Center for Universal Education at BROOKINGS

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GOING DIGITAL

HOW LEARNING AND EMPLOYMENT RECORDS SHAPE ACCESS TO QUALITY EDUCATION AND JOBS

ANNELIES GOGER, ALLYSON PARCO, ROHAN CARTER-RAU, JESSA HENDERSON, KAZUMI HOMMA, ANI MELIKSETYAN, AND NATALIE MILMAN

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ANNELIES GOGER is a fellow in Brookings Metro at Brookings.

ALLYSON PARCO is a research analyst in the Center for Universal Education at Brookings.

ROHAN CARTER-RAU is a senior research assistant at the Center for Universal Education at Brookings.

JESSA HENDERSON is a doctoral candidate at The George Washington University, Graduate School of Education and Human Development.

KAZUMI HOMMA is a doctoral candidate at The George Washington University, Graduate School of Education and Human Development.

ANI MELIKSETYAN is a doctoral student at The George Washington University, Graduate School of Education and Human Development.

NATALIE MILMAN is a professor of Educational Technology at The George Washington University, Graduate School of Education and Human Development.

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CONTENT

EXECUTIVE SUMMARY

This report examines how digital credentials and learning and employment records (LERs) are shaping the ways people access education and career opportunities around the world. A wide range of education and labor market technologies are proliferating, especially in North America and Europe. Although these new technologies may expand opportunities for many learners and workers, they also risk leaving many communities and individuals behind.[1]

This report first summarizes major trends and debates about how education technologies are creating new opportunities and challenges for achieving the fourth United Nations Sustainable Development Goal[2] (SDG 4): equitable access to quality education and lifelong learning. Our contribution to these debates is to bring in evidence from three case studies on implementing and governing digital credentials, micro-credentials, and online learning. We conducted qualitative research (semi-structured interviews) and reviewed relevant literature to compile the case studies, with the aim of grounding the debates about education technologies and digital credentials in concrete settings where countries and higher education systems are adapting to digitalization in education and career pathways.

Despite growing interest and rapid growth in these ecosystems, the widespread adoption of digital credentials and LERs at scale is still in very early stages. The foundational institutions, regulatory frameworks, and policies needed to govern technology—in general and more specifically to help people make sense of the ever-expanding smattering of digital learning and employment options—are very nascent. Many initiatives, such as efforts to digitize credentials and learning records, struggle with low awareness, lack of technical capacity, data security risks, and limited shared understandings of how to approach digitalization. We argue that the gradual process of adoption presents an opportunity for key stakeholders such as governments, post-secondary education providers, and employers to better align their underlying systems and technologies around the goal of advancing ethical and equitable access to education and lifelong learning.

We understand equity as achieving parity in policy, process, and outcomes for all, considering power, access, opportunity, treatment, impact, and outcome. This requires creating opportunities for marginalized populations and closing gaps in achievement and employment outcomes, while recognizing that learners are starting from different points and have different needs.

The first case study, the Irish University Association MicroCreds initiative, examines a higher education and government effort to integrate micro-credentials into the existing national qualifications framework and shows the importance of partnerships and collaboration with business-led organizations, government, higher education, and other key actors. The second case study, Indonesia Cyber Education (ICE) Institute, examines how a consortium of universities in Indonesia implemented national education policies with expanded online learning options from universities like Harvard and Massachusetts Institute of Technology (MIT) on the edX platform to increase access to high-quality tertiary education for institutions with limited resources and geographic challenges. The third case study, the Digital Credentials

Consortium (DCC), examines an international network of 12 universities that are working to develop shared technological infrastructure for issuing degrees as digital credentials, conducting user research within higher education institutions, and producing open-source technologies that enable the issuance, storage, and verification of digital credentials.

Each case study provides positive examples of how technologies can be leveraged in innovative ways to increase access to quality education and lifelong learning (SDG 4), but the cases collectively demonstrate some common challenges. In each case, awareness and engagement with digital credentials and micro-credentials among learners, employers, governments, and others need to be further fostered to maximize the potential of the initiative. Each case also emerged from within formal higher education institutions, which may have limitations for extending these models beyond formal education. This focus on formal learning carries the risk of benefitting learners with relatively more privilege rather than closing the digital and socio-economic divide among learners (and workers). Finally, each case demonstrates the importance of building broad coalitions of partners to create an equitable and ethical digital credential ecosystem with a shared language and understanding about the technological options, potential benefits, and possible pitfalls.

Based on the interviews, case studies, literature, and feedback from public engagements alongside the United Nations General Assembly and related pre-conferences, we present a conceptual framework for guiding the further development of digital credentials and LERs. This framework builds on three key principles from the Global Convention on Higher Education[3]—equity, sovereignty, and mobility—which we expanded further to add trust. For each principle, we provide recommendations to guide the development of more ethical and fair education technology ecosystems that do more good than harm.

The first principle, *equity*, refers to fair recognition of learning, and the promotion of inclusive access to quality education and lifelong learning with deliberate consideration for how innovations can be accessed by all learners. We present recommendations focused on prioritizing user-centered design, alignment of existing systems, digital inclusion, technical assistance, skills-based hiring, and establishing clear goals and metrics for assessing progress toward equity goals.

The second principle, *mobility*, refers to the physical or virtual ability of individuals to switch between countries, regions, institutions, or career pathways for the purpose of learning or working. We recommend a focus on adopting interoperable, open standards and ensuring that an individual's data is easily portable between systems. In addition, we recommend that governments adopt multiple strategies to recognize non-formal and informal learning, and that employers shift away from degree-centric selection criteria in the hiring process.

The third principle is *sovereignty,* which means that individuals (or their guardians) are empowered to make informed decisions about the use and portability of their own data, that identity verification systems are transparent, and that there are adequate protections in place to preserve data privacy and security. We recommend governance frameworks and policies to foster interoperability and open standards, data rights legislation to enhance security and clarify ownership and privacy protections, and implement policies and enforcement mechanisms to ensure that education technology ecosystems are competitive and accessible to a diverse range of individuals and communities.

The fourth principle is *trust*, which means that digital credentials and digital records systems are set up in a way that employers, learners, workers, and education and training providers feel confident and informed about the reliability, quality, and meaning of the data, the individual's identity, and the credentials they have earned. We call for a greater focus on adopting linked data infrastructure for verification and quality assurance processes that are user-friendly and minimize risk of security and privacy breaches. Outreach and user input are also essential to create more awareness of the value-add and quality of digital credentials and LERs, and the adoption of shared

metrics on outcomes and qualifications frameworks can help improve transparency around quality and the value proposition of a given credential and career progression.

These recommendations—and the conceptual framework we have used to organize them—are meant to provide guidance on how different actors can engage with this complicated digital ecosystem to help create more equitable learning and employment pathways. Numerous organizations around the world are currently working on each of these recommendations, but further support, coordinated efforts, and engagement are needed at this vital stage of development to ensure the maximum benefit to learners.

INTRODUCTION

As digital technologies make their way into every industry, workplace, and job, the returns to post-secondary education and the need for expanding opportunities for lifelong learning have increased.[4] People around the globe are using smartphones and other devices to access education, update their skills, or find jobs. This comes alongside a growing demand for shorter-term trainings and credentials designed around the needs of someone who is working and trying to advance their education or refresh their skills.[5] In response, a digital marketplace of platforms and services that offer digital credentials, micro-credentials, self-paced asynchronous courses, and job matching has expanded rapidly. The COVID-19 pandemic rapidly accelerated these trends toward digital and remote learning, but it also led to tremendous learning losses and career setbacks, especially among people without broadband, devices, or digital literacy skills.[6]

In this report, we share key findings from our research on digital credentials and LERs and present three detailed case studies of initiatives to govern and implement digital and micro-credentials with the goal of achieving the fourth United Nations Sustainable Development Goal[7] (SDG 4): equitable access to quality education and lifelong learning. Equity is understood as achieving parity in policy, process, and outcomes for all, considering power, access, opportunity, treatment, impact, and outcome. This requires creating opportunities for marginalized populations and closing gaps in achievement and employment outcomes, while recognizing that learners are starting from different points and have different needs. The case studies help ground the debate about education technologies and their potential to improve equity in the context of specific countries and institutional settings.

Our research uncovered significant innovation and expansion in digital credentials and LERs; however, the adoption of digital learning and employment records on a large scale has been relatively slow, and there is still very limited awareness of these options among learners, employers, and post-secondary education institutions. The slow pace of adoption provides an opportunity for learners, educators, employers, and governments from diverse communities and educational settings to engage in these conversations—and in doing so, to build awareness and trust, which are essential for adoption. The pace also provides time to better align the underlying systems, programs, and technologies to increase equity and economic mobility and to minimize the risk to learners and workers, especially people from marginalized communities that historically have not been well connected to quality education and technology.[8]

Based on the interviews, case studies, literature review, and feedback from public engagements, we present a conceptual framework for guiding the further development of digital credentials and LERs. This framework builds on three key principles from the Global Convention on Higher Education[9]– equity, sovereignty, and mobility–which we refined further to add the principle of trust. For each principle, we provide recommendations to guide the development of more ethical and fair education technology ecosystems that do more good

than harm. We hope to make the complex and evolving ecosystem more accessible to non-technical audiences.

The definitions below may help clarify the use of key terms throughout the report. Note that "digital credentials" refers to the format of a credential (electronic); whereas "micro-credentials" refer to the duration of a credential. These are not mutually exclusive, and they both have a role to play in making lifelong learning more accessible.

Key terms

Blockchain: Blockchains are distributed digital ledgers—meaning there is no central repository for data—that are tamper-evident and tamper-resistant. Because there is usually no central authority such as a company or bank, they allow users to record and share transactions with each other, and once the transactions are published, they generally cannot be changed (Yaga et al. 2018).

Competency-based learning: Competency-based learning allows students to be more autonomous, perform better, and be more motivated due to a stronger sense of perceived control over their own education, often through flexible offerings such as remote or hybrid platforms. It ensures that students master prerequisite materials before advancing to more complex content, which improves learning outcomes and experiences (Goger & Laniyan, 2022).

Digital credentials: Similar to how a paper degree, certificate, or diploma signal someone's education, digital credentials offer an electronic way for individuals to verify and signal their education. Digital credentials can include traditional academic degrees, shorter-term credentials, and competency-based learning outcomes. Entities that produce digital credentials ("issuers") include employers, training providers, universities, licensing bodies, etc.

Micro-credentials: Micro-credentials recognize completion of a shorter-term learning program (compared to a two-year or four-year post-secondary degree) to signal an individual's level of qualification in the labor market. They offer learners the flexibility of learning at their own pace, so they could get through months of academic coursework in a few weeks or gradually progress in learning level over a period of years (OECD, 2021).

Digital badges: Badges are a type of digital credential. As the learner successfully completes learning activities or exams, they earn a badge that offers a shareable *visualization* that they have achieved a certain learning outcome, license, course, or certification which can signal their qualifications to an employer. Typically, digital badges are offered through online learning platforms, such as LinkedIn, Mozilla, Instructure Badging, or Credly, although they may also be offered in traditional academic institutions to signal career-specific skills.

Learning and employment record (LER): An LER is a comprehensive digital record of interconnected (linked) data such as employment, earnings, skills, and credentials. LERs bring data from multiple sources together, and various products and services can be built from them to enable users such as employers, learners, and training providers to document, verify, and transmit qualifications (American Workforce Policy Advisory Board, 2020). LERs can include data from formal, informal, and non-formal learning, such as skills acquired through self-instruction, military service, volunteer experiences, hands-on training, and work-based learning.

Digital wallet: A digital wallet is an online or smartphone application that individuals use to control and manage their learning and employment data. This could be particularly useful for individuals who elect to market themselves or generate a job application package or portfolio for potential employers or education programs. Digital wallets allow users to accept, store, display, and exchange digital credentials (Jobs for the Future, 2022).

Interoperability: Interoperability allows learners to store their data and information such that it can be securely and dynamically linked and moved across data platforms, institutions, and data systems. In the case of digital credentials, interoperability allows for learners and employers to verify identity, verify credentials and skills, and connect data from different sources through the use of shared data definitions (Engler, 2022). Proprietary structures, closed business models, and a lack of shared data definitions, standards, protocols, and data portability impedes interoperability and undermines the goal of recognizing learning and skills obtained outside a traditional degree program.

Open standards: An open standard is a non-proprietary, broadly agreed upon design guideline that is widely available for adoption, implementation, and redistribution. Common open standards are those of the W3C, which standardized internet protocols for websites and other aspect of internet communication. Examples of existing open standards are HTML, decentralized identifiers (DIDs), and verifiable credentials.

The global landscape of digital learning and employment records

Further accelerated by the rapid switch to remote learning and working in the COVID-19 pandemic, education technology ecosystems and the digitization of LERs have grown rapidly.[10] In our earlier landscape analysis this year, "Learning and working in the digital age: Advancing opportunities and identifying the risks," we examined:[11]

1. What are the leading global initiatives currently underway to develop digital credentials and LERs?
2. Where are they located?
3. Who are the main parties involved, and what problems are they trying to solve?

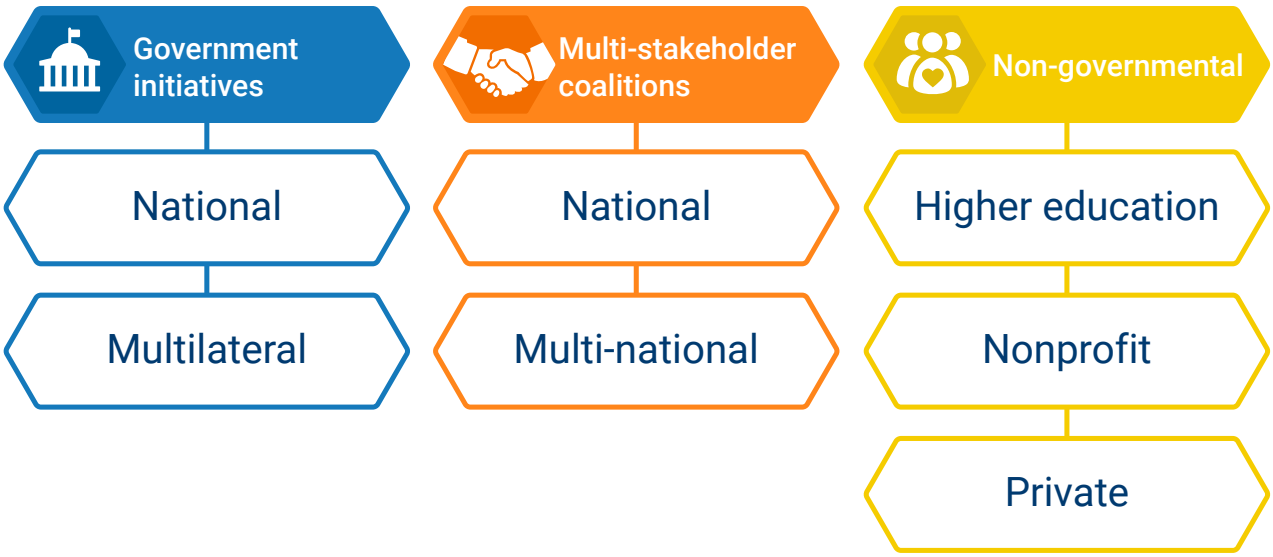
To investigate these questions, we conducted 45 interviews with key actors in the ecosystem, reviewed the literature, and participated in conferences and meetings. We found that global efforts to digitize learning and employment records were most prevalent in North America and Europe, although there were initiatives in low- and medium-income countries, as well. For example, we gained further insight on government and multilateral initiatives from the United Nations Educational, Scientific and Cultural Organization (UNESCO), New Zealand Qualifications Authority, U.S. National Governors' Association, and the E.U. Commission. We learned of projects and pilots from education technology experts and groups from the World Wide Web Consortium (W3C) Verifiable Credentials for Education Task Force (VC-Edu), the Groningen Declaration Network, and the Institute of Electrical and Electronics Engineers (IEEE). Additionally, we observed the growth of several nonprofit, higher education, and private sector initiatives to design and improve LERs, such as the U.S. Chamber of Commerce Foundation, Jobs for the Future, Learning Economy Foundation, Society for Human Resource Management, Opportunity @Work, and Digital Promise (Figure 1).

We found that there were several motivating factors to develop and implement digital LERs and digital credentials, including:

- New technologies (e.g., digital badges and digital wallets) offer a wider range of competency-based learning and skill signaling options to workers and learners;
- Digital credentials and micro-credentials offer cheaper and more flexible ongoing learning opportunities compared to traditional semester-based courses, which help adult learners overcome barriers such as cost, the need for child care, rigid work schedules, and transportation challenges.

FIGURE 1

Typology of digital learning and employment records initiatives



Source: Goger, A., Parco, A., & Vegas, E. (2022). *Learning and working in the digital age: Advancing opportunities and identifying the risks.* The Brookings Institution. Retrieved from https://www.brookings.edu/wp-content/uploads/2022/05/Learning-and-working-in-the-digital-age_FINAL.pdf.

FIGURE 2

Technologies are reconfiguring how people access skills and labor markets

Analogue: Learning via classrooms and workplace, applications on paper, and skill signaling through transcripts, paper diplomas, paper resume.

Online: learning through online courses and remote instructing; utilizing job boards, digital applications, and professional networks; demonstrating your skills through online degrees, certificates and professional licenses.

Platform: dynamic learning and credentialing; virtual/augmented reality trainings, gamified courses, and real time assessment; AI based job searching and candidate recommendations with skill matching; skill signaling with digital badges, nanodegrees, AI in candidate selection

Source: Goger, A., Parco, A., & Vegas, E. (2022). *Learning and working in the digital age: Advancing opportunities and identifying the risks*. The Brookings Institution. Retrieved from https://www.brookings.edu/wp-content/uploads/2022/05/Learning-and-working-in-the-digital-age_FINAL.pdf.

- Digital credentials and micro-credentials facilitate lifelong learning, particularly to refresh one's skills as technologies and equipment change and to stay competitive as often required by employers;[12]

- The ability to document, verify, and communicate learning achievements and competencies can help talent articulate their value in the labor market more holistically, and it can help facilitate a transition for employers from degree-based to skills-based hiring criteria;[13]

- To facilitate the use of skills-based hiring, including data analytics and algorithms to screen candidates or suggest learning and career pathway options for professional development;[14]

Technology is not simply moving traditional academic courses online, but innovating in several broader areas, such as through the growing use of online learning platforms, virtual and augmented reality, and job matching platforms (Figure 2). Online learning options have expanded such that digitally-connected learners around the globe can now find programs, trainings, and courses at all levels that they can access for free or at low cost, complete at their own pace, and start or stop at any time. HR (human resources) systems have evolved to use applicant tracking systems (ATS) and artificial intelligence in candidate screenings to identify patterns and make predictions for individuals with specific characteristics. Virtual and augmented reality learning options allow for learners to access simulated, hands-on, and gamified learning options that otherwise might not be possible—such as for people in rural areas, with disabilities or transportation barriers, or who cannot attend a class or training in person for other reasons, such as people who are incarcerated.[15]

Likewise, the COVID-19 pandemic has expanded remote work options, as well as the rise of international platforms for finding work in the gig economy and task-based work—with the highest engagement in these platforms coming from India, Bangladesh, Pakistan, the Philippines, and Ukraine.[16] For those able to access them, platforms expand access to opportunity by offering learners and employers more career information, curricula, networks, and credentials. Increasingly, platforms can also use algorithms to improve matches or offer customized suggestions that can ease career transitions or entry/re-entry into the workforce.[17]

Key challenges

Although these trends in how technologies are shaping learning and employment pathways have potential to expand opportunity and render job-relevant skills more visible[18] to make labor markets function better, there are also several potential risks and dangers. For example, while it is already possible for learners without degrees to accrue various digital badges and micro-credentials, it is still unclear to what extent employers value those credentials or see a bundle of them as comparable to a degree.[19]

Our research and analysis into digital learning and employment records ecosystems revealed several challenges related to the struggle of achieving equity in access to quality education and lifelong learning (SDG 4).

Access and Inclusion. A major gap in research and data is the demographic information needed to analyze the outcomes of digital credentials and how they have or have not included underrepresented communities in learning opportunities. Different learners value and seek out digital credentials differently,[20] and the lack of data and research in this area makes it challenging to measure the empirical outcomes. Digital credentials and online learning also rely on individual access to and understanding of technology, and yet more than one-third of the world's population—or 2.9 billion people—have never used the internet.[21] Even in areas with internet connectivity, maintenance and access to devices, such as laptops and tablets, remain unequal, creating another barrier.[22] The digital divide is especially pronounced in lower- and middle-income countries, putting learners from these places at major risk of being excluded from higher education, lifelong learning, professional networks, and decent work opportunities. This intersects with other existing inequalities, such as gender gaps. Girls and young women have disproportionately little access to technology compared to boys and experience more exposure to online violence and harassment, resulting in a slower development of necessary digital skills.[23] Creating a labor market that revolves more around digital systems will exclude people who lack internet access or strong digital literacy.[24] Another issue arises from the format of digital learning, which is primarily available in English, further limiting who can benefit from it.[25] Direct engagement and participation from a diverse range of actors and country representatives are essential to fully understanding the needs, challenges, and goals in different places to be successful in expanding access to quality education and lifelong learning (SDG 4).[26]

Data ownership and rights. Education technology experts often propose that digital credentials can be used to increase learner ownership and empowerment by providing control over all aspects of their data, including the ability to share or not share it.[27] However, some governance frameworks must be in place to provide learners with a basic level of control, protection, and security to clarify and protect individuals' rights. For example, the European Union (EU)'s General Data Protection Regulation (GDPR)[28] harmonizes privacy laws and requires that technology providers take certain steps to protect users from personal data breaches. GDPR requires two-factor authentication, encryption, data policies, and trainings, as well as privacy rights for information, access, erasure, and portability, among others. Similarly, the California Consumer Privacy Act[29] was implemented to provide users more control of their personal information, with new rights including: the right to know how businesses collect personal information, delete personal information, and opt out of the sale

of their information without facing discrimination for exercising these rights. For children specifically, the United States Department of Education enacted the Family Educational Rights and Privacy Act,[30] which affords parents the right to have access and review their children's education records, the right to seek to have the records amended, and the right over the disclosure of personally identifiable information from the education records. However, there are still other data governance challenges that undermine learner control, such as limited interoperability and low levels of user awareness and digital literacy, etc.

Interoperability. The proliferation of many new proprietary products and services for digital credentials and digital wallets has raised many concerns about the lack of interoperability, and how that may undermine equity and mobility goals in the ecosystem.[31] Interoperable systems allow data to be dynamically exchanged by individuals across platforms, agencies, and organizations, and contrasts with non-interoperable systems where data is proprietary and information from one system is incompatible with others. Interoperability is necessary for success across platforms, education systems, and countries. In the context of digital education and employment records, interoperability allows academic achievements, skills assessments, competence-based learning, and other digital credentials to be universally compatible. Without interoperability and open data standards, individuals will struggle to exchange data between different organizations, such as different education institutions, or their education institution and an employer. They may even have barriers to moving their data from one data storage system to another—locking them into certain platforms or service providers. Individuals being able to move their data freely is a requirement for them to truly control their data, making interoperability vital for the goal of individual data ownership and sovereignty. An example of this work is the European Commission's Europass Digital Credentials Infrastructure (EDCI) for organizations to implement and issue digital credentials.[32] The EDCI is a set of standards, services, and software for institutions, employers, and training providers who are looking to verify digital credentials, while Europass is a set of online tools for individuals who want to present their CVs, reflect on skills, share degrees, store European digital credentials, and learn about job opportunities in Europe.[33]

Trust. Broad engagement with digital credentials and record systems requires individuals and organizations to both see a value proposition in using them and trust the quality and authenticity of the data. Due to the vast array of digital credentials and badges, the lack of consistent labor market information to track outcomes, and the recency of their development, employers and learners may struggle to distinguish between the quality of different credentials or understand what having a credential or achieving a specific learning outcome means. For instance, a company interested in hiring an individual who is proficient in the Python programming language might not be familiar with all of the Python credentials, so the presence of the credential may not be enough to assess the candidate's skill level without further investigation. This uncertainly also undermines a learner's confidence that if they take the time to earn more credentials, it will pay off for them in the labor market. The underdevelopment of credential registries, qualifications frameworks, and quality assurance processes for digital and micro-credentials in most countries also reinforces a perception that informal and non-formal learning are of lower quality or status. Quality assurance is critical in establishing more trust within the ecosystem, such as by being able to verify that a given credential or set of credentials is a reliable signifier of someone's learning level or depth of knowledge.[34]

CASE STUDIES

This section presents three case studies on advancing digital credentialing and skills-based hiring ecosystems in an ethical and equitable manner. The purpose of the analysis is to ground our understanding of the promises and perils of digital credentials and LERs with lessons from specific initiatives in practice.

The case studies include:

- The Irish University Association MicroCreds Initiative (Ireland)
- The Indonesia Cyber-Education Institute (Indonesia)
- The Digital Credentials Consortium (United States, Germany, Mexico, Canada, Italy, and Netherlands)

The research team selected the cases in an iterative manner, starting with a short list of potential cases that were identified during the earlier landscape analysis.[35] From the short list of candidates, we selected for diversity in terms of the type of lead organization (e.g., governments or nongovernmental organizations), region, and focus area. We also sought to identify cases that were far enough along in implementation that there was some secondary literature and signs of early progress. Based on these criteria and availability of information, we selected our three cases. The selection of these cases does not indicate that we considered them the "best" initiatives in this space. Rather, the three cases had accessible information, covered the range of initiatives we wished to examine, and gave us diverse perspectives on issues of equity, access, and technology in and beyond North America and Europe.

The research team conducted 37 semi-structured qualitative interviews for the case studies with informants who were from the lead entity for the initiative, employers, funders, learner organizations, technology experts, higher education institutions, government officials, and researchers.[36] Virtual interviews lasted 30 to 60 minutes, and the research team recorded and transcribed the interviews with informed consent from each informant. We included secondary literature and reports in the analysis, along with participant observations in meetings and conferences about digital credentials and LERs. We received Institutional Review Board approval to minimize risk of harm to participants in the research. Informants throughout this research will remain anonymous to minimize privacy and confidentiality risks.

Each case study examines the context and motivations for the initiative, the vision for expanding opportunity, the successes and achievements, the challenges and risks, and some concluding points connecting the case study back to the major themes of this report. Looking closely at on-going initiatives helps provide an understanding of the intricacies of work in this field, how a vision can be implemented, the challenges faced, and the benefits that can be provided. The variation in form between the three case studies provides lessons for work across the entire ecosystem. Following the case studies, we analyze some of these lessons and takeaways from the case studies.

Irish University Association MicroCreds Initiative

The Republic of Ireland is approaching the middle stages of a five-year initiative that started in 2020 to create a national framework for accredited micro-credentials—aiming to be the first country to do so—through the Irish University Association (IUA) MicroCreds project.[37] The MicroCreds project is led by a project team at IUA, an enterprise advisory board, and university project leads from each of the seven higher education institutions involved. IUA is the representative body of the eight universities within the Republic of Ireland, governed by a council of member university presidents, that provides support, advocacy, and resources in researcher mobility, engagement, and internationalization.[38] IUA MicroCreds' main purpose is to further lifelong learning through flexibility and agility with a specific focus on developing strong partnerships between higher education and enterprise to meet fast-changing future skill needs. This initiative builds on previous work by Skillnet Ireland,[39] a business-led effort to address current and future skill needs, and aligns with the Council of the EU recommendations for micro-credentials to harmonize their design and definitions across the EU member states (Box 1). One of the principle aims of the IUA MicroCreds project is to improve the quality control and transparency of micro-credentials to facilitate more access to lifelong learning and professional development.

The key elements of IUA MicroCreds are:

1. Integrating micro-credentials into the Irish national qualifications framework (Boxes 1 and 2),

2. A viable and responsive model for collaboration between higher education and enterprise,

3. Micro-credential offerings via participating higher education institutions, and

4. A digital platform (i.e., discovery platform) for showcasing micro-credential offerings that link directly with Europass.[40]

The Irish government's Human Capital Initiative on Innovation and Agility (HCIIA) funded the IUA MicroCreds project. The HCIIA's funding comes from Ireland's National Training Fund, which is populated through a tax on employers. Currently the IUA MicroCreds project is in the early stages of planning, development, and implementation. Early work focused on building upon foundations from Skillnet Ireland [41] and integrating micro-credentials into the Irish National Framework of Qualifications (NFQ). They plan to launch the online discovery platform in 2023 to increase learner awareness of and access to micro-credentials.[42]

This case study draws from 11 semi-structured, virtual interviews with a variety of informants representing a range of perspectives from technology, higher education administration, academic research, government, business, and learners, as well as from IUA MicroCreds staff. Researchers also reviewed the academic literature and primary government documents to further inform this case study analysis.

EXPANDING OPPORTUNITY THROUGH FLEXIBILITY

Micro-credentials may offer individuals more opportunities for lifelong learning than traditional degree programs.[43] While lifelong learning is often a talking point, formal education systems rarely support continued, necessary professional development that occurs after earning a degree. IUA MicroCreds offers

BOX 1

How Ireland's micro-credentials align with EU recommendations

In May, 2022, the Council of the EU issued a Recommendation on a European approach to micro-credentials for lifelong learning and employability. The Recommendation included a definition, standard elements, and principles for designing and issuing micro-credentials. It defined micro-credentials as follows:

"The record of the learning that a learner has acquired a small volume of learning. These learning have been assessed against transparent and clearly defined standards."

In the spirit of the EU Recommendation, Ireland developed a system for incorporating micro-credentials into its existing national qualifications framework, the Irish University Association MicroCreds project. Ireland allows micro-credentials to be standalone or combined into larger credentials such as a degree, and are underpinned by quality assurance following agreed-upon standards in the relevant sector or area of activity.

Micro-credentials can be earned within levels 6-9 on the Irish National Framework of Qualifications, which refer to post-secondary education. Micro-credentials can be offered in online, blended, and in-person formats depending on the course. Learners are able to receive 1-30 credits in the European Credit Transfer System (ECTS), which allows the learner to transfer, record, and accrue credits for learning across the European region.

Source: IUA MicroCreds Project Overview, https://www.iua.ie/ourwork/learning-teaching/microcreds/microcreds-project-overview; Council of the European Union, 2022, https://data.consilium.europa.eu/doc/document/ST-9237-2022-INIT/en/pdf.

the opportunity to recognize and support learning that occurs outside the traditional degree path via the Irish NFQ.[44] Additionally, IUA is attempting to address issues of micro-credential quality by linking these micro courses directly to higher education institutions with existing reputations for high-quality learning and piloting transparent solutions through the creation of their discovery platform and partnership with Europass.

Another opportunity is the bite-sized nature of IUA MicroCreds, which provides learners with flexibility in time, place, and content by having targeted learning experiences that can be completed faster than traditional degrees and reach learners outside of university cities. Multiple interviews with individuals working with and for IUA MicroCreds emphasized that many organizations in Ireland, especially smaller businesses and those involved in health care, cannot afford to lose staff to formal education. Upskilling through micro-credentials is a way for employees to update their skills while continuing to meet the needs of their workplace. Interview respondents also highlighted the potential value of IUA MicroCreds for women—especially parents with caregiving responsibilities who may have left the workforce to attend to family during the COVID-19 pandemic—and the potential benefits from a more flexible format that

allows them to cultivate their skills while also meeting caregiving responsibilities.

Finally, multiple interview respondents with a business background emphasized that small and medium businesses often find it difficult to upskill and reskill their workers while meeting business needs. Such businesses comprise a large proportion of Ireland's private sector businesses and their unique needs have been an important focus for IUA MicroCreds. Providing flexible access to quality professional development options for employees is key to meeting the government's goals around future skills and training development.

EARLY ACHIEVEMENTS

A key factor in the success of the IUA MicroCreds project thus far stems from its integration with preexisting infrastructure and the way in which the national qualifications framework was set up to accommodate partial qualifications (rather than just full degrees). IUA Microcreds utilized higher education quality management, course development frameworks, and existing levers in the Irish NFQ and European Higher Education Area, which were developed to ease learner transition between countries. As a member of the European Union, IUA MicroCreds has benefited from existing structures designed through the Bologna Process[45] to ease learners' and workers' ability to move between countries within the Eurozone. For instance, European member countries already operate from a shared credit system called the European Credit Transfer System (ECTS),[46] which provides Ireland with a common credit system from which to compare micro-credentials, and the EU Recommendation (see Box 2). Additionally, the IUA MicroCreds project has benefited from an organized employer-led effort to develop a roadmap for micro-credentials in Ireland, Skillnet Ireland.[47]

Finally, learners can upload their digital credentials from their completed micro-credential courses into the Europass system, allowing them to share their credentials easily with potential employers if they choose to do so anywhere in the European Union. IUA MicroCreds is leveraging the existing reputation and trust of the higher education institutions involved and of QQI's qualification framework. Each higher education institution has its own quality assurance process. Figure 3 is an example of a current pilot quality process at one university, as described during an interview.

The Republic of Ireland is in a unique position, compared with other European countries, as the Irish NFQ was designed with categories that allowed for the integration of micro-credentials without having to revise the framework. These include "minor awards," "supplemental awards," and "special purpose awards." The current IUA MicroCreds offerings fall under these awards at the undergraduate and master's levels (most commonly NFQ levels 8 and 9). While in the early stages of implementation, the addition of small awards categories to other countries' NFQs[48] could allow a similarly smooth initial transition to micro-credentials.

BOX 2

What is a qualifications framework?

Qualifications frameworks are policy tools used to organize and classify skills, knowledge, and competencies. They show learners, workers, and employers the meaning behind credentials, how they relate to one another, and clarify learning progressions from basic to advanced levels. Qualifications frameworks can be designed in different ways to meet specific goals, such as: easing progression through learning levels or the changing of learning paths; aligning education paths and labor market needs; improving recognition of informal and nonformal learning; and regulating quality standards of qualifications (Goger and Laniyan 2022; ILO 2007).

TABLE 1

IUA MicroCreds key stakeholders

CATEGORY	DESCRIPTION	EXAMPLES OF STAKEHOLDERS
Higher education	Higher education partners contribute knowledge and experience as content experts, in quality assurance procedures, and as academic researchers.	• Dublin City University • Maynooth University • Trinity College Dublin • University College Cork • University College Dublin • University of Limerick
Government entities	In addition to being funded through an Irish government initiative, the project also works closely with QQI and the European Commission in the hopes of both aligning to and influencing the MicroCreds work as an early-success case.	• Department of Further and Higher Education, Research, Innovation, and Science • Quality and Qualifications Ireland (QQI) • Higher Education Authority • Regional Skills Forum • Skillnet Ireland • Council of the European Union
Enterprise/ business	IUA MicroCreds is funded by an enterprise tax in Ireland. As such, being responsive to the needs of enterprise is important. IUA MicroCreds has developed an enterprise advisory board to help represent the needs of enterprise beyond those highlighted by the government partners listed above.	• IUA MicroCreds Enterprise Advisory Group
Technology	IUA MicroCreds is working with the Europass system to ensure that both micro-credential courses are verified by their system and that the resulting digital credential can integrate into a learner's digital wallet.	• Europass • Parchment • Credentify
Learners	Learners were consulted in the early IUA MicroCreds planning phases Continued work will be needed to both target and engage this constituency as the project evolves.	• National Student Engagement Program (NStEP) • Individual university learner feedback systems

Source: Author's analysis

One of the IUA MicroCred initiative's early deliverables is an online portal that houses all the micro-credential offerings across the seven participating universities, scheduled for launch in early 2023.[49] An interview participant from IUA MicroCreds noted the discovery platform will help potential learners review course topics, course alignment to the NFQ, style of course, and university affiliation all in one place. The online portal is intended to increase user knowledge of course offerings and decrease bureaucratic hurdles that may have made connecting learners to courses difficult. The courses in the discovery platform will link directly to the European Qualifications Dataset Register as part of a pilot program to design a platform that seamlessly

integrates Ireland's micro-credentials into the existing European system.

According to the multiple interview respondents across perspectives, another key success of IUA MicroCreds is its work forming partnerships. See Table 1 for a description of the key stakeholders involved.

CHALLENGES

As IUA MicroCreds is at the higher education level and courses are operated by the universities themselves, multiple informants noted that the plan is for prices to reflect the established rates within each university. This was described as necessary to pay for the costs associated with the micro-credential offerings and to ensure that the micro-credentials are viewed with the same quality as other university offerings. Although some employers and the Irish government provide financial assistance for upskilling and reskilling, this aligning of prices with existing higher education may limit the program's ability to expand educational access to those currently excluded. Further analysis of costs, particularly for certain populations of learners, will be beneficial as the IUA MicroCreds moves forward. If the government of Ireland expanded the use of the National Training Fund to finance micro-credentials, that could play a key role in making them more affordable for learners and workers.[50]

General usage of micro-credentials remains low, with few employees reporting earning and experiences with a micro-credential during the hiring process.[51] The lack of awareness about micro-credentials is a challenge for IUA MicroCreds, as noted in interviews with those from the learner, business, and IUA MicroCreds perspectives. As a new initiative, IUA MicroCreds is working to inform potential students by highlighting their work through meetings with stakeholders, social media like Twitter and LinkedIn with the hashtag #MicroCredsIE, and by hiring full-time project leads at each member university. Currently, each university is marketing its own micro-credentials via their own websites. This has created additional hurdles for learning about these micro-credentials because their websites are complex and each one is different. Consequently, locating information is difficult. IUA MicroCreds expects the launch of the discovery platform will increase the sharing of information by having one website to house all of the micro-credentials offered across the seven member universities.

Learner feedback may also be a challenge. The Republic of Ireland has an existing foundation in which to incorporate student feedback into education discussions on quality and qualifications through programs like the National Student Engagement Programme (NStEP).[52] While learner feedback has been considered during the initial phases of IUA MicroCreds, further work will need to identify how to best engage and collect feedback from learners that are completing short-term courses quickly. This may prove to be more difficult than engaging traditional higher education students as they tend to remain in their programs for longer periods of time. Getting this engagement right could help address equity and/or quality concerns from the learner perspective, as well as build trust.

A final challenge for IUA MicroCreds has been the incongruencies with understanding of important terminology and language, despite many efforts from the European Union and Ireland to focus on shared definitions and raising awareness. An IUA MicroCreds representative interviewed noted the benefit of spending time on building a common understanding. Terms like "micro-credential" and "digital credential" often mean different things to different individuals, employers, and higher education institutions—an issue the EU has actively been trying to address with their recommendations for member countries (Box 1). Governments seeking to build their own micro-credential national framework should be prepared to clearly define critical vocabulary with all stakeholders to promote uniformity in comprehension of topics and to avoid conflict or inefficiency from misunderstandings.

CONCLUSION

The IUA MicroCreds project has a strong foundation, funding stream, collaboration, and oversight for meeting its goals. It has the potential to benefit

business/enterprise and higher education institutions through more nimble, flexible, and responsive educational opportunities that will increase access to learning, particularly for employees in high needs areas where there are shortages and for those with caregiving responsibilities. Some challenges are still ahead with regards to funding for micro-credential courses, how learners will engage with micro-credential offerings and how they will provide feedback in the quality process, how micro-credential offerings will evolve over time to keep up with changing skill needs, and how micro-credentials language can be harmonized within and outside of higher education institutions. Moreover, there is potential for the IUA MicroCreds to grow to include those who are not enrolled or have not completed formal degree programs. This would offer potential to increase educational opportunities for those who traditionally need the most flexibility and are often overlooked.

IUA MicroCreds presents several lessons on the role that qualifications frameworks can play in helping to increase transparency of learning pathways that involve micro-credentials and to establish equivalencies between an academic degree program and bundles of shorter-term credentials and skills. The case stresses the importance of building support for recognizing learning from micro-credentials across existing governmental structures and higher education systems. It also highlights the challenges related to the administrative costs for universities, learner and employer awareness or feedback, and the variation of language and key terms used when implementing digital credentials. It is evident that both the government of Ireland and the IUA value the ability to recognize learning in a more modularized form and will take steps to address the questions of transparency, quality, and user engagement moving forward.

Indonesia Cyber Education (ICE Institute)

Officially launched by Indonesia's Director General of Higher Education in July 2021, the Indonesia Cyber Education (ICE) Institute is a government-led initiative that aims to provide more accessible, equitable, quality higher education through a network of national and international online course providers (ICE, 2022).[53] The initiative is supported by technical assistance from the Asian Development Bank (ADB). The ICE Institute leadership developed the concept in 2017 as a national "digital marketplace" of online courses for Indonesia. They sought to address the following challenges:

1. The lack of access to modern, advanced courses for Indonesians due to resource constraints in higher education systems and transportation barriers due to the archipelago geography of Indonesia,

2. Fraud and other quality related challenges related of the proliferation of Indonesian "diploma mills," and

3. Limited alignment between educational offerings and employment needs.

To respond to these challenges, the ICE Institute implemented a large collection of online courses and digital credentialing via blockchain-based technologies, and analyzes the labor market and improves alignment of courses with local demand through artificial intelligence techniques.[54] The ICE Institute is still in the early stages of implementation (see Figure 4 for a timeline of its development).

The first three years of the ICE Institute 10-year roadmap are to establish its foundation. Years four through six will involve operations development,

FIGURE 3

Timeline of ICE institute development

Source: Key informant interviews

creation of a sustainability model to cultivate self-sufficiency, expansion of the types of online courses offered (e.g., formal, non-formal, upskilling, and reskilling) and to a wider range of students.[55]

For this case study, researchers conducted 11 virtual interviews with informants from funding organizations, consortium members from public and private universities, academics, researchers, and technology experts. Researchers also analyzed relevant academic literature, primary government documents, and other data

VISION FOR IMPACT: EXPANDING OPPORTUNITIES

The primary impetus for the ICE Institute came from Minister of Education, Culture, Research and Technology Nadiem Makarim and his goal of expanding access to quality higher education. As an archipelago with over 18,000 islands, Indonesia's geography poses a significant barrier in accessing higher education, especially for those of lower socio-economic status. Currently only 11 percent of learners from a low-income background pursue higher education.[56] Although Indonesia has more than 4,000 universities, their quality varies because of the lack of capacity for qualified faculty members and well-designed curriculum that is aligned with labor market demand and resources. Many of these universities do not supply the labor market with qualified professionals. According to the ICE Institute leaders, there is also a problem of some institutions committing credential fraud. The ICE Institute's vision is addressing these challenges via a modernized tertiary education system.

The COVID-19 push toward remote learning prompted the development and launch of ICE, with substantial involvement from executive leadership. In 2020, Minister Makarim introduced Regulation No. 7, which stipulates that college students may earn up to 50 percent of academic credits in online courses.[57] The minister also adopted the Merdeka Belajar ("Freedom of Learning") and the Campus Merdeka ("Freedom of Campus") policies, which allow up to 40 percent of these online courses to be taken outside the home university. This includes courses from abroad, such as those offered by Harvard University and Massachusetts Institute of Technology (MIT) through the online edX platform.

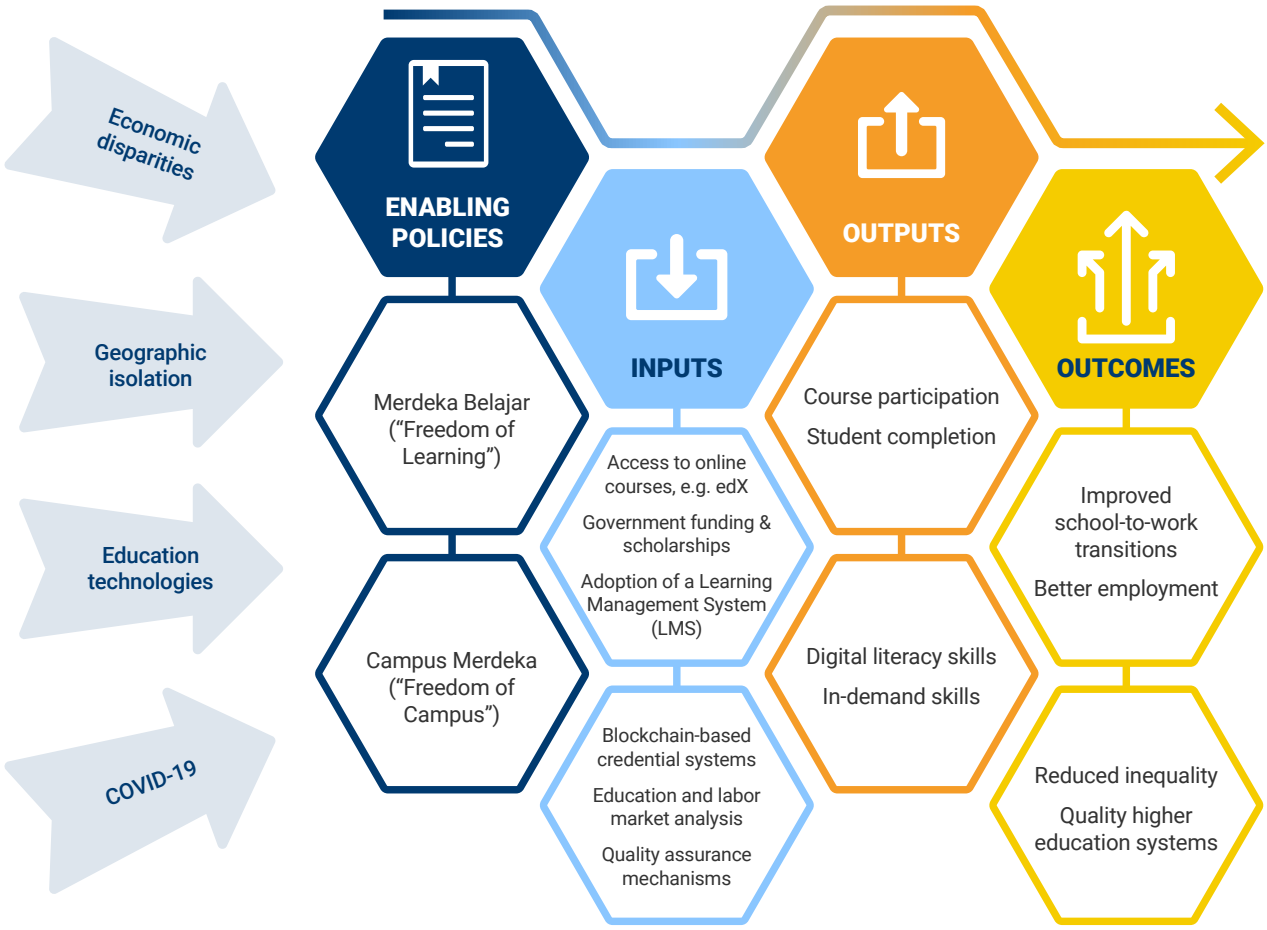
These policies are a creative solution to a challenge that higher education systems face all over the world: how to improve access to quality higher education curricula in a resource-constrained context? Rather than only building curricula that can be accessed in one institution, the ICE Institute is scaling access to advanced courses across all member universities at once, which creates a broader and deeper set of classes to choose. In addition to buying edX licenses to offer courses, Indonesian faculty and universities are also adding their own curricula, which expands access without duplicating effort across institutions. For individual learners, these options allow learners more agency in choosing their learning path by expanding course options beyond their home institution.[58]

The ICE Institute leadership sought ADB assistance to improve access, strengthen online learning, and introduce digital credentialing based on blockchain technology.[59] ADB mobilized a grant from the High-Level Technology Fund to help design the ICE Institute business plan, as well as mechanisms for governance, funding, and quality control.[60] The ICE Institute is also seeking to use the increased availability of credential data to analyze both the labor market and credential offerings through artificial intelligence. It hopes to use this technology to maximize alignment of courses with local skill demands, thereby improving higher education and labor market coordination.[61]

With access to tertiary education as a central goal for Indonesia, the government is working to remove financial barriers through large scholarship programs (Figure 5). This includes expanding access to the online courses through additional scholarships and covering the additional costs of the courses for existing university students. While the government hopes that this online course marketplace can be financially self-sufficient by 2030, with government funding set to decrease in 2023 and 2029, interview respondents said that it is unclear how they will ensure that the

FIGURE 4

Logic model of Indonesia's higher education policies



Source: Author's analysis

courses remain accessible, and costs do not become a significant barrier for students.

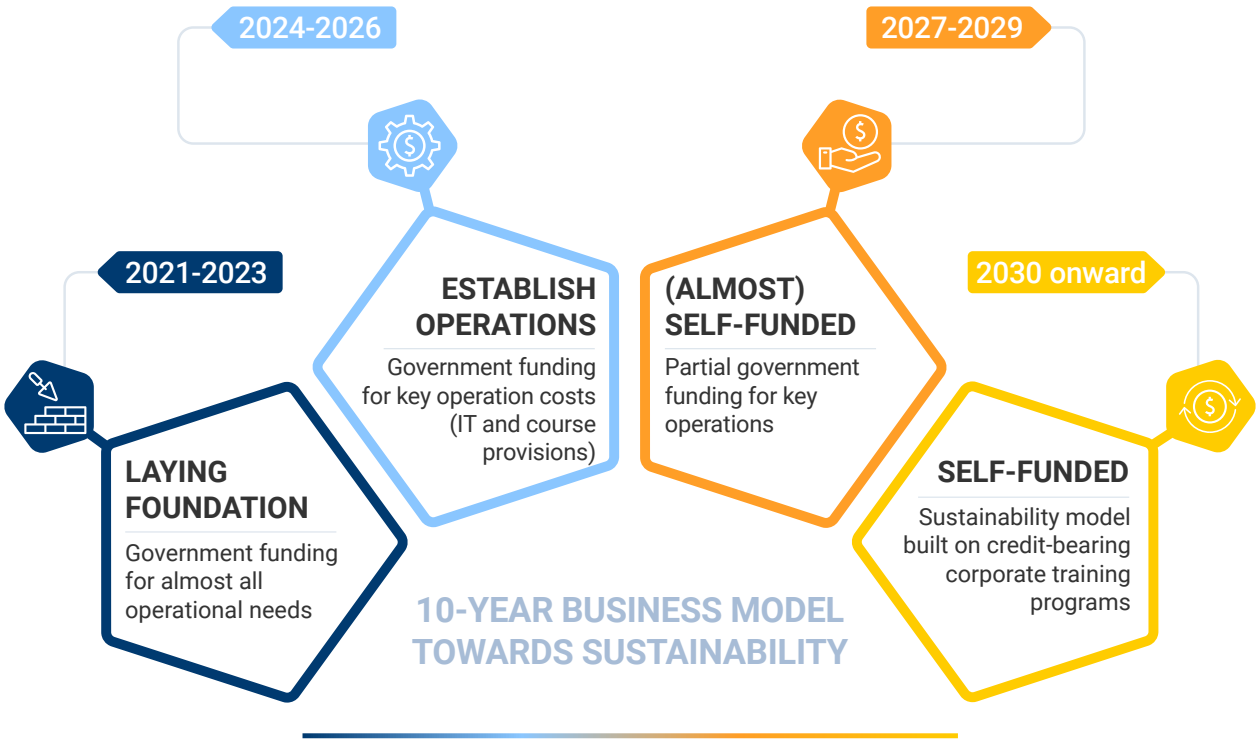
SUCCESSES AND ACHIEVEMENTS

The ICE Institute is still relatively new—and in the early stages of its long-term plan—but has begun to accomplish its early objectives. The leaders of ICE Institute have successfully achieved buy-in from diverse universities throughout Indonesia. At launch, nine member universities joined the Consortium.[62] Five more universities joined thereafter. According to interview informants involved in the ICE Institute, there are currently 28 provider institutions and 341 user institutions, whose students enroll in the ICE Institute's online courses. So far, the ICE Institute has provided access to 1,512 courses from the edX Online Campus Collections, 60 courses from XuetangX Collections, and 445 courses from the ICE Institute Consortium Collections (curricula provided by consortium university members.) During the first year, interview informants said that more than 7,000 degree-seeking students completed online courses from participating universities, with the Indonesian government covering the cost.

Another component of the initiative is the use of labor market analysis and skills forecasting as a modern, efficient, and cost-effective approach to aligning labor market and university offerings. As part of the ADB

FIGURE 5

ICE institute's initial 10-year financial plan



Source: Key informant interviews

Technical Assistance team's role in supporting the ICE Institute, the team contracted a third party to analyze education offerings and labor market needs. This analysis gathered available data from job postings and changes in job postings over time to provide insight into what hard and soft skills are needed for employment in different regions or sectors. One of the leaders of the ICE Institute said that analytical methods like this can help inform students about what skills they can work toward to increase the potential of finding a decent job.

Most of the interview informants felt that quality assurance mechanisms—and their independence—are fundamental for national and international recognition, and key for addressing Indonesia's diploma mill problem. ICE Institute's quality assurance working group reviews and adopts best practices for online course development, maintaining an approved catalog of vetted courses. The quality assurance process evaluates compliance with national and international qualification frameworks and considers alignment of courses to labor market demands and student enrollment.[63] Course accreditation is an essential part of the ICE Institute's catalog curation.

The ICE Institute also applies blockchain technology to deliver digital learning credentials and to try to safeguard data privacy and ownership, integrity, and security. The institute has utilized different blockchain credentials, including Accredible and BlockCerts, and hopes to create its own to meet its goals and needs. Several respondents explained that blockchain-based technology allows them to make credentials immutable, which they thought might enhance trust in the credential for educators, industry, and professional organizations. Respondents also claimed that blockchain technologies help reduce the prevalence

of fake credentials produced by diploma mills and protects students' data ownership rights by giving them more control of their private data.[64] For instance, when the ICE Institute issues a certificate to a student, the student can determine who to share access to their credential with. However, some experts have observed that fraudulent or incorrect information can still make it into the blockchain, and once that happens, it can be hard to change or remove. An ICE Institute technology expert noted a movement away from blockchain and that the ICE Institute is developing an in-house digital credentialing service based on verifiable credentials. Moving forward, the ICE Institute also plans to significantly minimize development and management costs to cope with budget cuts.

To ensure quality of course delivery, participating institutions adopted a standard learning management system (LMS), Open edX, for their online courses. Open edX is an open-source platform designed by Harvard and MIT to host online courses, and functions as a full LMS for these courses.[65] Getting each institution to share an LMS facilitates interoperability within the consortium through use of standard formats and data transfer protocols, which allows the student to transfer data from one institution to the next (often called "portability"). The standardized infrastructure also supports technical integration with other e-Learning providers.[66] The ICE Institute supports members who have difficulty transitioning from their own LMS to Open edX with training and technical assistance.

KEY CHALLENGES

The ICE Institute faces several challenges. First, the included population is limited to currently enrolled, full-time college students studying in degree programs at consortium universities. Expanding the target population to reach a broader range of Indonesian citizens, especially those from low-income or geographically isolated families, would increase its reach and equity impacts. Second, students appear to prefer online courses from their home universities instead of those from other universities that are also offered online via the consortium.[67] Another interview informant stated that enrollment of their students in the ICE Institute courses had decreased significantly, attributing this to organizational setbacks with the ICE Institute platform. Identifying the causes and what supports are needed to keep student enrollment and engagement up will help to address these challenges.

Third, some interview respondents raised a concern about the protection of student data privacy, sovereignty, and ownership due to what they perceived as a lack of adequate regulatory frameworks in Indonesia and the use of databases where one can find personally identifying information about students. Achieving better data protections will require a shift in legislation and practices in the country. In September 2022, the Indonesian parliament took steps toward this by passing the Personal Data Protection Act, which restricts use of personal data and created rights of access, deletion, and restriction. Currently, the act excludes education data from these new protections.[68]

Financial sustainability is another challenge. The forthcoming budget cuts may undermine their ability to achieve the long-run vision for financial sustainability. Additionally, informants indicated that the initiative relies heavily on in-kind services from staff at member universities to operationalize the ICE Institute, which overloads employees and leads to inefficiencies.

Finally, despite being a government-led initiative that invites concerted efforts of multiple stakeholders, the ICE Institute design, management, and implementation appears to function under the sole leadership of the education ministry. Given the ICE Institute's focus, the Ministries of Manpower, Public Works and Housing, Communication and Information Technology, Communication and Information Technology, and Law and Human Rights could be important ICE Institute collaborators to broaden its impacts.

CONCLUSION

Originating from a wish to establish a national marketplace of online courses for Indonesia, the ICE Institute is pathbreaking in that it is working to allow Indonesian students to enroll in online classes regardless of location, income, or other individual

limiting conditions. The ICE Institute provides students with greater flexibility and increased access to a wider range of courses than previously, and it does so by sharing curricula across institutions rather than duplicating effort. While working toward achieving this goal through a financial sustainability model, the initiative leveraged additional funding through the ADB to adopt technologies such as blockchain-based digital credentialing and artificial intelligence to address higher education capacity challenges and align coursework better with labor market demand.

The case of Indonesia's ICE Institute demonstrates the role that an enabling environment can play in implementing equity-based higher education policies. The case also sheds light on how challenging it can be to implement and scale digital learning systems. Student engagement must be deliberately fostered by increasing ease of access and demonstrating utility to learners. Quality assurance and data privacy of credentials also requires active efforts on both a technological and political level. Finally, achieving financial sustainability is a large concern, as efforts like these can exceed the capacities of individual ministries and higher education institutions.

Digital Credentials Consortium

The Digital Credentials Consortium (DCC), founded in 2018, is an international network of 12 higher education institutions that works in the field of digitizing learning records using a shared, open architecture (Figure 6). As the prospect of issuing digital credentials *en masse* has grown, the founding members thought their institutions could benefit from a broader technological infrastructure that allowed for the issuing and verification of credentials in this form.

The leaders of the initiative were interested in developing a set of shared resources and tools to support this and ensure that it was done in a standardized manner to make the process of digitizing records more efficient and useful for learners, employers, and higher education institutions. They formed the DCC, with the goal of creating a "trusted, distributed, and shared infrastructure that becomes the standard for issuing, storing, displaying, and verifying digital academic credentials."[69]

As an organization, the DCC is governed by a leadership council with one representative from each higher education institution. The DCC is funded through membership fees from participating institutions, and individual projects are funded through independently obtained grants and contracts.[70] The DCC leadership explained that they are seeking to positively shape the development of the entire digital credential ecosystem, including nondegree credentials, but the current primary focus is existing higher education. The consortium as a whole and its members individually have numerous projects at varying stages of implementation.

For this case study, the research team conducted 15 virtual interviews and reviewed the relevant literature on DCC and digital credentials. Interview respondents included employees of DCC, DCC university members, funders of projects, and individuals who had worked with DCC or member organizations in the past.

BOX 3

What problems can open standards and interoperability solve?

Technology experts within the DCC shared concerns that in a world where the digital credential ecosystem does not embrace a norm of open standards and interoperability, there will be risks of lock-in to proprietary systems and potential monopolies. In a proprietary system—or an ecosystem that has been monopolized—companies would have significant power over learners and learners' data. If companies decided to increase fees, analyze and sell user data, or otherwise harm or profit from learners, the users would not be empowered to switch to a different provider or platform. This lack of user ownership and control over their own data is a dangerous vulnerability for learners, and it also inhibits innovation in the ecosystem due to the lack of competition. To address these concerns, DCC works to create open-source standards, frameworks, and protocols, rather than leaving them to the market alone.

FIGURE 6

The 12 member universities of the digital credentials consortium

1. Delft University of Technology (Delft, The Netherlands)
2. Georgia Institute of Technology (Atlanta, Georgia)
3. Harvard University (Cambridge, Massachusetts)
4. Hasso Plattner Institute, University of Potsdam (Potsdam, Germany)
5. Massachusetts Institute of Technology (Boston, Massachusetts)
6. McMaster University (Hamilton, Canada)
7. Tecnológico De Monterrey (Monterrey, Mexico)
8. Technical University of Munich (Munich, Germany)
9. University of California Berkeley (Berkeley, Northern California)
10. University of California Irvine (Irvine, Southern California)
11. University of Milano-Bicocca (Milan, Italy)
12. University of Toronto (Toronto, Canada)

VISION FOR EXPANDING ACCESS TO LEARNING AND OPPORTUNITY

DCC members are committed to the principles of interoperability and open standards to maintain equity in ownership of digital credentials and academic records (Box 3). An interoperable digital credentials ecosystem allows individuals through their digital wallets to accept credentials from any institution, share credentials between wallets, and enable verification systems to work across different credential issuers. This is achieved by building technologies according to open-source (non-proprietary) standards. Interoperability allows learners to store and share their credentials with any host they choose without being locked into individual learning platforms or educational systems. DCC leaders and technical experts felt strongly that in addition to empowering

learnings and minimizing risk, interoperability will be key to uptake and equitable access. In an interoperable system, individuals have enhanced ability to move and share credentials, which will increase the utility of digital credentials to both learners and employers and incentivize uptake.

DCC also sees a role for itself in ensuring a viable open-source alternative to proprietary providers and promoting choice in the digital credential ecosystem, such as working with partners on creating open-source education technologies. If DCC can create and promote shared, open-source infrastructure for issuing and verifying digital credentials, it will make it easier for other institutions to adopt them. For example, a community college that wants to issue digital credentials may struggle to build the requisite infrastructure from the ground up. With the right internal capacity, a community college could use the software provided by DCC or another standards-creating organization and take the code as an advanced starting point to digitize their credentials. Nondegree programs could also utilize this technology for credentialing.

Ultimately, DCC members hoped that public and open-source education technology infrastructure may enable any education or training institution to join this ecosystem, while interoperability and open standards will maximize the potential to both learners and employers. Leaders of the DCC contend that the consortium recognizes the importance of equity in access to higher education and that their projects attempt to put *users* first.

BOX 4

Credentials to employment: The Last Mile

The DCC commissioned research to investigate the gap between the promises of digital credentialling for skills and their widespread adoption in employment. While the research findings highlighted that employers have different needs and challenges regarding digital credentials, they identified a set of common challenges for employer engagement with skill-based credentials:

- Employers and HR management systems lack incentives to change hiring practices.
- Data-rich skill-based credentials are rarely issued by education institutions and employers, despite a high demand for these skills in job applications.
- Education and employment use different languages, and credentials are designed around issuers', not employers', needs.
- Digital credentials are not connected to current trust relationships between employers and credential issuers.
- Verification and validation tools are still developing.
- The HR industry has made slow progress toward accepting verifiable credentials.
- Key actors and organizations within the skills sector lack communication and integration.

Source: Camilleri, A., Muramatsu, B., & Schmidt, P. (2022). ***Credentials to Employment: The Last Mile***. Digital Credentials Consortium. Retrieved from https://digitalcredentials.mit.edu/docs/Credentials-to-Employment-The-Last-Mile.pdf.

SUCCESSES AND ACHIEVEMENTS

To achieve its goal of an open-standards infrastructure for digital credentialing, the DCC has been an active participant in the collaborative creation of open standards, such as verifiable credentials,[71] decentralized identifiers,[72] and digital credential wallet specifications[73] with organizations like the W3C and non-open standards bodies such as 1EdTech. DCC has also created open-source software following open standards, in the form of their Learner Credential Wallet (LCW).[74] The LCW is a digital wallet designed to hold credentials in the verifiable credential open standard format and was built to an open standard specification created by MIT.[75]

The DCC recently published a report containing a thorough analysis of digital credentials and employers' demand for them. This "Last Mile Report"[76] explores why employers don't yet use digital credentials in their hiring practices and what the main barriers are to their adoption in hiring practices (Box 4). The research sheds light on what needs to be done to expand uptake of digital credentialing, and how to maximize their potential for improving skills-based hiring practices.[77]

DCC member institutions are also engaged in numerous projects related to furthering the development of the digital credential ecosystem. For example, McMaster University is currently piloting decentralized credentialing systems that issue verifiable PDFs of academic documentation; Georgia Tech's Center for 21st Century Universities has piloted and conducted student user research[78] for digital credentials issued through Canvas; MIT deployed the LCW at three higher education institutions[79] through an agreement with the U.S. Department of Education; Tecnológico De Monterrey, among other DCC institutions, has established systems for issuing BlockCerts or other forms of digital credentials; and Delft University of Technology has engaged in research on the compatibility of decentralized digital credentials and data governance laws in the EU, such as GDPR. The University of California at Irvine (UCI) has focused on the issue of quality assurance, which plays an important for building trust and buy-in among employers and learners (Box 5).

BOX 5

Quality assurance process at the University of California, Irvine

The quality of learning represented and signaled by digital credential contents is an unresolved question. UCI is one of the members that has been focusing explicitly on quality assurance. UCI established formal standards for what can be digitally credentialed. Their aim is to ensure the digital credentials they provide students, which they call alternative digital credentials, are valuable for learners when seeking employment. UCI has established guidelines for digital badges that specify that these credentials be issued only for professionally relevant competencies, and that learners must have passed a rigorous assessment to obtain the credential. It is not required that the badge represents full mastery, because competency badges come in different levels. The competency represented and the requirements to achieve the credential are detailed in the digital badge's metadata, allowing those it is shared with to know what skills it encompasses and how mastery was demonstrated. This focus on competencies over "seat-time" is only one approach to quality assurance for digital credentials, but the overall need to develop processes like this is increasingly important as digital credentials proliferate.

According to DCC staff, they will soon release Web Verifier Plus, a digital service that allows receivers of verifiable credentials to instantly verify that they are authentic, without needing to directly contact the issuing university or a national clearinghouse. This technology will also allow organizations that individuals share credentials with to verify them without needing full access to the user's data, taking a step toward improving trust, reducing risk, and lessening administrative barriers.[80]

CHALLENGES AND RISKS

As DCC evolves as an organization, its members are confronting several questions about the scope of their work and priorities moving forward. Some interview respondents were hesitant about DCC becoming a software provider, as doing so takes substantial time, expertise, and financial resources, while others felt that DCC could have the greatest impact by focusing on the development of open-source software that adheres to open standards. Another question is how to engage with the private sector through partnerships. Private sector partnerships offer substantial financing options for achieving scale, though it may be challenging to find partners with shared commitment to DCC's values and open standards.

DCC members recognize their position as a consortium of elite institutions but hope their work can expand access to digital credentials for a broader set of learners and institutions/issuers. Many interview respondents supported the concept of expanding the membership, either by adding members to the consortium or creating other forms of membership based on levels of participation. It was important to them that the organization have participation options that support a wide range of institutions' financial positions. Some interview respondents also stressed the importance of expanding support within member institutions, where work is often limited to only one department.

Aligning digital credentials with labor market demand and incorporating them into hiring practices is likely to take a concerted, long-term effort, and it is still unclear to what extent DCC will focus on that.

Finally, some respondents expressed a need to keep the work rooted in building a value proposition for learners and workers to use digital wallets, especially when considering potential users who do not attend an elite university. They stressed that to maximize the potential of DCC's work, it will be important to have very clear use cases in mind and to ensure direct engagement with the learners who need it most so that it adds value for them.

CONCLUSION

Through numerous ongoing projects, DCC has already made meaningful contributions to the overall ecosystem of digital credentials. Until now, most of the work has focused on building foundational digital credential infrastructure that emphasizes open standards, interoperability, and learner control over one's own data. Mass participation of learners and employers are necessary for the work to reach its full potential, but the approach of getting technology right first can help mitigate potential harms from technology being deployed too rapidly and without sufficient caution.

The DCC has played an important role by bringing several universities into the conversations about how to deploy technologies equitably and ethically in a way that empowers learners to control their own data. By working as a consortium of international universities, DCC not only has greater technical capacity, but has a greater ability to spread norms and encourage adoption of open standards. While DCC projects may be directly focused on institutions like themselves, the work will become more meaningful for improving equitable access to higher education as the technology is utilized beyond formal academic settings. Moving in this direction will likely require attentiveness to digital literacy and user-friendly interfaces, quality control, and verification to ensure trust and a meaningful value proposition for learners and employers alike.

SYNTHESIS

This section analyzes the case studies, interviews, and literature to inform debates about how to ensure that digital LERs and digital credentials ecosystems can be built in an inclusive and ethical way. Overall, the research team's case study research on credentials revealed a common set of motivations that jump-started the implementation of their work. Key motivators were:

- Improving transparency about skills and qualifications beyond college degrees in the labor market,
- Building trust and facilitating an easier verification process, and
- Expanding access to post-secondary learning opportunities and the recognition of learning in multiple forms.

The case study research uncovered several innovations that other countries or leaders may wish to consider:

- **Reducing duplication and enhancing curricula through online learning platforms:** The ICE Institute's approach to using online learning platforms to expand access to curricula that may not be available at the nearest university, as well as offering more advanced learning content in specific high-demand fields, is an example of how some leaders in low- and middle-income countries are at the cutting edge of education technology innovation. Their solutions may be easier to translate into other resource-scarce educational settings.
- **Implementing universal wallets to leverage shared infrastructure rather than creating new wallets from scratch:** Europass (government) and DCC's digital wallet (private/nonprofit) offer potentially replicable models for creating shared, interoperable services and tools that partners can use to enhance cross-national learning recognition and learners' control over their own data. These shared resources also help reduce strain on existing higher education institutions, which might otherwise struggle to create such infrastructure from scratch.
- **Using qualifications frameworks to build trust and transparency:** The Irish case study on incorporating micro-credentials into the existing qualifications framework (as well as similar efforts in New Zealand and elsewhere) highlight the need to establish and adapt systems for overseeing the quality assurance of credentials to slow down and prevent bad actors (e.g., diploma mills) from eroding the trust and value of lifelong learning options for learners and employers, especially short-term and modularized learning that can be bundled or stacked into a degree-equivalent credential.
- **Adopting laws similar to the EU's GDPR and artificial intelligence legislation to enhance the protection of privacy and data rights:** The EU Artificial Intelligence Act[81] will lead to legal responsibilities for artificial intelligence systems used for hiring or determining educational access. These requirements cover data standards, accuracy, non-discrimination, cybersecurity, and risk management for the artificial intelligence systems, which are intended to reduce discrimination and errors. One drawback of the regional, multilateral approach to technology regulation in the EU is that the staff in a given country, such as Ireland, may not take as much ownership over ensuring compliance, ethical data use, or security because they assume it is already in place.

There were also some common challenges or barriers identified in our previous research and case studies. A very significant barrier was the low awareness of digital credentials and the value proposition they bring among learners, employers, and policymakers. As we found in the landscape study, the low level of awareness and confusion about the value they bring is due, in part, to the rapid proliferation of credentials having weak systems of quality management (or absence altogether, in many countries).[82] Another common challenge was financial sustainability, with each case facing questions around how to achieve this. As

digital credential projects expand, so do their funding needs, and government funding can be slow to grow and inconsistent. Private partnerships offer one path forward but must be developed carefully to ensure they do not jeopardize equitable outcomes.

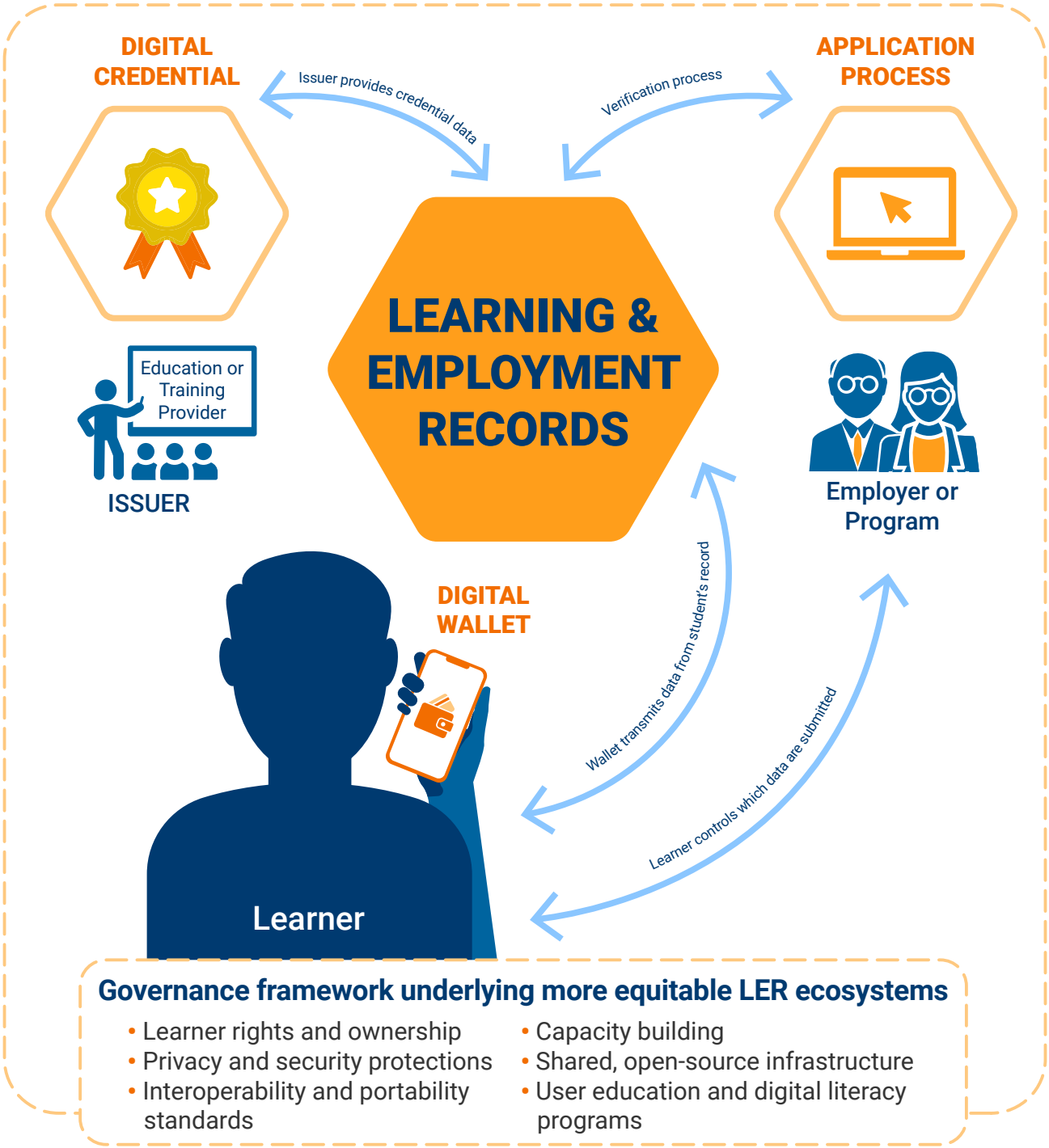
Each of the case studies approached implementation by starting from within formal higher education systems. This has the advantage of leveraging existing resources and galvanizing political will around the need to adapt to surging demand for lifelong learning and reskilling models that are designed around the needs of working learners. On the other hand, the risk is that these initiatives may end up reaching learners who are already privileged enough to be enrolled in formal higher education or those who already have a degree, which is consistent with existing evidence about who is using digital credentials in practice.[83] Therefore, if the goal in a digital credentials ecosystem is to use these technologies to support global efforts to get on track with the equity and lifelong learning goals of SDG 4, these case studies suggest a need to be more explicit and intentional about focusing on populations of marginalized learners who are typically excluded from formal higher education, including an ongoing focus on digital connectivity, digital literacy, financial aid, and affordable access to devices as a foundational requirement for building equitable education technology ecosystems.

Another shared lesson across the case studies was the need to engage a broad coalition of partners and get input from diverse communities and learning settings to increase buy-in and ensure that the technology and underlying systems effectively meet the needs of different users. In each case, the ability to work across government domains that are normally siloed and to develop public-private partnerships to scale implementation was essential. Working across domains of technology, education, and labor can also be challenging due to vast differences in technical terminology and jargon in each domain, so the need for developing a shared language with common understandings can be critical to success. Across each of the case studies, the connection to employers and business was rather weak thus far, signaling a need to think through how those partnerships might work better to ensure that the learners coming out with credentials could get a quality job and earn a decent wage. The leaders for each case study seemed to be particularly strong at building support within postsecondary education institutions, such as how the DCC, ICE Institute, and IUA Microcreds initiatives were able to get and retain the engagement of several higher education partners. Another more challenging area was ensuring a stronger partnership with government agencies and policymakers responsible for the oversight of technology companies, such as through policies and legislation governing privacy, security, and sovereignty—the ability for learners to control how their data was used, shared, and protected.

The inadequacies of regulatory structures to govern data and technology marketplaces impact the digital credentials ecosystem in many ways (Figure 7). This came up in the case studies most prominently in Indonesia, where there were not many protocols in place for when and how student data could be shared. In the absence of formal governance, normative practices and routines often end up shaping the "rules of the game" in the ecosystem. The lack of voices at the table for setting norms and the rules of the game in education technology may ultimately mean that the priorities and needs of low- and middle-income students and countries are not incorporated into the foundational technologies that learners, workers, employers, and education institutions will use every day. There are several specific risks. For example, there is a risk that proprietary providers,[84] in the absence of effective regulatory frameworks, could dominate the market or create a handful of different platforms that users and institutions get locked into. In addition, as digital credentials enable the growing use of artificial intelligence to identify skills or match workers with jobs or gig work,—such as in the case of Indonesia—our interviews with technical experts suggested that there are many dangers associated with monitoring and enforcing bias in artificial intelligence algorithms, which can disproportionately impact people with disabilities, racial minorities, and other underrepresented groups.

FIGURE 7

Learning and employment records ecosystem



Note: An employer can also be a credential issuer if they provide training.

RECOMMENDATIONS FOR MORE EQUITABLE DIGITAL LEARNING AND EMPLOYMENT RECORDS

We propose utilizing four interconnected principles as a guiding framework for the development of digital learning and employment records systems. Three of the key principles come from the Global Convention on Higher Education,[85] and we added a fourth principle, trust, based on our research findings and feedback received as part of events we convened alongside the 77th United Nations General Assembly and the Transforming Education Summit. We have developed a series of recommendations for each principle to guide action based on the findings of our research, convenings, and case studies.

Orienting action around these four interconnected principles can help actors work toward an equitable system that increases access to quality education for all learners (Figure 8). Below, we utilize the conceptual framework for presenting the key takeaways and policy recommendations derived from our and case studies.

Equity

The first principle, *equity,* refers to fair recognition of learning, and the promotion of inclusive access to quality education and lifelong learning with deliberate consideration for how all learners can access innovations. There are several ways in which higher education institutions, technology experts, and policymakers can center equity in the implementation of digital credentials and LERs. At a basic level, equity starts with whose voices are at the table and to what extent those are engaged during the design process. We recommend:

- Product developers incorporate **user-centered design methods** and other forms of input in a wide range of settings and with diverse sets of users, including learners from different backgrounds, learners who are low income, employers, users in rural areas, and staff involved with the day-to-day management of LERs.

- Governments focus **change management** beyond technology implementation alone to improve community engagement, access to broadband and devices, affordability, and digital literacy. Consider populations that require additional infrastructure for digital learning, such as high-speed internet and broadband service.

- Governments and funders provide **shared resources** for technical assistance and capacity building for LER development and implementation, such as access to training curricula for staff involved in different agencies/ministries or aspects of implementation.

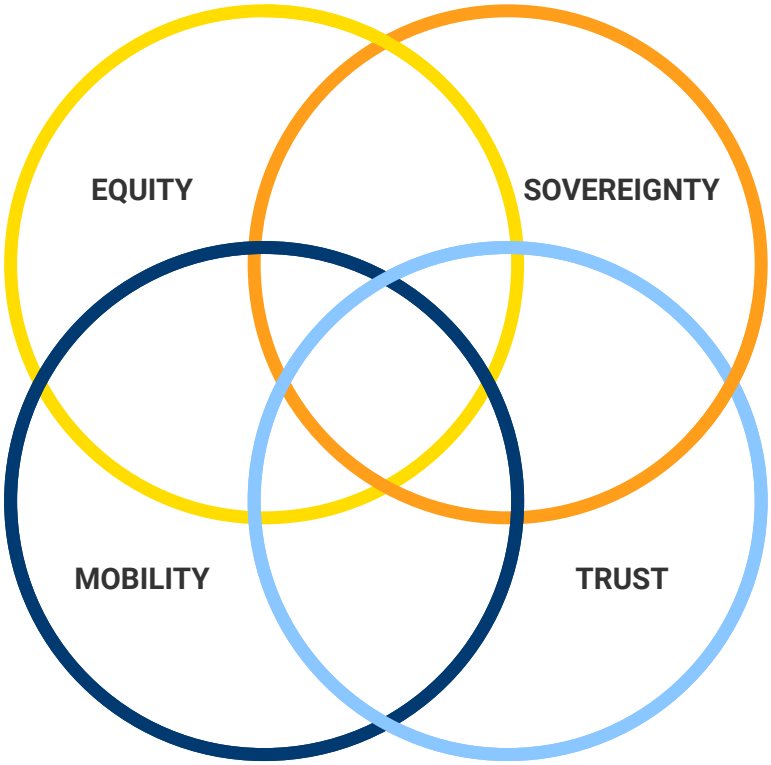
- Employers incorporate elements explicitly designed to **minimize bias and discrimination** in hiring processes when developing LERs. Hiring managers and human resources staff may need training or incentives to change their hiring policies to assess candidates in a way that minimizes bias and values skills and experience as much as a degree for certain roles.

- Product developers, governments, funders, and employers **specify equity goals** and clear metrics to define upfront what success and continuous improvement looks like from an equity perspective, including the elucidation of which target populations, metrics, and data sources will track progress toward equity goals. At the local or regional level, metrics may include user engagement, connectivity, demographic characteristics, participation over time, and impact and evaluation. Success must be defined and measured in a way that captures progress, but also sets the stage for evaluation that can examine overall outcomes and impacts at the same time as disaggregated impacts by population.

- Government legislation should establish **clear roles** for who will lead and enforce different policies to improve access, digital literacy, data protections, and other elements of equity-centered design that focuses on learners and the ways in which they use, benefit from, and question technology.[86]

FIGURE 8

Conceptual framework for guiding implementation



ACTIVITIES SUPPORTING KEY PRINCIPLES				
EQUITY	MOBILITY	TRUST	SOVEREIGNTY	
✓		✓		User-centered design
✓				Change management across institutions
✓				Shared resources for capacity building
✓	✓			Reducing bias and discrimination in hiring
✓				Clear equity goals and metrics
✓				Clear roles for leading and implementing policies
✓	✓			Commitments to skills-based hiring
	✓		✓	Interoperable and portable data
	✓			National and regional frameworks to recognize learning
	✓	✓		Quality assurance and transparency
	✓	✓		Qualifications frameworks for transparent learning progressions
	✓		✓	Rights of individuals to own and control their data
			✓	Open standards and shared data infrastructure
		✓		Secure verification processes
✓		✓		Outcomes tracking and research on effectiveness
		✓		Outreach and education

Mobility

The second principle, *mobility*, refers to the physical or virtual ability of individuals to switch between countries, regions, institutions, or career pathways for the purpose of learning or working. The recognition of learning, as well as the interoperability and portability of digital credentials, are necessary for all workers in an economy undergoing rapid changes. These are especially advantageous to migrants, refugees, and learners who are switching careers. These groups are in a unique position, wherein they may have the skills and qualifications required for a job but may not be able to demonstrate that or transfer their credentials to another higher education institution. Recognizing learning and setting up systematic processes for transferring credits can facilitate stability and an easier transition into a new learning environment. We recommend:

- Governments, higher education institutions, and employers adopt **interoperable and portable data and systems** that allow learners to access, export, and easily move their data across institutions, workplaces, platforms, and countries. Interoperability plays an important role in preventing vendor lock-in, but it also allows users to readily access their data.

- Governments, education and training providers, and labor market intermediaries adapt or develop national qualification frameworks and processes to improve the **recognition of non-formal and informal learning** as individuals enter the labor force, seek to advance their learning level while in the labor force, or attempt to access more education in order to change jobs or careers. In addition, these frameworks can improve transparency by mapping out the learning progression into stackable credentials.

- Governments, employer-serving organizations, and employers make commitments and lead the shift toward **skills-based hiring** to recognize talent and skill in more diverse and precise forms rather than overly relying on college degrees for candidate screening.

Future areas of research for mobility should examine the relationship between access to education and climate change, global challenges of education in crisis,[87] design of international qualifications frameworks, the different circumstances of students, and risks of learning loss. Mobility should be viewed as a necessary and preventative measure for learners, education institutions, and governments that are currently, or will be, working against natural disasters, political conflict, and other emergencies. An important consideration with these recommendations is how to best use open-source technology for learning recognition, policy efforts, and the presentation of credentials across data systems.

Sovereignty

The third principle is *sovereignty*, which means that individuals (or their guardians) are empowered to make informed decisions about the use and portability of their own data, that identity verification systems are transparent, and that there are adequate protections in place to preserve data privacy and security. The development of LERs comes with increased digitization of personal data. As this ecosystem develops, it will be increasingly important that this personal data is protected, and that learners are given as much agency as possible over who can access their data, how it is accessed, and when. We recommend:

- Governments pass legislation and policies to incentivize or require **interoperability and portability** of LERs to foster education technology ecosystems that are more competitive and accessible. Interoperable and portable systems allow learners to access, export, and easily move their data across institutions, workplaces, platforms, and countries. For instance, the European Union has made significant progress with Europass EDCI recognition of learning achievements across Europe.

- Governments create and develop governance and policy frameworks for an interoperable education technology ecosystem that protects the **privacy, security, and data rights** of end users. A useful example of such a framework is the European Union's data protection law, the GDPR.[88]

- HR departments and product developers design and use data systems that follow **open standards**[89] and shared data infrastructure to ease the exchange of data and encourage interoperability, privacy, and portability on the corporate end for talent acquisition and HR procedures.[90]

Despite the promises of control, this principle leaves several open questions as to who is funding the technical infrastructure and what sovereignty might look like to different audiences. Sovereignty must also include awareness of rights and capabilities and establish shared language across agencies/ministries and functions.

Trust

The fourth principle is *trust*, which means that digital credentials and digital records systems are set up in a way that employers, learners, workers, and education and training providers feel confident and informed about the reliability, quality, and meaning of the data and credentials. For digital credentials to gain broad acceptance—and for their utility to be maximized—they need to be a high-quality signal of skills or learning. A core means of achieving this is adopting standards that ensure the metadata of digital credentials contains a detailed description of what criteria were met for the credential to be issued. Schemas such as CTDL[91] and ESCO[92] can provide a framework for common language to communicate this information. Other work, such as that done by the Groningen Declaration Network, can create access to internationally verified issuers of credentials. We recommend:

- Employers, learners, technology providers, and verification bodies work to create or implement **verification processes** with linked data to build trust and confirm identity among employers, learners, and workers without the need to directly exchange personally identifiable information. The continued development of technologies like DCC's Web Verifier+, and open standards such as verifiable credentials facilitate an accessible infrastructure for this field of work.[93]

- Employers, higher education institutions, training providers, policy leaders, and labor market intermediaries collaborate to develop or enhance **quality assurance processes** to improve access to accurate information about the value and skills associated with a given credential. Quality frameworks, such as that developed by Rutgers University, can provide a starting point for this work.

- Product developers and higher education institutions establish **clear benefits for use**. Development of these technologies must keep in mind both the user's needs and abilities. Thus, speaking directly with learners to learn what they need and how the technology can have clear value proposition is an important step in the process. This can also be used to shape **user-centered design**, which is essential for ensuring the technology is accessible to those with varying digital literacy skills.

- Governments adapt existing **qualifications frameworks** (or develop new ones) to structure the role of credentials and recognize multiple forms of learning in education and qualification systems.

- Governments build infrastructure to **gather data and evidence** on digital credentials to inform broader research and to evaluate outcomes and impacts over time, including the integration of real-time measures of job placement, earnings changes, and completion rates for different populations of learners and workers and to gauge alignment between curricula supply and labor market demand. The education technology sector alone (the supply side) cannot lead the development and implementation of LERs and digital credentials.

- Governments, higher education institutions, and funders invest in outreach and education to **raise awareness** of digital credentials among learners, employers, and the general public, as well as how to determine their impact (such as a "scorecard" with outcomes data).

The establishment of trust across communities engaged with digital credentials and LERs can increase potential collaboration from different sectors, exhibit diverse use cases for the technology, and bring attention to common challenges that implementers, issuers, and users face. The sheer number and variation of digital credentials are a major challenge for building trust. Moreover, assigning quality can be a subjective process, or at least the indicators of quality may vary depending on whether the learning is academic in orientation or applied/experiential.

CONCLUSION

The COVID-19 pandemic has brought rapid changes to both education systems and the labor market. This came alongside a growing push to move toward digital records, the use of algorithms in digital platforms, and skills-based hiring as a means of making learning tools and hiring processes more efficient, inclusive, and precise than manual and paper-based processes. Both employers and workers can benefit from hiring practices that are more effective and inclusive through emphasis on a holistic set of qualifications beyond degree requirements and better recognition of learning both inside and outside formal academic programs. Changing the underlying systems and processes for collecting, storing, and communicating skills takes time and a culture of collaboration across spheres of governance, administration, and funding that are often separate.

The global landscape analysis uncovered a wide-ranging wave of interest in digital credentials and LERS from industry, governments, higher education institutions, and nonprofits. There are organizations working on creating interoperable technical infrastructure for issuing, storing, sharing, and verifying credentials; expanding access to digital learning and employment platforms and credentials; creating ways to integrate digital and micro-credentials into existing qualifications frameworks; creating user-friendly interfaces with input from learners and employers to ensure LERs and digital credentials are accessible and add value; and much more. Most activity in digital LER ecosystems is occurring in the U.S. and the EU, but initiatives have also emerged in low- and middle-income countries—including the ICE Institute in Indonesia that was profiled in this report.

There is a pervasive tendency in the development field, and more narrowly the field of education, to overstate the potential for new technologies to be a silver bullet for solving social problems and addressing inequities. In retrospect, the humbling evidence from remote learning in the pandemic and "tech for good" initiatives more broadly suggests a more complicated picture.[94] First, there is the question of whether more access to information and connection necessarily leads to positive outcomes (e.g., countervailing challenges of privacy breaches, data theft, bias in artificial intelligence algorithms, and the viral spread of misinformation).[95] It is important to approach LERs and digital credentials as one component of a broader effort to address systemic inequalities in access to opportunity. Better data and systems alone will not lead to greater equity and inclusion in labor markets, because long-standing cultural attitudes about race, gender, age, socio-economic status, and disabilities are pervasive. Conscious and unconscious biases shape how someone's qualifications are literally and figuratively valued, and long histories of wealth inequality shape access to formal degrees and professional networks. Overcoming these barriers to create an equitable implementation of digital records will require all the actors involved to acknowledge these stereotypes and power dynamics, and to work deliberately to overcome them.

Second, as tech-enabled platforms in education and labor markets become more mainstream, will this leave some communities even more excluded from learning and livelihood opportunities, professional networks, and information about jobs, skills, and careers?

Understanding how LERs and digital credentials are evolving in a diverse range of countries, communities, learning contexts, and labor markets is an important area for future research to avoid implementing tools and technologies that are unworkable and to minimize the unintended consequence of primarily benefiting people and places that are already privileged, connected, and well resourced.[96]

All of this suggests a need to be more thoughtful about new technologies from the outset and a need to approach a given initiative in education technology ecosystems with an intentional scope, specific goals, a well-defined set of use cases, engagement from a diverse set of stakeholders, and systematically gathering input from end users at every stage. Technology can be a facilitator and tool to achieve education and employment goals in particular contexts. How, where, and for whom education technology ecosystems are built and deployed is more important than the promises of a specific technology product or service itself. As more and more people use tech-enabled platforms to find work, get a certification, hire workers, or connect with colleagues, it is important to remain focused on what it will take to build education technology ecosystems that reflect the values of equity, sovereignty, mobility, and trust.

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