DEVELOPING THE AFRICAN CONTINENTAL QUALIFICATIONS FRAMEWORK (ACQF)

GUIDELINE 09

Innovation and technology in the context of qualifications systems

ACQF
African Continental Qualifications Framework

African Union

THE AFRICA-EU PARTNERSHIP
LE PARTENARIAT AFRIQUE-UE

This guideline in innovation and technology in the context of qualifications frameworks is elaborated in 2021-2022 in the context of the project AU-EU Skills for Youth Employability/Skills Initiative for Africa, Technical Cooperation – Developing the African Continental Qualifications Framework.

We acknowledge all contributors, institutions and experts who shared views, comments and recommendations during the consultation process, and supported the authors' team in the accomplishment of this mission.

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Date: 5 May 2022

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List of acronyms

ACQF	African Continental Qualifications Framework
AI	Artificial intelligence
AfCFTA	African Continental Free Trade Area
AQRF	ASEAN Qualifications Reference Framework
ASEAN	Association of Southeast Asian Nations
AU	African Union
AUMS	AU Member States
CAT	Credit Accumulation and Transfer
CBA	Competence-based assessment
CESA	Continental Education Strategy for Africa
EAQFHE	East African Qualifications Framework for Higher Education
EQF	European Qualifications Framework
ESCO	European Skills/Competences, qualifications and Occupations
ETF	European Training Foundation
HE	Higher education
LMI	Labour market intelligence
MOOCs	Massive Open Online Courses
ML	Machine learning
MS	Member States
NQF	National Qualifications Framework
NQS	National Qualifications System
QA	quality assurance
QF	Qualifications Framework
RDMS	Relational database management system
RPL	Recognition of Prior Learning
RQF	Regional Qualifications Framework
SAQA	South African Qualifications Authority
SSI	Self-sovereign identity
TVET	Technical and Vocational Education and Training

1 Introduction

Trends such as digitalisation, migration and sustainability have created a demand for innovations in key areas of the development, management, and revision of national and regional qualifications frameworks. Such innovations allow for improvements in labour market intelligence, yield new data sources and analysis methods, improve efficiencies, and allow education systems to respond to the needs of individuals, societies and the world of work.

New types of recognition of learning such as micro-credentials and digital credentials are emerging, non-formal learning and alternative learning pathways are increasingly being recognised, and innovations such as partially-automated credential comparison and qualification passports have been introduced to allow greater labour mobility and opportunities for migrants.

This document briefly describes each innovation and its relevance to qualifications frameworks and includes information on the contexts in which it can be applied, required conditions for launch as well as links for further information.

The innovation and technology guideline is one of 10 ACQF guidelines. The ACQF guidelines give tangible substance to Output 3 of the ACQF project namely the ACQF policy and technical document. The guidelines are tools to support the practical application and sustainability of the principles, objectives and milestones defined in the ACQF documents (see sources).

1.1 Purpose of this guideline

The purpose of this innovation and technology guideline is to:

- provide a broad range of innovations that have applications to qualifications frameworks, including but not limited to technological innovations
- provide information on issues related to the implementation of innovations and technology, including innovation readiness and ethical considerations
- provide a technical orientation for national implementing bodies and stakeholders, especially the lead institutions managing the NQF and interacting with the (future) ACQF implementation/ steering unit

The key message of this document is that innovations and technology have a range of applications related to national and regional qualifications frameworks, credentials, and the recognition of learning, which can be leveraged to enhance government service delivery to constituents. Key principles of ethical collection, processing, use and sharing of data and information must be considered at all stages of innovation.

1.2 Guideline structure

This innovation and technology guideline includes a trio of documents: (1) a synthesis guideline, (2) a technical guideline and (3) a training module:

- *Technical in-depth guideline*: This document forms the core of the trio of documents. It will present as a short handbook: for clarification and technical support. This will be used by implementers, practitioners, and other groups.
- *Synthesis version*: This version is a shorted version for policy purposes. It will be used primarily by policy institutions, and other groups, and has a key purpose to provide policy orientation.

- *Training module*: This version will form part of the knowledge base and used for the ACQF Training programme and ACQF e-learning platform.

As an ACQF instrument, the innovation and technology guideline:

- works in synergy with, and complements, other ACQF guidelines
- refers to the relevant existing (or planned) African Union (AU) policies, instruments and recommendations
- contributes to an AU area of education and qualifications, based on converging elements and recommendations that eventually contribute to continental integration and mutual understanding while respecting the diversity of the national and regional context

1.3 Target users

The main target users of this innovation and technology guideline are:

- members or stakeholders of steering groups/ implementation groups for the ACQF
- National Referencing Committees/ National Coordination Points and policy advisers involved in education and training
- implementers and practitioners of NQFs and NQSs
- individuals and institutions actively involved in choosing and pursuing innovations and/or technologies to be implemented in education and training

The ACQF learning outcomes approach will be important for referencing (establishing the link between) the national level descriptors or national qualifications levels to the ACQF levels. The referencing outcomes and implications will be of importance to persons involved in supporting mobility for lifelong learning.

1.4 Objectives

The innovation and technology guideline aims to:

- introduce a range of innovations in the context of NQFs and RQFs
- clarify the key requirements for countries looking to implement each innovation
- provide conceptual and technical orientations to countries and regional economic communities (RECs) to support the improvement and consolidation of their own NQSs and NQFs and links with the ACQF - this reinforces objective 3 of the ACQF which is to work in cooperation and complementarity with the NQFs
- contribute to a common understanding of innovation and technology in the ACQF and its application across countries and regions to ease the implementation of the ACQF at continental, national and regional levels
- present and elaborate on specific tools culminating in an ACQF handbook
- seek synergy between the innovation and technology guideline and complementarity with already existing AU policies and instruments

1.5 Links between ACQF guidelines

The ten ACQF guidelines have a key intention to contribute technical and methodological support to countries participating in the ACQF process.

The innovation and technology guideline (Guideline 9) links with the other nine ACQF guidelines and corresponds with the proposed ACQF referencing criteria. All the guidelines have some links to each other whether explicit or implicit (See Figure 1). Innovation and Technology links to all other guidelines as there are innovations and/or technologies which are currently or could be applied in all other areas. For example:

- Innovations such as personalized learning and learning management systems relate to learning outcomes (Guideline 1);
- Automation in the comparison of qualification frameworks related to the ACQF levels and level descriptors (Guideline 2) and referencing criteria (Guideline 3);
- Processes in the recognition of prior learning, competency-based assessment, stealth assessment and virtual assessment relate to the validation of learning (Guideline 4);
- Data collection methodologies such as crowdsourcing can feed into quality assurance processes (Guideline 5);
- Big data processes and skills matching, digital certification and micro-credentials relate to the registration of qualifications (Guideline 6);
- Data collection processes and innovations such as micro-narratives and data exhaust can support government systems of monitoring and evaluation (Guideline 7); and
- Establishing interoperability, relational databases and data visualization can support government-to-government collaboration and innovations in social media can support government-to-citizen communication (Guideline 8).

2 Innovation and technology in qualifications frameworks

Although they have been around for some time in other context, within Africa the construction and use of National and Regional Qualifications Frameworks is itself a new and innovative development (ACQF, 2021). Qualifications frameworks are classification tools. Qualifications are ordered based on a hierarchy of difficulty, in which obtaining a lower level qualification is a prerequisite for enrolling for a higher level (ibid). Practically, the qualifications framework uses what are called level descriptors which outline at every level what a student is supposed to know in order to be considered competent and gain a qualification. The difficulty and complexity increases progressively with every level as the student advances (SAQA, 2012). Standards guide what students should learn in each course or programme as they move towards qualifications (HCPC, 2017). National, regional and continental qualifications frameworks provide transparency and a means to compare and reference qualifications within and between countries (Coles, 2017).

As Africa moves towards closer regional economic integration, a common system of recognition of training and qualifications becomes ever more important. As a referencing tool, a Continental Qualifications Framework (CQF) will provide the blueprint to enable credential fluency and the mobility of skilled labour, a crucial part of regional integration and closer economic ties. However, comparisons between qualifications across borders can be labour-intensive, as can ensuring available qualifications and their associated standards align to skills and social demands within each given context, and as always access to formal education and the fair and inclusive recognition of skills remain foregrounded in African education systems.

Innovations, which include but are not limited to technological innovations, provide some responses to the key challenges facing governments in creating and implementing qualifications systems. This section outlines a series of existing and emerging innovations in the development of qualifications, frameworks and standards; comparing and analysing qualifications; the registration and management of qualifications;

and credentials and the recognition of learning. Section two also touches on innovations in data collection and use, communication and monitoring and evaluation, to present innovations directly in relation to other ACQF Guidelines.

This first overview of innovations in the development of qualifications, frameworks and standards will be enriched and completed in the next version of the Guideline. A section on types of qualifications databases and registers will be added, based on innovative experiences (global and African).

2.1 Innovations in the development of qualifications, frameworks and standards

A. Qualifications passport

A qualifications passport system works with nationally-regulated qualifications and can be an adjunct to formal skilling and qualifications pathways in countries with high numbers of migrants and refugees, providing opportunities to more rapidly absorb the available labour these populations provide to host countries.

Context: The increasing number of migrants and displaced persons in the world do not always have access to either paper documents or to the institutions that issued them, raising challenges in verification of qualifications. Further, qualifications may not be recognized across country borders. This results in lost skills absorption opportunities in host countries and lost social and economic opportunities for refugees and migrants.

Rationale: A qualifications passport maps and presents the available information about education levels of refugees and migrants through a combination of document analysis, structured interviews by credential evaluators and/or authorized assessments. The qualifications passport is not a travel document or a substitute for formal qualifications or recognition, but can be leveraged by migrants for entry into work or further education as they pursue avenues to access their existing qualifications. Qualifications passports developed so far are valid for a limited time, generally 3 - 5 years.

Examples:

- The European Qualifications Passport of Refugees (Council of Europe), which has been tested in nine countries is a standardised document that details the qualifications a refugee has following an assessment that is based on available information. Although it does not constitute formal recognition, it does provide useful information.
    - Linked resource (pdf): Sample and template for a Qualifications Passport
    - Linked resource (web page): Nokut's Recognition Procedure for Persons without Verifiable Documentation
- The UNESCO Qualifications Passport for Refugees and Vulnerable Migrants which draws on the methodology of the European Qualifications Passport of Refugees
- Linked resource (video): Testimonials from Qualifications Passport participants in Zambia

Requirements for implementation:

- Accredited and experienced credential evaluators

- Legal structures that allow migrants to work or study in host countries

B. Flexible learning pathways

Context: Rapidly changing skills needs, access to educational technologies such as MOOCs and micro-credentials and increasingly diversified provision of skills and training programmes all speak to the need for flexible formal education systems which can respond to the demands of youth and lifelong learners alike. Particularly in contexts in which poverty and/or high rates of internal migration, the creation of flexible learning pathways can improve participation and completion rates.

Rationale: Flexible learning pathways incorporate RPL, credit transfer, and flexible teaching and learning options such as electives or 'flex time' to pursue individual projects to support lifelong learning. They provide multiple entry points to and progression routes between institutions, courses and/or education levels, allow students to 'step in and step out' of studies and learn at their own pace.

Examples:

- The UNESCO International Institute for Educational Planning summary report on flexible learning pathways (2021, pdf): SDG 4 - Policies for Flexible Learning Pathways in Higher Education: Taking Stock of Good Practices Internationally
    - Case studies (pdf): Britain, Chile, Finland, India, Jamaica, Malaysia, South Africa

Requirements:

- A well-articulated National Qualification Framework for the recognition and classification of education programmes.
- Appropriate legislation to support the regulation, funding, articulation and transfer of credentials
- Quality Assurance and accreditation systems
- Credit accumulation and transfer systems
- Robust career and study counselling services

C. Stackable credentials

Stackable credentials can be accumulated over time to build up a qualification.

Context: Structured qualification and degree programmes rarely allow students to obtain 'partial' qualifications for credits or modules completed. This has led to many students 'losing credits', particularly when they transition multiple times between education and work or unemployment, a situation often caused by a lack of finance or personal challenges.

Rationale: Stackable credentials are systems in which classes taken in one or more programmes 'stack' like bricks towards a qualification. Students receive credit for learning completed and can use it for job market access even if they have not fully completed a degree. Advantages are that students can pursue higher degrees with lower initial investment, pursue learning at their own pace without losing any credit, and can pursue work experience after completing only part of a qualification. Stackable credentials also offer pathways to continuing education or lifelong learning. Stackable credentials should have a labour market value, distinct from a full qualification.

Examples:

- Miami Dade College is one example of an institution that offers stackable credential pathways.
- Further reading:
    - Bailey and Belfield, 2017. This paper reviews recent evidence on the labour market returns to credit accumulation, certificates and associate degrees from community colleges in the United States.
    - MICROBOL, 2021. This paper lists the recommendations by the MICROBOL project for the EU Council recommendation on micro-credentials.

Requirements for implementation:

- A coherent framework within which to incorporate short-term credentials into degrees is required, with defined components, stacking criteria and rules and regulations guiding the recognition of stackable credentials at institutional and national levels, to avoid confusion between stackable and traditional qualifications. Frameworks aim to incorporate stackable credentials into existing NQFs against generic level descriptors and learning outcomes.
- Strong career guidance systems and processes. These can be supplemented by guided learning pathways or career maps.

D. Personalised learning pathways

Personalised learning allows flexibility and student agency in education and can also leverage self-paced formal and non-formal learning experiences such as micro-credentials. It can be used as part of flexible learning pathways and/or stackable credentials as well as to identify and fill skills gaps for RPL. When integrated into qualifications frameworks, personalized learning supports lifelong learning and improve credential fluency.

Context: As the skills needs of labour markets diversify and the demand grows for 'soft skills', there is a greater need for more flexibility and student agency in learning, which can contribute to both skills and metaskills such as 'learning to learn', an important consideration in lifelong learning.

Rationale: Personalised learning addresses student agency, providing choices in what, how, when and where students learn. Personalized learning can take place in both traditional and technology-enabled classrooms, and some AI algorithms are designed to support personalized learning. Personalized learning can include elements of mentorship, project-based learning and self-assessment.

Examples:

- The Republic of Korea's Human Resources Development Service launched an app which allows users to complete courses and gain certificates for technical and vocational skills.
- Further reading:
    - Holmes, Anastopoulou, Schaumburg and Mavrikis, 2018. This paper explores technology-enhanced personalised learning;
    - Wong, 2020. This paper provides a review of journal articles on personalised learning published between 2001 and 2018, highlighting changes in features and trends over time.

Requirements:

- Teachers who are trained in the pedagogy of personalized learning

- Flexible learning pathways
- Monitoring, quality assurance mechanisms

2.2 Innovations in comparing and analysing qualifications

E. Automation in the comparison of qualifications and frameworks

Machine learning and AI holds some promise for the future of taxonomy mapping, for credit transfer, skills matching, qualifications comparisons, and verification processes. These technologies could improve the accuracy and quality of many of the elements involved in creating and maintaining qualifications frameworks, while reducing the time and effort required to do so.

Context: As the need for comparing qualifications and qualifications frameworks increases, and integration of frameworks deepens through regional QFs and credit transfer and sharing agreements, so too will the need for quick, accurate, and up-to-date comparisons to facilitate mobility and portability. Current methods of comparison are labour-intensive and highly dependent on expert human input.

Rationale: While still in development, the use of AI and Machine Learning to assist in the mapping, comparison, alignment, and classification of qualifications across national and regional qualifications frameworks is promising, and could allow for faster, more accurate and reliable cross-country comparisons in future, facilitating the easier alignment or realignment of curricula and frameworks to the needs of the labour market and society, and further enabling labour migration.

Examples:

- The ACQF project includes the piloting of a semi-automated process to match learning outcomes of qualifications. The first pilot project linked learning outcomes of registered qualifications from Cameroon, Cape Verde, Kenya, Mozambique and South Africa to the European Skills, Competences, Qualifications and Occupations (ESCO) taxonomy.

Requirements:

- Availability of structured data
- Availability of computer processing power
- Adherence to a common semantic framework or translation mechanism (such as the ESCO or other taxonomies).

F. Credential fluency

The recognition of all forms of learning (formal, non-formal and informal) is a central feature of qualifications systems and frameworks. The new concept of credential fluency attempts to provide a more futuristic view of this increasingly seamless interrelationships between the recognition of formal, non-formal and informal lifelong learning made possible through a user-centric approach, digital forms of recognition, improved data interoperability, and closer alignment between learning and the world of work.

Context: Qualifications systems and frameworks make it possible for learning that is not formal (i.e., it may be non-formal [structured learning, but lies outside the qualifications system] and/or informal

[unstructured, resulting from daily activities]) to be recognised. Such a recognition process can take place through RPL (see section 2.4), but with the accelerated development of digital platforms, digital credentials and many of the innovations outlined in this manual, we are seeing more seamless forms of recognition emerging.

Rationale: Credential fluency can assist policymakers and practitioners to develop more inclusive systems of recognition, and potentially also new forms of RPL. It will be important to link the notion to new forms digital platforms and take care to avoid proprietary systems that could potentially lock countries into expensive solutions that may not be sustainable in the long run.

Examples:
The concept is new and so there are few detailed examples outside of emerging research, most of which is not yet publicly accessible. One recommended reading is:

- Keevy and Dale-Jones. 2021. *Digital credentials: Discussions on fluency, data privacy and the recognition of learning in higher education beyond COVID-19*. This paper discusses the links between digital credentials, credential ownership and credential fluency in the modern higher education environment.

2.3 Innovations in the registration and management of qualifications

National qualifications frameworks and systems need specific operational instruments to manage qualifications of all types and make this information accessible for all target groups, especially the end-users. This section will include specific information on different types of qualifications databases and registers, accessible online and allowing links to other regional / continental databases. Information on qualifications databases and registers is being collected and will be included in the next version of this Guideline.

G. Interoperable data systems

Interoperability of data systems hold enormous potential for national and regional qualifications frameworks in terms of data capture, processing, and analysis, for maintaining and updating the QFs, while the ability to access and utilise data from partner organisations could support a number of other processes such as credit transfer, RPL processes, verification, while generating data for LMI and other skills and labour market planning activities.

Context: A range of organizations may be involved in qualification and credentials, including industry certifying bodies, education departments, higher education institutions, TVETs and - increasingly - online providers. Each generates data, for example records of qualifications or courses, which could potentially be leveraged by other organizations, but this cooperation is often blocked due to mis-alignment in digitization, structure of data, terminologies used and methods of exchange.

Rationale: Coherent structures and processes for data collection, storage, management and exchange using common *standards*, or guidelines for how data is described and recorded, allow the free flow of information between government departments and between governance structures and the organizations and individuals they interact with. Students can seamlessly use credentials from one system in another,

and government agencies can easily view trends and make decisions using labour market and education data gathered from a range of sources.

Examples:

- The PSET Cloud is a digital platform for strengthening, coordinating and integrating the governance and management of the post-school education and training system in South Africa. It includes information about work opportunities, formal and non-formal learning requirements, and where those competencies can be acquired.
- The Statistical Information System Collaboration Community is an open-source community that supports common standards and aggregates/analyses/disseminates official statistics from a number of governments, private and civil society organizations.
- The Cedefop Skills and Labour Market is based on interoperability of different databases and data sources including surveys, internet data and official statistics. This platform offers the following tools: European Skills Index, Matching skills, Skills Forecast, Skills intelligence and Skills-OVATE. The latter is an innovative and interactive platform, based on data collected from online sources of job advertisements, analysed, classified and visualised using AI-aided technology.

Requirements:

- This solution relies heavily on the digitization of data. Systems which are still largely recording and transmitting information using paper-based methods and/or unstructured data records such as those commonly found in PDF or word processing must first digitize their records and systems.
- The procurement of expertise in developing and interpreting data standards, which may be developed within government (e.g., standards bodies) or contracted.
- The development of government protocols for data collection, capture and exchange.
- Associated training widely throughout the organizations such as educational institutions and certification boards.

H. Relational databases

Relational databases can support interoperable data systems. They store information in a series of tables in order to retrieve information in relation to other pieces of information.

Context: Various data needs to be accessed, interpreted, and exchanged between organisations operating within a single system, such as between several schools in a district, or between higher education institutions, national education departments, and labour bureaus. However, when different components of a system are built independently of one another, 'conflicts' in data processing and retrieval can occur, which need to be resolved to allow for smooth data flow.

Rationale: RDMSs can be used to resolve 'conflicts' between different datasets and allow information from different systems to be integrated, 'joined' or reconciled into one database. Once that data has been reconciled, it can be used as the foundation for websites, apps, or dashboards, or the data can be visualised for better communication and understanding.

Examples:

- MySQL
- MariaDB

Requirements:

- Relations databases require highly structured data, so clear data standards
- Digitization of data and databases
- RDMS software

I. Credit banks

A credit bank system strengthens the articulation pathways between institutions and course offerings, enabling lifelong learning and improved labour mobility.

Context: In order to facilitate lifelong learning, credit accumulation and transfer (CAT) is necessary. However, when transferring between institutions, or between countries, there is a risk of losing credits obtained because of a lack of credit recognition or ability to verify credits between institutions.

Rationale: Credit banks are systems for recognising and certifying prior learning and granting credits, credit accumulation by 'housing' records of learner's records and achieved credits, and facilitating the transfer of credits between institutions. Related processes include the recognition of prior learning, flexible learning pathways and stackable credentials.

Examples:

- The Shanghai Academy Credit Transfer and Accumulation Bank for Lifelong Education is a centre which allows citizens to save and aggregate their formal and non-formal education outcomes, applying some types of credits towards academic degrees.
- The European Credit Transfer and Accumulation System is a system for recognizing and translating credits achieved to a standard regional system, which can then be applied across all participating countries and institutions, facilitating recognition of prior learning and student mobility.

Requirements:

- Mutual recognition of credit banks and their functions by various organisations, public and private, operating within the credit bank's national or regional education system.
- A platform for storing learner records, institutional credit transfer agreements, the necessary rules and regulations.
- Credits are awarded, recognised, transferred, and allocated according to existing national and regional qualifications frameworks, and will need to be pegged to these frameworks.
- Appropriate policies and legislation to support credit transfer and accumulation.

2.4 Innovations in credentials and the recognition of learning

J. Recognition of Prior Learning (RPL)

Recognition of Prior Learning (RPL) is a process of identifying, documenting, assessing and certifying formal, non-formal and informal learning outcomes against the standards used in formal education and training. RPL is not limited to assessment but includes processes of identification, documentation, assessment and certification. RPL policy should be aligned with relevant regional and international qualifications

frameworks to maximise migrant and worker mobility, and to allow for the absorption of both skilled and unskilled refugees and asylum seekers into national and regional labour markets in their host countries.

Context: Competences can be acquired through formal, non-formal and informal means. However, informal and non-formal learning, especially outside of academic institutions, is not formally recognised, making this type of experience difficult to add to a portfolio or contribute towards a formal qualification. Particularly for individuals with financial constraints, skills can often be gained through informal work or other life experience, but this experience cannot be leveraged for entry into formal education or employment.

Rationale: RPL has emerged as a mechanism for the recognition and formalization of informal or non-formal learning, generally involving processes of document reviews, interview and/or assessments to verify experience and competences. In some modular systems, skills demonstrated through RPL can be combined with targeted coursework to fulfil complete credential requirements. Formal certification increases labour mobility and can provide increased opportunities to migrants, refugees and asylum-seekers. RPL is driven by a people (learner)-centred approach with guidance and support throughout the process. Individuals make decisions and pursue desired outcomes such as part or full qualifications, building a portfolio of documented experiences, and/or individualised roadmaps for further training to acquire missing skills.

Examples:
The following are some examples of how RPL policies and practices are structured from a few countries in Africa and the European Union:

- The South African Qualification Authority's National Policy and Criteria for the Implementation of Recognition of Prior Learning (pdf).
- Mauritius Qualifications Authority's Recognition of Prior Learning Guidelines (pdf).
- The Kenyan National Qualifications Authority's RPL framework (pdf).
- European Union´s Validation of Non-Formal and Informal Learning (VNFIL) Platform offers policies, inventories of VNFIL systems and developments in Europe, thematic and country analyses and European Guidelines for VNFIL.
- Bertelmann Stiftung's #ShowYourSkills platform in Germany combines a variety of instruments to make people´s skills and competences visible, including the My Professional Experience self-assessment of professional competences; the MYSKILLS test supporting job seekers; and Career Cards and Competence Cards to improve career guidance and migration counselling.

Requirements:

- A regulatory framework situating RPL within existing national human, sectoral and regional economic and development policies
- Defined RPL guidelines, including standards, processes, and measures for RPL quality assurance.
- Phases of RPL processes: identification, documentation, assessment and certification. RPL should not be limited to assessment.
- Linkage and complementarity between RPL and national qualifications frameworks and systems.
- People (learner)-centred approach, based on adequate guidance and support throughout the process, and allowing individual decisions on the desired outcome (a part qualification, full qualification, a portfolio of documented experiences, an individualised roadmap for further training to acquire missing skills, among others).
- Learning outcomes-based standards of qualifications as reference and basis for RPL.

- An institutional framework outlining institutional responsibilities for planning, implementing, monitoring and evaluating RPL.
- Plan for securing commitment to RPL and collaboration.
- A financing plan to ensure the funding and institutional arrangements for RPL.

K. Digital certification and digital credentials

Digital credentials are digital forms of any kind of credential or certification, and include formal and non-formal learning, macro and micro-credentials. There are different methods of digital certification, with badges being prominent. Digital certification and digital credentialing will allow for improved and more secure transfer of information between institutions, government, and employers, and support the digitalisation of activities linked to NQFs and RQFs including credit transfer, verification, and quality assurance of qualifications and other credentials.

Context: Accessibility has become a very important factor in an increasingly digital society, and in many sectors paper records have been replaced with digital alternatives. However, in many education contexts paper records are still the norm. This method of keeping records is outdated and can be disadvantageous for populations that live in precarious conditions such as areas prone to natural disasters or political instability. If a disaster strikes or one has to leave home abruptly, these records can be costly to replace, or simply lost.

Rationale: Along with other forms of digital identity, such as driver's licences or identity documents, digital credentials offer a greater degree of security and flexibility in the ways that people access control, and share their educational credentials, including across borders and between institutions. Digital credentials are a safe, secure and reliable means of sharing and verifying an individual's credentials, and alternative digital credentials such as e-portfolios facilitate lifelong learning for career development.

Examples:

- Open Badges is a type of digital badge that carries verified and portable digital records of an individual's credentials.
- The European Digital Credential for Learning (EDCL) is one the main tools of the Europass platform. EDCL allows qualifications and other learning achievements to be securely and digitally recognised and verified across Europe. The EDCL tool is designed for learners and for issuers of Digital Credentials. Other tools of the Europass system: Europass profile, Europass documents, European Qualifications Framework (EQF).
- Additional reading: González, Porto and Cotón, 2021, Ravaioli and Ferrell, 2021

Requirements:

- The necessary techno-legal frameworks for the standardization of credentialing information
- Recognition of self-sovereign identity
- Mechanisms for ensuring user and data safety and privacy, and protecting user's digital identities

L. Micro-credentials

A micro-credential is a proof of the learning outcomes that a learner has acquired following a short learning experience and the proof is contained in a certified document that lists the name of the holder, and, where

applicable, the qualifications framework level and the credits gained (EU Commission, 2020). The debate is still ongoing on whether they from a part of formal or non-formal learning.

A micro-credential can refer to both i) the learning activity that leads to a credential and ii) a certification. These can be formal or semi-formal accreditations, and are generally stackable towards a larger qualification. The inclusion of micro-credentials in qualifications frameworks is in the early stages, but are important considerations for the comparison of qualifications, articulation, stackable credentials and flexible learning pathways.

Context: Rapid innovation cycles and advanced systems of knowledge distribution contribute to the need for individuals to continuously update their knowledge and skills through lifelong learning. This lends itself to demand for short-term flexible learning opportunities.

Rationale: Micro-credentials are one method through which people embrace lifelong learning. By integrating micro-credentials and their learning outcomes into NQFs (for example through stackable credential framework), they can be used to make access to learning more equitable and more affordable.

Examples:

- The European MOOC Consortium's Common Micro-credential Framework (CMF) uses the European and other national qualifications frameworks to award credits to micro-credentials.
- The New Zealand Qualifications Authority's micro-credentials framework allows tertiary education institutions to apply for micro-credential approval.
- Additional reading:
    - EU, 2020. This is a report by the European Commission on how Europe approaches micro-credentials released in 2020, one step towards the development of a common European approach to micro-credentials.

Requirements:

- A common or shared understanding of micro-credentials and how those will translate into existing qualifications frameworks must be developed
- A micro-credentialing framework detailing the rules and criteria for micro-credentials, underwritten by a national qualifications authority with alignment to existing national and regional qualifications and standards

M. Self-sovereign identity

Self-sovereign identity (SSI) is the idea that individuals should be the primary controllers of their own data, with access to this data granted by peer-to-peer exchanges initiated or approved by individuals. While there is increasing interest in SSI, much energy is currently being devoted to building the necessary infrastructure (technological, policy, and legal) to host the applications which will 'house' self-sovereign identities in the future.

NQFs and RQFs should recognize digital credentials as growth of SSIs offers the potential to issue, verify and transfer credits, certificates, and credentials quickly and securely.

Context: Although individuals pay for and work towards credentials, these credentials are 'owned' in perpetuity by the institutions that grant them and/or education systems more broadly. If the institution should cease to exist, individuals may lose access to these records.

Rationale: Application of the principles of self-sovereign identity to educational credentials. Students become the owners of their credentials, and can access verified and trusted digital versions of these credentials for their lifetime.

Examples:

- A self-sovereign identity initiative in Turkey allowing Syrian refugees to be issued with secure digital identities and to use those to register their businesses is currently in the pilot phase.

Requirements:

- Self-sovereign identities must be attributed to individuals and no two identifiers can be the same.
- SSIs must allow for user consent and control.
- SSIs must be interoperable.

N. Competency-based assessment (CBA)

As an assessment tool, CBA can readily be used for RPL as well as vocational and self-paced training if it is recognised in the policy and frameworks underpinning NQFs and RQFs. CBA also has applications to alternative credentials, micro-credentials and stackable credentials.

Context: One of the key challenges faced by many systems is a misalignment between education and training and the skills required by the labour market. Graduates may lack skills or be under-skilled compared to the expectations of entry-level jobs, creating challenges in employability.

Rationale: Competency-based assessment (CBA) has been introduced in many education systems to ensure that competencies developed by skilling systems align to labour market needs. CBA is based on clear standards and is a practical means of assessing an individual's ability to apply knowledge, skills and attitudes to successfully carry out a specific task. CBA emphasizes the application of skills in complex and/or real-life contexts.

Examples:

- Additional reading:
    - Gallardo, 2020. This paper looks at Competency-Based Assessment and the use of performance-based evaluation rubrics in higher education, and outlines anticipated challenges for the next decade.

Requirements:

- The occupational profile of jobs must be clearly identified.
- Developed standards and competency frameworks.
- The appropriate assessment tools need to be developed, and quality assured.

O. Stealth assessment

Stealth assessment takes place using information gathered from individuals during the course of regular activities. The aim of stealth assessment is to blur the line between learning and assessment while remaining reliable and accurate.

Context: Traditional forms of assessments are unable to effectively assess the complex competencies required for dealing with 21st century problems, including the learner's ability to think systemically, creatively, and critically, and to develop persistence, self-efficacy, openness, and teamwork.

Rationale: In addition to keeping learning fun and anxiety-free, stealth-based assessments can assess multiple, complex applications of various skills and competencies. Stealth assessment works well with technology-based educational delivery and especially game-based learning, as data can be gathered from individual students as they interact with the technology without requiring individual teacher time. However, the principles of stealth assessment can also be applied to competency-based assessment.

Examples:

- Shute and Wang (2013) used Portal 2, a popular physics-based computer game, to assess problem-solving, critical thinking, and spatial skills.
- Allen and McNamara (2015) used a natural language processing tool, TAALES, to predict students' performance on a measure of vocabulary knowledge in their essays.

Requirements:

- A means of gathering learner data unobtrusively, and
- A framework or rubric for assessment and analysis of that data.

P. Virtual assessment

Assessment is one aspect of education and training which has begun to be delivered through online or digital modalities. Virtual assessment provides i) e-assessments in which students complete electronic or digitised assessments in a virtual learning environment, and/or ii) fully- or partially-online simulation environments which replicate real-life workplace situations, allowing aspects of competency-based assessment in a controlled environment.

Context: The Covid-19 pandemic forced education institutions to migrate to online teaching, learning and assessment. This exposed both the weaknesses of systems and the opportunities inherent in distance education, which can improve access for students in rural and remote areas, as well as improving the efficiencies of systems by unblocking constraints such as limited physical environments or space for assessments, limited numbers of qualified assessors or the lack of assessors in specific areas.

Rationale: Virtual assessment can include the application of skills in context, interviews and role-playing as well as traditional assessments and reduce the financial costs associated with traditional assessment. In cases where the assessment is supported by back-end analytics, detailed data can be gathered and some aspects of marking may be automated, increasing efficiency. Data such as videos, automated marks and portfolios can be reviewed from any location, in some cases reducing pressure on available resources.

Examples:

- The European platform for individuals' management of their skills, qualifications, job search and career, Europass, launched a new online tool Test your digital skills, with the following functions: test to learn about your digital skills, discover what your level is and take the next step to improve them. The test involves a range of areas of competence: information and data literacy, communication and collaboration, digital content creation, safety and problem solving. The tool offers users the possibility to record their digital skills, receive course suggestions and discover their learning roadmap.
- The MySkills tool and platform in Germany scales up validation of vocational skills using ICT.
- The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) used virtual assessment to select candidates for their 2020 and 2021 AFRIKA KOMMT! leadership programmes and successfully assessed candidates from 50 countries, while gauging candidates' digital skills.
- Vulcan links to virtual reality or augmented reality to provide back-end analytics and feedback for occupations such as painting and carpentry.
- TLE TeachLivE™ provides initial teacher education through a virtual simulation environment that provides automated feedback on items such as the percent of teacher and student talk time and the number of open-ended questions asked.

Requirements:

- Assessments designed for a virtual assessment environment
- Integration of the necessary hardware and software for the virtual assessments to be used
- Appropriate systems and quality assurance mechanisms to ensure ultimately human responsibility for formal achievement records

2.5 Innovations in data collection and use

Q. Innovative data collection

Traditional qualitative and quantitative studies are often time-consuming and costly to carry out, and data can rapidly become dated and less reliable the longer the gap between data collection and publication. Innovative data collection methods can be used to collect both 'historical' and real-time data, allowing for practical applications, and richer problem-solving and analysis.

Scraping and crowd-sourcing two examples of innovative data collection used to expand the types and sources of data available to policy-makers and education researchers.

- Scraping extracts data such as daily changes in stock prices or new listings on job listing websites and stores it for later analysis. Scraping has manual and/or through automated processes.
- Crowdsourcing collects data from a large number of people, usually voluntarily and free of charge.

Examples:

- Scraping has been used to collect comparative product information and for gathering labour market information from online sources.
- Crowdsourcing has been used to audit election processes in Honduras, track the COVID-19 outbreak and to label data for natural language processing.
- Further reading: Zhao, 2017

R. Automated and AI-enhanced Labour Market Intelligence

Traditional methods of labour market intelligence gathering have a significant delay of months or even years between the reporting and analysis of labour market needs. Big data analytics are increasingly being used to provide real-time information about the skills needs and demands of employers. These innovative methods feed into labour market intelligence systems to support skills matching and skills anticipation and inform the development and revision of qualifications and qualifications frameworks.

The integration of automated skills matching processes into labour market intelligence provides real-time information on labour market needs and accurate trends over time through scraping and analysing secondary data sources such as job postings. This data can be harnessed to better understand changes in the labour market, indicate which skills and competencies are in demand, and potentially indicate how curricula can be revised to better reflect that demand.

Examples:

- CEDEFOP's Skills-OVATE portal uses data collected from online job vacancy websites across 28 European countries to offer granular and real time analysis of the demand for skills, occupations and sectors of economic activity. The large volume of data collected through scraping is analysed, classified and visualised on interactive dashboards through AI-aided technologies.
- The European Training Foundation (ETF) project "Big Data for Labour Market Intelligence". Based on data collected from internet sources (online job advertisements). Currently three data systems and dashboards have been established and maintained: Tunisia, Ukraine and Georgia. The data dashboards provide real-time and granular data on demand (occupations, skills-knowledge and attitudes, industries, sectors. A "Green dashboard" was created focused on "green skills" demanded in online job vacancies - example: Tunisia. ETF developed a Handbook "Big Data for labour market intelligence: an introductory guide" (ETF, 2019), and a series of online training programmes to disseminate information and build capacities.

S. Learning management systems

Learning management systems provide users with digital methods of classroom administration, delivery of educational programmes and documenting learning records. Increasingly, Learning Management Systems are being used to organise digital course materials, monitor student progress, conduct skills needs and other assessments, house learner portfolios, collect data on skills needs and shortages, and provide tailored training, self-paced, and open educational content to users.

They are often accompanied by learning analytics and insights on student performance and risk factors, which can be used as a basis for personalized learning pathways. They also provide opportunities for stealth assessment and flexible learning. User data generated on LMSs could also be fed into larger skills planning and anticipation activities.

Examples:

- **ManpowerGroup** developed FuturSkill and BridgeToWork programmes which provide ICT-related training and match people to ICT-related work opportunities.
- LMSs such as OpenLMS's Personalized Learning Designer also incorporate personalised learning

Requirements:

- Sufficient organisational or institutional capacity to implement and maintain an LMS
- Financial and infrastructure resources, and technical support
- Developed course content
- Knowledgeable facilitators

2.6 Innovations in communication

T. Social media

Social media are a wide variety of web-based services that allow people to chat, create and share user-generated content and join online communities such as through blogs, wikis, social networking sites and media sharing sites. The volume of communication through social media makes it a valuable tool for sharing and receiving information, for communicating in real-time, and for participating in educational and professional communities.

Social media can be used to raise critical awareness amongst the general public about the existence of QFs, their uses, and related activities such as credit transfer schemes, RPL, and different kinds of credentialing. Social media has enormous potential for increasing awareness and information access that underpins principles of equity and lifelong learning in education. Higher education institutions, think-tanks, non-profits, government departments and other organisations have embraced social media and use it for showcasing research, sharing learning content and introducing products and services.

Examples:

- Stanford University through its YouTube channel makes lectures freely available to the public. Recorded lectures are published here, so anyone with interest and internet can gain access to the information they share for free.
- Further reading:
    - Social media use in government, OECD. This paper is from the OECD iLibrary's working paper series on Public Governance and highlighted for the 'Selected studies on public governance policy prepared for use within the OECD'.

Requirements:

- Appropriate social media accounts linked to your organisation.
- Social media management and content plan.

2.7 Innovations in Monitoring and Evaluation

U. Micro-narratives

A form of data collection and analysis using individual stories to understand emergent issues in times of uncertainty. It combines quantitative and qualitative methodologies, dealing with both numbers and text, and is implemented through technology such as SenseMaker™, which aim to allow researchers and policy-makers to find patterns in the narratives of diverse populations.

Micro-narratives can support policy-makers, researchers and implementers of NQF and RQFs to better understand citizen perceptions of qualifications, qualification types, government implementation and skilling needs.

Examples:

- The UNDP Ukraine recently used micronarratives to investigate trends in views on the COVID-19 pandemic, and micronarratives have been used to investigate reception to government services.
- Further reading: Kylymnyk, 2020

V. Data exhaust

Data exhaust is an unintentionally produced type of big data that results from normal internet browsing and other activities. Data exhaust can take the form of web search results, online purchases, cookies, or location data. This type of data is referred to as 'found data', and can be passively collected and used in conjunction with other types of data to make inferences about human behaviours. It is widely used in targeted advertising.

Data exhaust can inform aspects such as effective government communication channels and provide information about populations and job-seekers.

Examples:

- Further reading:
    - O'Leary and Storey, 2017. This link provides further definition of the term 'data exhaust' from the Encyclopedia of Big Data).

W. Data visualization

Data visualization is the graphic representation of the results of data analysis. Data visualization can range from a simple pie chart or bar graph in a report, to an interactive digital dashboard utilising real-time data from multiple sources. Data visualization allows the demonstration of underlying patterns and trends, particularly for audiences that may lack data science or statistical expertise.

Through data visualization, large and complex datasets and their analysis are accessible to a wide audience, and can be used by the general public and policy-makers for planning and reporting processes.

Examples:

- Google Data Studio is one data visualization tool. It is an online tool for converting data into customizable informative reports and dashboards introduced in 2016 as part of the enterprise Google Analytics 360 suite. There is a a free version for individuals and small teams.
- The OECD's Skills for Jobs portal uses data visualization to represent skills shortages and surpluses for selected occupations in OECD countries
- Additional reading:
    - Boyles (2018). This link provides a further definition of the term 'data visualization' from the Encyclopedia of Big Data).

3 Databases

Databases are a critical component underlying many of the technology-based innovations currently happing in the qualifications space. Databases contribute to the recognition and management of credentials, and provide a basis for many of the innovations discussed in section 2. An understanding of databases and their roles in qualifications frameworks is therefore a pre-requisite underpinning much of the innovations and technologies which can be leveraged.

A database is an organised collection of structured information, or data, typically stored electronically in a computer system with functions to find, add, delete and change the data. Databases are important because in the information age many things are create and/or stored electronically, and through digitization processes a large amount of existing data is continuously being converted into a digital format to be stored electronically. Databases are a critical component of managing information in today's society, particularly for businesses and governments.

A database is operated by a database management system (DBMS). A database management system (DBMS) is a computerised data keeping system used to control a database. A DBMS serves as an interface between the database and its end users or programs, allowing users to retrieve, update, and manage how the information is organised and optimised, making it an integral part of data management.

Databases are used to solve one of the most fundamental challenges of the information age, storing and accessing large amounts of collected data. Databases allow users to not only store data but also reduce the amount of work necessary to retrieve, check and analyse data. It is easy to share data using a database as the data resides on a centralized system. Through a DBMS, users can query the system easily, data can be locked to prevent users from accidentally deleting or changing data, and a recovery manager will retrieve data in case of system crashes or errors. DBMS also have extra security measures to help protect data.

Databases also play an important role in the reduction of data redundancy within a computer application. Data redundancy is when multiple copies of the same information are stored in more than one place at the same time. A database will eliminate any data redundancy before the data is presented to the end-user, allowing for a cleaner and more accurate analysis with less effort. A database also offers the end-user consistency in its operation, be it in data analysis or updating the data, and also reduces incidences of data errors. Database Management Systems (DBMS) are often independent of any other computer programs and can be accessed by all other applications. And lastly, it is easy for users to access all relevant data in a database through the use of hosts and query languages such as SQL.

As with any innovation or new technology, limitations should be considered as well as the benefits. The fact that limitations exist should not serve to discourage the use of databases, but an awareness of limitations can ensure users have realistic expectations about what can be achieved and what other strategies may need to be used in conjunction with the technology.

One of the key limitations of databases is that they have high start-up costs. Databases are complex, difficult, and time-consuming to design, and building a database from the beginning therefore requires a substantial amount of work. Even if a commercial or existing database, databases also require a substantial amount of hardware and software, and there are also conversions costs to move from a file-based system to a database system. A database needs a moderate to high level of skill to set up, maintain and use. Databases are not designed to be intuitive like spreadsheets, so this expertise is critical to recruit or build

within organisations moving to database systems. They may not be suitable for small firms or organisations which do not have large volumes of data. Finally, for commercial database management systems, frequent upgrades usually add new functionality to the systems, but these updates may also at times require hardware upgrades.

There are many different types of databases which can be leveraged. The decision of what type of database to use will depend on the needs of the organization, and the hardware, budget and skills available. Table 1 outlines different types of databases, their requirements and some advantages and disadvantages of the type of database.

Table 1: Overview of common database types

Databases	Description	Requirements	Advantages	Disadvantages
Centralised	A centralised database is basically a type of database that is stored, located as well as maintained at a single location only.	Mainframe computer and Local Area Network (LAN) or Wide Area Network (WAN).	• Data is stored at a single location only so is easier to access and coordinate data. • Minimal data redundancy • Lower cost than other types	• Higher data traffic • If any kind of system failure occurs at the centralised system then the entire data will be destroyed
Distributed	A distributed database is a collection of multiple interconnected databases, which are spread physically across various locations that communicate via a computer network. For organisations with multiple offices/branches. Useful for closed networks.	Client-server architecture - the principle idea of this architecture is to define specialised servers with specific functionalities such as: printer server, mail server, file server, etc. these serves then are connected to a network of clients that can access the services of these servers.	• This database can be easily expanded as data is already spread across different physical locations. • The distributed database can easily be accessed from different networks. • This database is more secure in comparison to a centralised database.	• This database is very costly and it is difficult to maintain because of its complexity. • In this database, it is difficult to provide a uniform view to users since it is spread across different physical locations.
Cloud	A cloud database is designed for a virtualized computer environment and can be accessed via the internet from the cloud database service provider and is deliverable to the users when they demand it.	Typically built using a cloud provider (Windows Azure, Amazon SimpleDB, or Google Cloud SQL); Individuals can create via Microsoft Access web apps. Can be accessed via computer through the internet, or a user using a mobile phone can access	• Fast • Cost savings as it eliminates the need to own data centres and staff to manage it • Scalable • Can access the information from anywhere	• Pay-per-transfer model • No control over the servers, software and security where your data is stored • The data you have hosted on the cloud database is totally dependent on the service provider

		the cloud database via 3G or 4G services.		• It is very difficult to transfer so much data to a computer • Data is fetched via the internet, so if the server is down access can be lost.
Open-source	An open source database allows users to create a system based on their unique requirements and business needs.	A database management system (DBMS).	• It is free and can be shared. • The source code can be modified to match any user preference. • Cost effective. • Better quality source code. • More secure.	• It provides limited technical support.
Commercial or closed source	Closed source databases are proprietary software where the source code cannot be accessed, modified, distributed, or reused.	Customer Relationship Management (CRM) system.	• It provides guaranteed technical support.	• They are premium and are not free like open source databases.
Non-relational databases	Unlike relational databases, non-relational databases store data in any format. Data is not required to be formed into a table, instead, it could be anything from document to graph.	NoSQL supported server e.g. Redis Server, Memcached Database Server or Oracle NoSQL.	• Elastic scalability: These databases are designed for use with low-cost commodity hardware. • Big Data Applications: Massive volumes of data are easily handled by NoSQL databases. • Can be easily installed in cheap commodity hardware clusters as transaction and data volumes increase.	• NoSQL databases don't have the reliability functions which Relational Databases have. • NoSQL is not compatible (at all) with SQL. • NoSQL is very new compared to Relational Databases, which means that they are far less stable and may have a lot less functionalities.

Relational	The most common database which stored data in tables. Different tables are then connected to the others through unique key fields.	A database management system (DBMS) - the software which controls the storage, retrieval, deletion, security, and integrity of data within a database.	• The simplest model, as it does not require any complex structuring or querying processes. • Provides data accuracy and easy access to data. • Sturdy Data entries and legitimacy validations ensure data integrity. • Possesses qualities for levelling up, expanding for bigger lengths, as it is endowed with a bendable structure to accommodate the constantly shifting requirements. • Known for high security. • Feasible for Future Modifications.	• The underlying cost involved in a relational database is quite expensive. • Performance of the relational database depends on the number of tables and more makes it slow. • Requires a tremendous amount of physical memory since it is with rows and columns. • Risk of information loss when it is transferred between systems. • Structure limitations because the fields that are present on a relational database are with limitations.
Operational	Common in organisations as they store payroll records, customer information and employee data. With operational databases, records can be added, removed and modified in real time.	Operational DBMS	• Records can be added, removed and modified in real time. • Versatile and accommodate distributed systems like NoSQL, SQL, New SQL Databases. • These systems are highly available, fault-tolerant and highly scalable as discussed. • Secure as they offer built-in support for encryption, auditing, and protection from cybercrime.	• Steep learning curve that increases the overheads expenses. • The installation process of such an operational database system requires time and effort • Stored in a remote location having overall control could be difficult.

4 Measuring innovation readiness

Notions of innovation are closely tied to economic growth and development. The UN Economic Commission for Africa (2018) suggests that "for growth to result in economic transformation, it must be knowledge-based and innovation-driven, based on evidence from advanced economies and newly industrialized countries." In turn, countries must have the necessary criteria in place to enable them to successfully adopt and implement innovations. An assessment of those criteria might provide an indication of a country's 'innovation readiness'.

Innovation readiness indicators are useful means of assessing country innovation readiness. While multiple frameworks and indicators have been developed to measure innovation in different countries, industries, and sectors, in general, a country's innovation readiness level can be assessed across three domains as show in **Figure 1**.

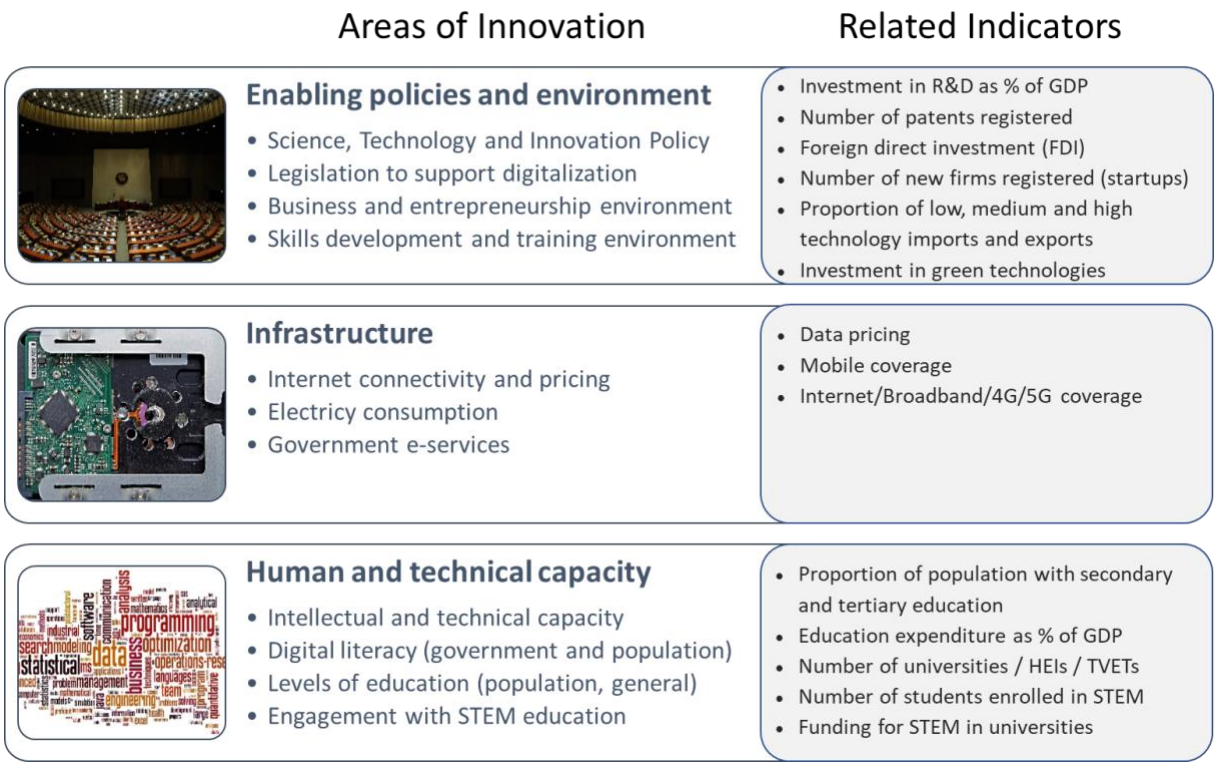

Figure 1: Areas of Innovation Readiness

Additional reading on innovation readiness:

- Oxford Insights AI Readiness Index
- UN Economic Commission for Africa framework for assessing science, technology and innovation readiness in African countries
- World Economic Forum Readiness for the Future of Production Report 2018
- World Intellectual Property Organization Global Innovation Index 2021
- Tufts University Digital Intelligence Index
- Information Technology and Innovation Foundation Contributors and Detractors: Ranking Countries' Impact on Global Innovation report
- DQ Global Standards Report 2019 Common Framework for Digital Literacy, Skills and Readiness

- World Bank GovTech Maturity Index : The State of Public Sector Digital Transformation
- World Bank Digital Adoption Index (DAI)

5 Ethical considerations

A large proportion of innovations today leverage technology and more specifically data. While there is promise in the use of artificial intelligence techniques and processes such as automation, the use of individual data in particular needs to be considered carefully.

In 2021 the OECD published a set of principles of data ethics (OECD, 2021) for the public sector, driven by an assertion that data use by governments should serve the public interest and deliver public good. The principles are:

1. Manage data with integrity. Officials should ensure trustworthy data management. Officials must not access, share or use data for personal profit or goals that do not serve the public interest, or that undermine human rights.
2. Be aware of and observe relevant government-wide arrangements for trustworthy data access, sharing and use. Officials should be trained on roles and responsibilities, and governments should ensure adequate expertise is available to all departments to manage data ethically.
3. Incorporate data ethical considerations into government decision-making. This includes considerations such as government planning, funding, ensuring unbiased sources of data and government contracts related to data.
4. Monitor and retain control over data inputs, particularly for AI systems. Further, public officials should be the decision-makers on issues that require human insight or may have adverse impacts on human rights, democracy or the rule of law.
5. Be specific about the purpose of data use, especially in the case of personal data. Ensure that there is a legitimate reason for collecting and using data. Place the needs of citizens at the centre of data activities. Ensure data is representative and fit for purpose.
6. Define boundaries for data collection, access, sharing and use. In the case of personal data, the minimum amount of data necessary for the defined purpose should be collected.
7. Be clear, inclusive and open. Governments should be transparent about what data is collected, when and how it is collected, and for what purpose. Governments should take steps to ensure data literacy among the population so that they may be educated consumers and understand the implications of data use.
8. Publish open data and source code. Open government data policies support socio-economic benefits, foster citizen engagement and ensure transparency, accountability, and public scrutiny of governments' decisions and policy outcomes.
9. Broaden individuals' and collectives' control over their data. Individuals and communities should have decision-making power and agency over their data, including to freely give or withdraw content to its use. This links to the principles of self-sovereign identity.

6 Key recommendations for responsive innovations

As the nature of work and employment has changed, so too have the requirements of qualifications and standards as well as the certification of competencies and the recognition of learning. In addition to traditional (macro) qualifications, the need for upskilling and reskilling means that short, self-paced micro-credentials and alternative credentials are now also in demand, and the means of delivering and assessing learning has become increasingly personalised and digitalised.

This paper has presented a wide range of mechanisms and tools to respond to the shifting demands of today's society and labour market, and there for the educational needs of citizens. Should one apply all of them all at once? Which are most important?

The answer depends upon the context, primarily upon (1) the *needs of citizens, industry and education systems* and (2) the *opportunities and resources available to the country or region*. An innovation readiness assessment or review can assist with determining the latter, while the former would ideally be based upon targeted research (possibly with data collected through some of the methodologies outlined in this text, such as micro-narratives).

Key questions to ask:

- What are the different roles and needs of policy-makers, implementers, private and third sector stakeholders, and especially citizens in relation to:
    - Designing, implementing, monitoring and quality-assuring qualifications frameworks and standards?
    - Accumulating formal and informal records of learning achievements such as credentials?
    - Accessing, storing, retrieving and verifying credentials?

Once a legitimate need or set of needs is established, it is possible to begin to review available options to see what solutions and opportunities fit the needs or challenges voiced. This paper has presented a range of opportunities and their potential or existing applications to NQFs and RQFs, but this is by no means an exhaustive list. Thorough research on available options as well as strategy sessions, if necessary, with the inclusion of technical expertise, can help to generate options. One key point is that the design of any innovation, whether digital or not, should be *centred on the users*, the people who are ultimately intended to benefit. Users should be involved in the initial research, the design and the testing and refinement processes of any innovative solution.

Key questions to ask:

- How will this innovation respond to the identified need(s)?
- How will citizens benefit from this innovation?

In the initial design phase, a multi-stakeholder team including users should ensure that the innovation is *contextually relevant* and *feasible*, meaning it responds not only to the needs but also the realities of the context. The best design in the world will never materialize without funding, and the best app in the world will not work if the intention is to deploy it in an area with high data costs or no connectivity – these problems must be solved before such a solution can be deployed. Integrated strategic planning for innovation which takes place between departments responsible for entrepreneurship, ICT infrastructure and education is one method of supporting citizen needs effectively.

Key questions to ask:

- What are the implementation requirements of this innovation?
- How ready is our system in terms of policy, finances, infrastructure and human capital to implement this innovation? What steps need to be taken to ensure the system is ready?

Finally, for any innovation the ethics of its development as well as its intended and actual uses should be thoroughly investigated, not as a once-off process but routinely, to ensure that the innovation remains fit for purpose, intentional and ethical.

Key questions to ask:

- Is the proposed innovation ethical? What are the concerns in terms of sustainability and energy use, cost-benefit, privacy (including data privacy) and other human rights?
- What processes will we put in place to test this innovation throughout its development and deployment?
- What data will we gather, and how will we gather that data? Who will analyse it?

7 Sources

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Annexes

Glossary

The focus in this guideline is on terms not included in the ACQF thematic brief 1 on Concepts and Definitions to avoid duplication.

Artificial intelligence	A branch of computer science concerned with building machines or software programs that simulate human thought and decision-making.
Big data	Data sets that are too large or complex to be managed traditional data-processing application software (like Excel).
Credential fluency	The more coherent and meaningful recognition of formal, non-formal and informal learning made possible by concepts such as interoperability, common taxonomies and digitalization.
Credit bank	An institution for recognising and certifying prior learning, credit accumulation, and facilitating the transfer of credits between institutions.
Data exhaust	An unintentionally produced type of big data that results from normal internet browsing and other activities.
Data scraping	A method (manual or automated) which collects data from websites and stores it for later analysis.
Database	An organised collection of structured information, or data, typically stored electronically in a computer system.
Database management system	A computerised data keeping system used to control a database.
Digital credential	A digital form of any kind of credential or certification.
Flexible learning pathway	A system or framework for learning with multiple entry points to and progression routes between institutions, courses and/or education levels that allows students to 'step in and step out' of studies and learn at their own pace.
Interoperability	The state in which all prerequisites are in place so that machines or systems of machines can exchange information seamlessly.
Micro-narrative	A form of data collection and analysis using individual stories to understand emergent issues in times of uncertainty.
Personalized learning	A flexible, student-controlled method of learning, which can include self-paced, formal and informal learning experiences.

Self-sovereign identity	The idea that individuals should be the primary controllers of their own data, with access to this data granted by peer-to-peer exchanges initiated or approved by individuals.
Stackable credential	Credentials which can be accumulated over time to build up a qualification.
Stealth assessment	Evaluation of learning or skills using information gathered from individuals during the course of their regular activities.
Virtual assessment	1. e-Assessments in which students complete electronic or digitised assessments in a virtual learning environment. 2. Fully- or partially-online simulation environments which replicate real-life workplace situations.