBSI Council, which has endorsed a set of governing principles. The primary governance principle is that the platform should facilitate a distributed consortial effort, with the secondary principle being to maximise transparency and community input.

KEY TAKEAWAY

The EBSI platform is governed by an external body of experts and is publicly accessible and open for participation by everybody. The EBSI wants to be as transparent as possible about how the EBSI platform will be governed because the founders believe this is important for its success. The EBSI Council comprises of representatives of each EU member state and is in the midst of developing policies, guidelines and strategies for the implementation of a governance framework.

Case Study 2 – Credential Engine

Credential Engine was launched in 2017 in the United States of America with the aim of mapping the credential landscape with consistent information and empower individuals to find the best pathways for learning and work. It also ensures the use of a common description language, namely the Credential Transparency Description Language (CTDL), which is available under an open licence. CTDL can be used to describe (1) providers of any type of credential; (2) the credential itself; and (3) all of the skills and anything an individual needs to know about the credential itself in order to make comparisons. In so doing, the platform is able to provide evaluative analysis, build out pathways and make recommendations for learners, job seekers and employers. The CTDL is thus a family of schemas developed to describe credentials, learning opportunities, assessments, transfer values, jobs, competencies and related skills that individuals can acquire or need in order to perform specific tasks or roles.

The language is managed through Credential Engine's schema management system. Participating organisations publish data to the cloud-based Credential Registry, which hosts detailed information about credentials and skills that is accessible to anyone, from anywhere. The CTDL specification provides a structured framework for describing competencies and skills, including their relationships to each other, as well as their alignment to educational and occupational frameworks. This specification enables a consistent and standardised way of describing competencies and skills across different domains and contexts.

The three primary uses of the Credential Engine platform are to (1) catalogue and make transparent essential information about all credentials (e.g. diplomas, badges, certificates, certifications, apprenticeships, occupational licenses and qualifications/degrees of all types and levels); (2) support comparison, analysis and informed decision-making; and (3) provide APIs and other tools for publishing and consuming data from the Credential Registry, which is structured as CTDL-linked open data to support tools and services that benefit students, workers, employers, educators and policy-makers.

The use of CTDL has been growing in the education and training industry as it allows for the better matching of education and training programmes to the needs of learners and employers. CTDL can be used by any organisation to support a wide range of use cases, for example assessment and competency mapping to create competency-based assessments that focus on demonstrating mastery of specific competencies and skills rather than relying solely on traditional measures of knowledge acquisition.

Credential Engine is a not-for-profit organisation, governed by a board of directors and managed by a chief executive officer. Board members represent an array of industries and professions who are leaders in their fields, including representatives from state government, business and non-profit organisations, national and international standards organisations, and education institutions. Multiple advisory and task groups are also maintained along with policies on how CTDL is updated. Although well funded, Credential Engine also has a business model that allows it to sustain itself.

Credential Engine recently launched an international advisory group to provide guidance on increasing partnerships that support credential transparency and data interoperability. The organisation offers service packages with options that charge for technical expertise when helping states and organisations apply CTDL to their operations. Their partnerships include contracts with state agencies, institutions, regional foundations and the US Navy.

KEY TAKEAWAY

The Credential Engine platform is governed by a board made up of a variety of stakeholders, whose members include representatives from state government, business and non-profit organisations, national and international standards organisations and education institutions. Platform governance also includes a CTDL Advisory Group and working groups with members from around the world and across the stakeholder community.

Case Study 3 – MyCreds

Launched in Canada in the year 2020, MyCreds is helping Canada's colleges and universities deliver digitised and portable transcripts and credentials – including badges and microcredentials – to post-secondary learners online anytime, anywhere (ARUCC, 2020). MyCreds is a platform developed by the Canadian government that allows individuals to access and share their academic achievements in a secure and verifiable way. MyCreds is governed and owned by the MyCreds Foundation as a federally incorporated not-for-profit association with the mission to create a platform that gives every citizen the opportunity to have lifelong access to their personal verified information. Established by the Association of Registrars of the Universities and Colleges of Canada (ARUCC), MyCreds aims to provide fast and easy access for students and graduates to request and send their transcripts, graduation awards, credentials, badges and other academic documents to employers, government and others all over the world.

MyCreds has about 350,000 user wallets and over 500,000 documents and credentials in circulation. There was no seed funding for the platform until Canadian higher education institutions were asked to voluntarily fund the initiative. Territories within Canada sponsored the initiative at a grassroots level with a small number of passionate founders and community leaders who championed the initiative. In two years, MyCreds has gone from zero to 39 universities and was officially launched in November 2022. Seneca College and Toronto Metropolitan University were the first concept schools in summer 2020, with the University of Lethbridge the first school to launch on MyCreds.

The platform is designed to be accessible and understandable to all users, and any changes to its governance or policies are communicated clearly and openly. MyCreds, developed and maintained through a partnership between government, education institutions and other stakeholders, is governed with a focus on collaboration to ensure it meets the needs of all users and remains relevant and effective over time.

Overall, the most important thing about MyCreds' governance is its commitment to privacy, security, transparency, accountability and collaboration. These principles are essential for ensuring that the platform is trustworthy, effective and accessible to all users.

KEY TAKEAWAY

The MyCreds platform is governed by an elected board and its sustainability is based on grant funding from the government, both as an incentive and as a form of support. MyCreds operates with transparency and accountability to help people understand and trust their services. Policies have been developed that guide the operations of the platform while the management of the platform is outsourced.

Case Study 4 – YoMobi

YoMobi is a South African platform that was launched in June 2022. Through its research, YoMobi found that organisations are severely constrained in their access to technology due to a whole range of factors that are not limited to resourcing (such as limited funding for ICT), skills backlogs, lack of dedicated ICT support, etc. YoMobi was established as a result of the research findings.

The platform is aimed at digital transformation, with the goal to empower organisations that work with the youth using technology by creating a suite of digital tools that support positive outcomes. The main users of the platform are youth and civil society organisations working together as a network. YoMobi has over 60 organisations represented on the platform and, at the time of the interview, it was targeting reaching 70 before the end of 2022. The platform was a result of a public-private partnership between UNICEF, PwC and Capacitate, who also provided the funding. For ongoing sustainability, and to add more functions and features, YoMobi is crowdfunding and charging for-profit organisations to use the platform.

KEY TAKEAWAY

The YoMobi platform has an independent operator that provides first-line support that, for example, helps onboard organisations onto the system, and open and close tickets, etc. The previously unemployed young people who staff the organisation are trained to use the platform and other platforms so that they can serve as support agents for platform users, carry out community-building and awareness-raising, and also provide user base-testing for the enhancement and extension of the system.

A technology partner is responsible for maintaining the code base, infrastructure and providing additional technological support. YoMobi is in the process of establishing a steering committee to oversee operations, which will provide structures to the governance and use of the platform. The steering committee will be composed of the funding partners, the technology partner, the founding partners holding the original IP and representatives from the operator itself.

Case Study 5 – Yoma

Yoma (Youth Agency Marketplace) is a digital platform on which the youth can develop their skills, find opportunities and achieve impact while connecting to peers in a supportive community. This is achieved through an inbuilt marketplace that connects the youth to the opportunities uploaded by education and training partners and future employers. Using ethical and privacy-preserving machine learning algorithms, AI and psychometric tools, Yoma identifies, nurtures and connects hidden talent, providing individualised learning-to-earning pathways.

Launched in January 2021, it was initially funded by community and private donors, namely the Botnar Foundation and GIZ (the Deutsche Gesellschaft für Internationale Zusammenarbeit), keeping in mind that donor funding will not always be available and that the current business model is not sustainable. In the hope of maintaining their sustainability, Yoma is considering alternative revenue-generating options such as offering freemium services and ranking job listings to boost income.

The Yoma platform is governed by its user, designer and developer communities. The general approach to governance includes participation in open-source projects and working groups. However, it has also built a Trust Framework by developing self-sovereign identity (SSI) functionality through blockchain technology. Yoma has recently published an interesting report that details the phased process of its development (Sroor et al., 2022, p. 271), which is quoted below:

> Model creation took place in four phases accordingly with data collection. Data were extracted from the meeting minutes and the initial document for the GF that was undergoing continuous development during all four phases.
>
> **Phase one: Governance models.** We modelled the key actors and their roles in the ecosystem, then linked each actor/role to their rights, responsibilities, and incentives gained from being part of the ecosystem. We took into consideration that each actor could have only one role or multiple roles; for example, Education Opportunity Provider had two roles: the first is Youth Credential Issuer, and the second is a Yoma Organisational Member.

> **Phase two: Modelling business aspects.** The primary concern was the business activities for each actor/role. We linked each actor/role to their revenue model and to the expected costs, including cost type (fixed or variable).
>
> **Phase Three: Technology model.** The technology model represents Yoma's services, for example, Employment Provider Onboarding, Notifications, and Credentialing. It also represents technology components, for example, the Yoma platform, framework, applications, and middleware. Lastly, data objects and data storage, Indy ledger, Aries wallet, and different data storage components.
>
> **Phase four: Legal and regulatory aspects.** The legal and regulatory model represents all the agreements that control actors' interactions.

KEY TAKEAWAY

Yoma has an open process for developing governance procedures and structures that includes all stakeholders, with the aim of remaining accountable to the community they serve. The Yoma ecosystem has been built using a value-based engineering methodology in which youth defined their core values as privacy, personal self-development, trust, community, fairness and inclusion. These values serve as the basis for the whole platform's technology and governance design. The governance system for the SSI layer of technology (that ensures data privacy and security) is mutually shared to enhance transparency and serves as a baseline governance framework on which other digital platforms in education can develop customised frameworks to suit their needs. As such, Yoma's governance framework is not generalised for all interoperable digital platforms.

Case Study 6 – National Skills Development Corporation

Established on 31 July 2008 by the Indian Ministry of Finance, the National Skill Development Corporation (NSDC) is a non-profit organisation aimed at promoting skills development in India by creating vocational schools of a high standard and offering funding to develop scalable and profitable vocational training initiatives. The aim of the NSDC is to promote and develop the skills of India's workforce, with a focus on creating opportunities for youth and women to acquire relevant skills and improve their employability. Furthermore, as part of its mandate, the NSDC provides support services for faculty training standards, curriculum, quality assurance, information systems, and more.

Established as a public-private partnership, with the Government of India (through the Ministry of Skill Development and Entrepreneurship) holding 49% of the NSDC's share capital while the private sector holds the balance of 51%. Due to the government's involvement, the NSDC is able to hire full-time staff members to manage day-to-day operations.

Before the NSDC was established, the ministries were siloed. However, in 2022, the government put in place a new policy that interlinked of all these ministries, allowing for seamless interoperability between them. This approach is similar to what the PSET CLOUD is trying to achieve with key PSET stakeholders in South Africa. Before the systems were interlinked, there was a lot of duplication, for example individuals would register on different ministry platforms as candidates and trainers without identifying themselves as the same person. With an interoperable system, the ministries are able to communicate with each other and verify peoples' identities and skills, thus eliminating duplication.

The NSDC works with various stakeholders – such as government agencies, industry associations, training providers and other organisations – to develop and implement skills development initiatives across different sectors and industries. Providing funding, accreditation and other support to training providers, the NSDC also facilitates partnerships with employers and industry to promote demand-driven and industry-relevant training.

The NSDC's mission is to skill India's growing workforce and improve the country's economic growth and social development. As such, the organisation has been instrumental in creating a strong ecosystem for skills development in India and has played a key role in implementing several flagship skills-development programmes, such as the Pradhan Mantri Kaushal Vikas Yojana (PMKVY).

KEY TAKEAWAY

The NSDC utilises an interoperable platform linking government departments for the purpose of sharing data between the education and employment sectors in India. It is wholly funded by the government and receives full support from several government ministries.

4.2 Insights and observations

With the exception of two entities, the NSDC, which is a public-private partnership initiative, and the EBSI, which is a multinational initiative of EU member states, the remaining platforms have all been initiated by 'founding members' who had a common vision, namely to address problems in the education sector by taking advantage of the opportunity technology offers. The problems are related to learners from learning institutions finding employment, meeting supply and demand, as well as the issuing of credentials and digital badges due to the surge of globally accessible massive open online courses (MOOCs). These challenges sometimes intersect, serving as pathways for learners to penetrate the world of work. In almost all cases of growth and progress, the organisation had grappled with its organisational structure.

All the cases showed a similar evolution around their growth, challenges and establishing workable governance frameworks to guide their activities and responsibilities. Five of them were established as non-profit organisations due to their requirements for an independent structure that could assume full responsibility for the initiative's activities. One respondent claimed that registering the entity as a non-profit should have come a lot earlier in the process and that much more progress would have been made through such a formalised structure.

All the entities began as donor-funded startups, heavily reliant on volunteer engagement and support from various governance committees and 'user groups'. The original start-ups were sustained through this model, with the main cost being technology infrastructure, including security monitoring and technology expansion and functionality.

> Formalising the structure has not been easy. There have been many considerations especially when there are several stakeholders involved and lots of planning for a good governance framework that all must agree to. (Case Study Respondent 3)

Establishing an institutional form and building a governance framework for interoperable digital platforms present common challenges that require time and effort to reach consensus with ecosystem stakeholders. All the case study respondents made clear that addressing these challenges early in the platform establishing process is a crucial step for providing the necessary guidance. This process could be cyclical and should ideally remain agile and flexible. Alignment between the social and technical systems is key.

Lines of authority

Does your organisation have full-time employees and a board of directors? How is the entity managed and operationalised?

While a common approach to establishing an institutional form was to register as non-profit organisations, another key process that emerged from the study was the need to establish lines of authority early on in the project, especially when securing donor funding and getting the initiative off the ground. A common feature among many cases was the establishment of a steering committee, which was considered as their most accountable body. These committees consist of funding partners, support agents, technology providers and volunteers with expertise who agree to serve as members.

The registered non-profit organisations have an internal structure with a full-time staff contingent and accounting authorities to whom staff report. Almost all the entities have separated the roles and functions of governance and technological development.

Governance is primarily the responsibility of the board (mainly established by founding members) and a steering committee that provides leadership and guidance. Technological development is often outsourced, with a technology working group reporting to the board and/or governing structure. Information publicly available on the entities' websites highlights the following:

YoMobi has a steering committee responsible for governance, support and guidance Then, on the same level, there is a technical support team responsible for platform maintenance, enhancement and technical support. An outsourced company, Engage, is the operator responsible for training, implementation support and community building. A graphic of the operating structure can be accessed here.

Credential Engine has a board of directors to whom the CEO and CTO report. In addition to a contingent of full-time operational staff, there are also three advisory groups, namely the EdTech Advisory Group, Occupational Licensing Advisory Group and the CTDL Advisory Group.

The NSDC has a board of directors to whom the CEO and the CFO report and the rest of the operational staff are full-time appointees.

While the EBSI currently allows anyone to operate an EBSI node, users/operators of these nodes have to abide by the EBSI's centralised governance rules and respect its General Conditions for Node Operators in order to ensure the integrity and stability of the network. The EBSI is in the process of changing its governance structure however.

Yoma is still in the process of implementing its governance and team structure but have done an extensive amount of work to decide on which governance model team structure to follow. A detailed view of their governance model can be seen here.

MyCreds currently uses service providers but does intend to hire full-time staff. These outsourced service providers report to a board of directors.

Case Study 7 has a CEO, who reports to a board of directors. Additionally, the company has several independent branches globally that are responsible for their own business development, growth, sustainability and meeting the specific market requirements of their respective localities. The interviewee highlighted that their management structure is a hybrid of centralised and regionalised presence due to the different business in various markets that they operate in. The organisational policies that govern the day-to-day running and management of the organisation are centralised. However, operating in diverse markets with different legal frameworks necessitates compliance with the regulations of each market while simultaneously upholding the central policies of the organisation.

The case studies reveal a separation of responsibilities among governance, management and technology administration, emphasising the importance of defining clear lines of authority between these different aspects of the digital platform.

Technology platform administration and management

How is the digital platform maintained?

Two platforms, MyCreds and Yoma, reported that their platforms are managed by external service providers, who manage different components of the platform. RLabs manages Yoma's operations while DIDx manages their IT infrastructure. Similarly, MyCreds has hired Duklas Cornerstone Consulting Inc. to assist with overall program management and Digitary Core to assist with technical support and to manage their IT infrastructure. However, MyCreds is currently in the process of hiring full-time staff members to run the platform's day-to-day operations.

Respondents from the other companies reported having internal full-time staff members with technology expertise to manage and administer their platforms, who are overseen by specific management and governance structures. These structures differ among the organisations, and capacity, expertise and overall day-to-day management are addressed when need arises. The running of their administration and management departments is dependent on available funds and the speed at which the digital platforms grow.

The deep dive into the case study companies revealed that the governance frameworks providing direction to operations and technology development consist of separate components. As development progresses, decision-making becomes aligned with the platform requirements, services and ecosystem demands. Maintaining digital platforms involves ongoing procedures that ensure their effective and efficient functioning. Some of the key activities involved in maintaining digital platforms include:

- **Regular updates and upgrades:** Digital platforms need to be updated regularly to ensure they remain compatible with the latest software and hardware developments, as well as to fix bugs and address security vulnerabilities.

- **Monitoring and testing:** Regular monitoring and testing of the platform can help identify potential problems before they become major issues. This can involve regular performance monitoring, and security and user testing.

- **Content management:** Digital platforms require regular management and updates to ensure the relevance and accuracy of their content, a process that involves content creation, editing and deleting.

- **User support:** Support is crucial to help users resolve any issues they encounter while using the platform. This can involve providing FAQs, user guides and helpdesk support.

- **Security and data protection:** Maintaining the security and integrity of the platform and its data is critical. This involves regular backups, disaster-recovery planning and implementing robust security measures such as firewalls, encryption and access controls.

- **Performance optimisations:** Performance must be optimised to ensure digital platforms are fast, reliable and responsive, which can involve optimising server configurations, databases and code.

Overall, maintaining digital platforms is an ongoing and multifaceted process requiring a range of technical and non-technical skills and expertise. Maintenance is crucial for ensuring digital platforms remain functional, secure and effective for their users.

Funding and sustainability

Does the current funding mechanism sustain the initiative? If not, what else does the entity do to generate an income? Is the platform for monetisation or for the public good (do you charge for these services)? How is the funding related to governance mechanisms?

During the interviews, it became apparent that funding for long-term sustainability was a key issue for most platforms, which all started off with donor funding. In most cases, the startup was governed by founding members and moved to include members of stakeholder groupings. The funding and sustainability of the platform is the primary responsibility of the board of directors or founding members.

Five of the platforms were funded through private-public partnerships while one was exclusively funded by government and the other comprised a merger between two organisations. With no guarantee of ongoing funding in the long term, the main challenge reported concerning sustainability was that most of the digital platforms are non-profit organisations. In addition, the majority of the service offerings are zero rated and without dedicated funding from donors sustainability becomes a challenge. The platforms are developed to address work and learning challenges and to provide solutions provided for the public good. Nevertheless, innovative ideas for generating income are emerging and the potential of offering services to companies for a fee are being considered.

> So, I don't expect that the services will be charged for in the future. We want to enable the marketplace as best as possible. So, we need to make sure that (buyers), well supply and demand, are both encouraged to be on this platform. We may in time, from the employer partner perspective, create some freemium functionality that they can pay for, maybe to get their jobs listed higher or, you know, offer some potential insights into their users because we sit with a lot of data. (Case Study Respondent 6)

A key takeaway from the interviews regarding the funding and sustainability of these non-profit organisations is that a good funding model is critical, one that clearly articulates how the organisation plans to remain sustainable. Relying on donor funding is not the best strategy idea and can jeopardise the development of the platform. The need for monetising the platforms became a common thread in the interviews, simply from the perspective of guaranteeing sustainability. Maintaining good relationships between the public and the private sectors are critical since most cases in the study were funded through public-private partnerships.

Finally, it must be acknowledged that the platforms' largest expenditure is on technology. Apart from remunerating technology experts, the big costs come from the continuous growth of the platforms. As revealed by one respondent:

> User wallets: 350,000 with over 500,000 documents and credentials in circulation and we are part of an international consortium with three million learners and ten million documents in circulation. (Case Study Respondent 4)

Unfortunately, the exact costs linked to the growing numbers of platform users were not provided, although understandably so. However, Table 2 provides a summary of the funding models that are currently at play in the digital ecosystem space.

Table 2: Types of funding in the digital ecosystem

Platform	Funded by	Type of funding
Credential Engine	Funded by the Lumina foundation, JPMorgan Chase and Co, Bill and Melinda Gates foundation, etc.	Private-public funding
EBSI	Initially financed through the Connecting Europe Facility programme, the EBSI is now being funded by the Digital Europe Programme, which is a new EU funding programme focused on bringing digital technology to businesses, citizens and public administrations.	Public funding
MyCreds	Funded by the Association of Registrars of the Universities and Colleges of Canada (ARUCC).	Public funding
NSDC	Established as a public-private partnership, with the Government of India (through the Ministry of Skills Development and Entrepreneurship) holding 49% of the share capital while the private sector has the balance.	Public-private partnership
Yoma	Initially funded by public and private donors, namely the Botnar Foundation and GIZ.	Public-private partnership
YoMobi	Funded by PwC, UNICEF and Capacitate.	Private-public funding
Case Study 7	Funded by the initiators.	Private funding

A deep dive into governance mechanisms for interoperable digital platforms for work and learning

Challenges

Some of the major challenges emanating from the evolution of the seven case studies can be attributed to digital platforms in general.

- Regardless of their purpose and aims, there are no internationally accepted guiding principles or governance frameworks for digital platforms in education.

- Several aspects of governance emerge as platforms are developed and the need for guidelines and rules become necessary. Policies are drawn up through a process of trial and error, which remain in place for extensive periods during the exploratory stages as a governance framework is built.

- Governance mechanisms are dependent on an organisational structure that is in turn dependent on the kind of business model that is adopted. They tend not to be planned in advance but rather on an 'as and when' basis.

- Collaborative governance and the decentralised autonomous organisations (DAOs) that bring social and technological aspects together require rules and regulations as well as decisions as to who is involved in making the rules.

- In a situation where there is no central owner, the governance of digital platform ecosystems is both challenging and crucial for innovation.

- It is apparent that what initially starts as a technology solution to address challenges of siloed operations within a given sector ultimately circles back to issues related to communication, cooperation and collaboration.

- It is not simply about finding the technological tools that will resolve divisions and silos, but rather about fostering the trust, openness and willingness to close the gaps that create divisions in the first place.

- Before a governance framework can be established, business models need to be developed and adopted that take the governance structure into consideration and who is part of it. The business model thus provides the 'how' for the technology and offers guidelines for future growth.

- The development of a governance framework is a cyclical and continuously evolving process. Accordingly, transparency and openness must be central in all multistakeholder processes to prevent unequal power relationships.

- The demand for digital platforms to enable credential fluency, the recognition of lifelong learning and jobs matching is escalating rapidly. As a result, the need is urgent for widely accepted governance frameworks that are transparent and trustworthy.

5. Conclusions, recommendations and principles

5.1 Choosing a governance model

The aim of this study was to investigate the existence of a standard governance mechanism or framework for interoperable digital platforms in education. Our examination of seven case study platforms has uncovered that each ecosystem presents unique and intricate challenges to overall governance, and that establishing relationships is a crucial first step in ensuring openness and participation among ecosystem actors. In the current digital landscape, the demand for interoperable platforms that facilitate smooth communication and data exchange among various organisations and systems is on the rise. However, effectively governing such platforms is a multifaceted issue that requires thoughtful deliberation.

Combining centralised and decentralised governance structures can be an effective solution to address the challenges of governance for a digital interoperable platform – this is known as a hybrid governance model.

As evident from the case studies, in the hybrid governance model, there would be a centralised authority responsible for overseeing the platform's overall strategy and direction, setting technical standards and ensuring compliance with legal and regulatory requirements. However, there would also be decentralised elements, such as community-driven decision-making processes and open access to data and APIs.

The key advantages of a hybrid model of governance for a digital interoperable platform include increased flexibility, transparency and accountability. This model can also help to balance the need for central control and coordination with the benefits of decentralised innovation and participation such as

using smart contracts. This balance will facilitate greater transparency in the governance mechanisms' decision-making processes and build vital trust frameworks.

Overall, a hybrid model of governance can be an effective way to ensure the long-term success and sustainability of a digital interoperable platform. By combining centralised and decentralised approaches, this model can help to create a platform that is both reliable and adaptable while also fostering innovation and collaboration.

Engagement of a wide variety of stakeholders within ecosystems in various countries has taken time and effort and continues to do so several years into the establishment of interoperable digital platforms. There is no common approach to developing governance frameworks and each ecosystem needs to consider the requirements and systems that would build trust in its own ecosystem. The first step in designing a governance framework for an interoperable digital platform is to understand the nature of the platform, including its purpose, scope and stakeholders – information that can be used to define the governance structure and the roles and responsibilities of different stakeholders.

Collaborative governance can be an effective way to address complex problems; however, it is important to ensure that power is distributed fairly among all parties involved. Power dynamics play a crucial role in collaborative governance – those with more power may dominate the decision-making process, leaving others feeling marginalised and disenfranchised. To avoid this, we must ensure that all stakeholders are given equal voice and representation in a collaborative process.
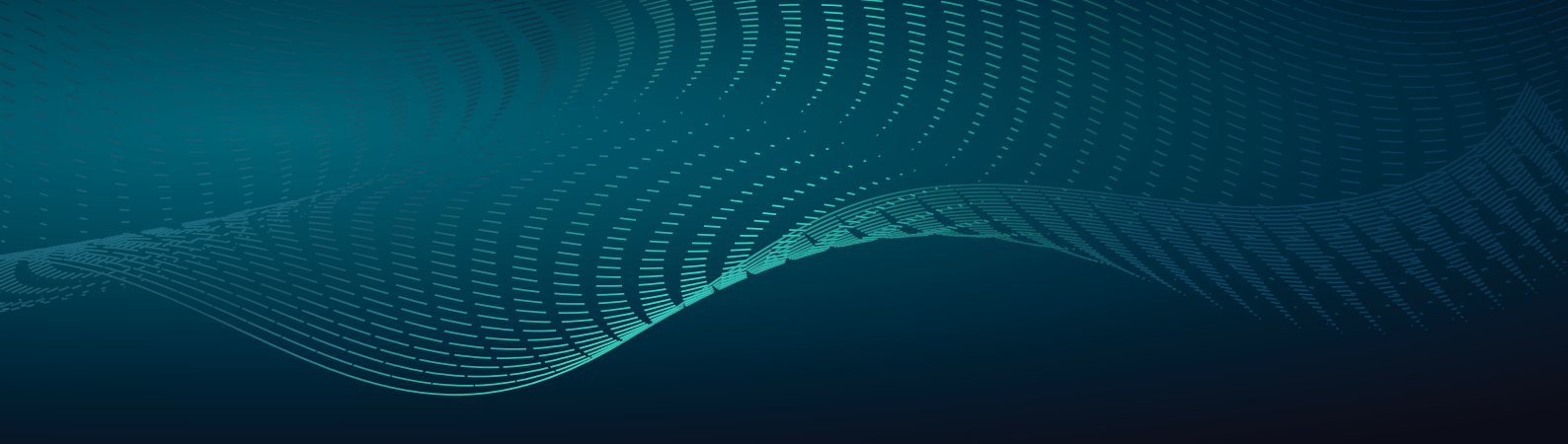
One way to achieve this is to establish clear rules and procedures for decision-making, including how decisions are made, who has the final say and how disputes are resolved. It is also important to ensure that all stakeholders have access to the same information and resources, and that their contributions are valued and respected. In addition, we must be mindful of the structural and systemic factors that contribute to power imbalances. This should include addressing issues such as economic inequality, discrimination and historical injustices.

Governance frameworks require a big picture approach with collaborative and inclusive dialogue to develop policies, principles, guidelines, regulations and standards. The importance of designing digital platforms that are inclusive and accessible to all users, regardless of their level of digital literacy or access to technology, cannot be overemphasised. By providing alternative means of access and participation, digital platforms can ensure that all users can fully engage in the governance processes and have their voices heard.

According to the researchers, there has not yet been a thorough global conversation or initiative regarding governance frameworks for digital interoperable platforms in the context of work and learning. As a result, innovative governance measures are required to establish an integrated framework at both national and international levels, and research such as this study should encourage future discussions on governance strategies.

While the study points towards a hybrid governance model and provides guiding principles to initiate international discussions and advance the conversation in the next section, we must remind ourselves that as digital platforms continue to grow in influence and impact, their governance models can shape the evolution of the digital ecosystem as a whole. Understanding these models enables researchers, policy-makers and stakeholders to anticipate emerging trends, proactively address regulatory gaps and design governance mechanisms that promote innovation, equity and sustainable development.

Overall, a hybrid model of governance can be an effective way to ensure the long-term success and sustainability of a digital interoperable platform.

5.2 Principles and practices towards developing governance frameworks

PRINCIPLE 1 **Collaboration and collaborative governance are key to the success of the platform in the long term.**	Multi-stakeholder platforms contain many voices, equating to many decision-makers. There must be a willingness to collaborate towards achieving common goals by establishing clear rules and procedures for decision-making, including how decisions are made, who has the final say and how disputes are resolved. This principle would help ensure that all stakeholders have a shared understanding of the governance process and can work together effectively.
PRINCIPLE 2 **Trust and transparency in systems, processes and activities is critical to the success of the digital platform.**	Trust and transparency have to remain high on the agenda and must be adopted as the key to successful governance and sustainability. Fostering a culture of trust and respect among stakeholders includes being transparent about decision-making processes, valuing different perspectives and ideas, and treating all stakeholders with respect.
PRINCIPLE 3 **Socio-technical aspects must be fully and transparently explored.**	Collaborative governance and DAOs bring the social and technological aspects together but still require rules. Consequently, stakeholders must actively pursue ways in which these two aspects are managed openly and in a transparent manner.
PRINCIPLE 4 **Ensure the diversity and inclusivity of governance structures.**	Ensure that the governance model is diverse and inclusive, with representation from a wide range of stakeholders, including those who may be marginalised or underrepresented such as civil society. This principle can help ensure that decisions are informed by a range of perspectives and that the governance model is responsive to the needs of all users.
PRINCIPLE 5 **A separation of functions in digital governance structures is vital.**	As is typical in corporate governance, a separation between the founders/directors and the managers responsible for internal control is particularly important to maintain a balance in power dynamics between them and with their users. Dispute resolution mechanisms are crucial to good governance at an individual and systems level and can be regulated through contracts. Such contracts must be detailed and well articulated.
PRINCIPLE 6 **Value creation for both public and private players is important to increase investment in the growth and sustainability of the platform, and is one way of ensuring full participation.**	Providing adequate resources will ensure that stakeholders have everything they need to participate effectively in the governance process. This may include providing training, support services, or access to relevant information and data.
PRINCIPLE 7 **Inclusivity and the agency of people who are not digitally connected or lack easy access to technology must be thoroughly considered.**	This principle can be achieved by designing digital services and interfaces that are accessible to a wide range of users, including those who may have limited digital literacy or access to digital tools. In addition, digital platforms should provide alternative means of access and participation, such as offline channels or support services, to ensure that all users can fully exercise their rights and engage in decision-making processes.

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