Workshop to Sharing Experiences and Best Practices on How APEC Economies' Qualifications Frameworks are Coping with the Disruptive Impact of Emerging AI Technologies

Compendium

APEC Human Resources Development Working Group

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Introduction

Technological development is advancing at a fast pace, contributing to the competitiveness and productivity of the different economies across the globe. Such is the case of AI, which can, for example, drastically and efficiently improve production levels in the manufacturing industry when implemented in combination with automation. However, this carries the latent risk that certain operational jobs will no longer be needed as they will be replaced by AI: e.g., ChatGPT that has prompted IBM's CEO to pause the hiring of about 7800 back-office related positions and gradually replace them with AI over 5 years. This is the case in much of the formal labor market, raising serious concerns about the impact on MSMEs, but also in the informal market; and not only that, women are also experiencing segregation in some areas of knowledge, such as ICT or STEM, where they are under-represented with low participation rates, putting them at a disadvantage in benefiting from new job opportunities. The rapid advancement of technology and its pervasive influence on various sectors have significantly reshaped the global economic landscape. In this context, economies are increasingly recognizing the imperative need to equip their workforces with the relevant skills and competencies to navigate these changes effectively.

According to the APEC Economic Policy Report 2021 on Structural Reform and the Future of Work "(…) Government can support the development of skills by developing better skills forecasting systems, expanding reskilling and upskilling programmes, promoting lifelong learning and increasing targeted investment in education to better align school curricula and labor market skills needs".

In this context several APEC economies are at some stage of having implemented a QF that incorporates the qualifications from at least some education and training sector into a domestic framework:

• Australia – Australian Qualifications Framework (implemented)
• Canada – Various provincial frameworks (not a domestic QF)
• Chile – Chilean Qualifications Framework (in progress)
• China – Domestic Qualifications Framework (in progress)
• Hong Kong, China – Hong Kong, China Qualifications Framework (implemented)
• Indonesia – Indonesian Domestic Qualifications Framework (implemented)
• Japan – Japanese Qualifications Framework (in development)
• Malaysia – Malaysian Qualifications Framework (implemented)
• Mexico – Mexican Qualifications Framework (in progress)
• New Zealand – New Zealand Qualifications Framework (implemented)
• Peru – Domestic Qualifications Framework of Peru (in progress)
• The Philippines – Philippine Qualifications Framework (implemented)
• Singapore – Singapore Workforce Skills Qualifications (implemented)
• Thailand – Thai Qualifications Framework (implemented)
• USA – Various sectoral or regional systems (not a QF)

In this sense, this project proposes to analyze the implementation of APEC economies' QF to identify the skills, knowledge and competencies needed by professionals to cope with the disruptions of new technologies in different fields of the productive sector, and how they can reduce the negative impact on the workforce by rapidly adapting academic offerings for the well-being of people and society in an increasingly digitalized economy.

One of the primary functions of QFs is to provide a structured and coherent system for the classification and recognition of qualifications based on defined levels of learning outcomes. This not only promotes transparency and comparability of qualifications but also ensures that the skills acquired by learners are aligned with the requirements of the modern labor market.

The integration of AI and digital technologies into education and training poses both opportunities and challenges for QFs. On the one hand, these technologies offer new avenues for delivering education and training more effectively and efficiently. For example, the use of AI in personalized learning can help tailor educational content to the needs of individual learners, thereby improving learning outcomes. On the other hand, the rapid pace of technological change requires QFs to be adaptable and responsive to emerging skills needs. This calls for continuous engagement with industry stakeholders to ensure that the frameworks remain relevant and capable of supporting the development of an AI-symbiotic workforce.

In addition to aligning educational outcomes with industry needs, QFs play a pivotal role in promoting social inclusion and equity in education. The rapid adoption of digital technologies has the potential to exacerbate existing inequalities, particularly in economies with significant digital divides. Therefore, it is crucial for QFs to incorporate strategies that ensure equitable access to education and training opportunities. This includes the recognition of non-formal and informal learning, as well as the provision of flexible and modular learning pathways that accommodate diverse learner needs.

The challenges of integrating new technologies into QFs are further compounded by the need to maintain the reliability and credibility of qualifications. As such, robust quality assurance mechanisms are essential to safeguarding the integrity of the frameworks. This involves the accreditation of educational institutions and training providers, the standardization of assessment practices, and the periodic review of qualifications to ensure they reflect current industry standards. Moreover, the role of QFs in fostering international collaboration and mutual recognition of qualifications cannot be overstated. The development of regional qualifications frameworks, such as the AQRF, facilitates the comparability of qualifications across APEC economies, thereby supporting the mobility of students and workers. This is particularly important in an interconnected global economy where cross-border movement of labor is increasingly common. By aligning their QFs with regional and international standards, APEC economies can enhance the portability of their qualifications and contribute to the development of a more integrated and competitive regional workforce.

This document seeks to analyze the role of QFs in APEC economies as a strategic response to the challenges posed by technological disruptions, with a particular focus on their impact on the future of work. The analysis will examine the integration of AI and digital competencies into QFs, the alignment of qualifications with industry demands, and the promotion of lifelong learning and upskilling initiatives.

Specifically, this work aims to review the experience of nine APEC economies: Australia; Chile; Malaysia; New Zealand; Peru; The Philippines; Singapore; Thailand; and Viet Nam in search of best practices and lessons learned from their successes or failures in the journey of designing and implementing Domestic Qualifications Frameworks. To achieve this, the methodological strategy included conducting interviews with experts involved in the policies of each economy and a comprehensive review of relevant documents. In cases where interviews could not be conducted, the research relied solely on bibliographic and documentary review. Additionally, participation in the workshop held in Lima, titled "Workshop to Share Experiences and Best Practices on How APEC Economies' Qualifications Frameworks Are Coping with the Disruptive Impact of Emerging AI Technology," provided an opportunity to gain deeper insights into the experiences and challenges of the different economies that participated and shared their journey in developing QFs. The expectation is that these documented experiences may serve as inspiration due to their impact and replicability, in a collective effort of cooperation to address the challenges that AI imposes on the economy and society, so that its numerous opportunities can be leveraged by all for economic growth and the well-being of our societies.

The document is structured into three main sections. The first section presents some basic concepts related to Qualifications Frameworks that are essential for understanding the economy-specific experiences. The second section provides a brief overview (much more could be written) of some characteristics of the technological changes we are currently undergoing. The third section discusses the gender perspective and its importance in the context of AI to prevent the perpetuation of biases. The fourth section presents the experiences of the aforementioned economies, gathered through interviews, document reviews, and participation in the workshop. Finally, the document offers some conclusions and final reflections that attempt to organize the collected experiences and their lessons.

Qualifications Frameworks, Basic Concepts

Some Basic Concepts

This section will conceptually present the Qualifications Framework as a tool and other concepts attached to it, with the objective of harmonizing terminologies that will later be used to describe the experiences of the selected economies and also to consider the recommendations or strategies they have designed to address the challenge.

Perhaps the first term to reconcile when discussing Qualifications Frameworks is precisely "Qualifications." The OECD defines a qualification as being achieved when

a competent body determines that an individual has acquired knowledge, skills, and/or broader competences to specified standards. This standard of learning is confirmed through an assessment process or the successful completion of a course of study. Learning and assessment for a qualification can take place during a programme of study and/or through workplace experience. A qualification confers official recognition of value in the labor market and in further education and training. A qualification can also be a legal entitlement to practice a trade.

This definition makes an important clarification for this compendium by highlighting that learning for the achievement of a qualification can occur in an educational setting or through work experience, thus underscoring the capacity of qualifications—and consequently, the framework—to propose a common language between education and work, which is central to its application and development.

In short, qualifications are "a formal outcome of an assessment and validation process, which is obtained when a competent authority determines that an individual has achieved learning outcomes to given standards."

Within that definition of qualifications, another concept is introduced that is central to a qualifications system: Learning Assessment. While its definition may seem straightforward, it is important to conceptualize it to fully grasp what its implementation entails. A Learning assessment is an individual process of evidence collection regarding a person's performance, which allows for the assessment and demonstration of their competence to carry out a set of tasks or achieve a set of outcomes, based on a standardized benchmark. Competence is inferred from the person's performance, making it crucial to rely on evidence. The evaluation standards must include task performance criteria and expected evidence.

Competency assessment is a process rather than a single event; therefore, it typically involves different stages in various settings, combining multiple assessment instruments that are known in advance by all parties involved. Upon completion of the process, properly trained evaluators will be able to determine whether the individual is competent in performing the assessed tasks. Evaluation is a central component of the certification process and of the educational and career guidance provided to the evaluated individual. The certificate, within a qualifications system, allows the individual to validate their competence in the relevant context, whether it be in the workplace or in education.

Having defined the concept of qualification, it is pertinent to ask: what is a qualifications framework? Once again, the OECD provides a definition that is highly relevant for this document: "A qualifications framework is an instrument for the development and classification of qualifications according to a set of criteria for levels of learning achieved. This set of criteria may be implicit in the qualifications descriptors themselves or made explicit in the form of a set of level descriptors. The scope of frameworks may be comprehensive of all learning achievements and pathways or may

be confined to a particular sector – for example, initial education, adult education and training, or an occupational area. Some frameworks may have more design elements and a tighter structure than others; some may have a legal basis, whereas others represent a consensus of views of social partners. All qualifications frameworks, however, establish a basis for improving the quality, accessibility, linkages, and public or labor market recognition of qualifications within an economy and internationally."

In essence, a Qualifications Framework serves as a common language between learners, education, and the labor market, facilitating both the process of skill formation and the recognition of skills for employment. In the same sense, the ETF says that a QF offers common sets of principles and references. They provide the opportunity to make informed decisions on the relevance and value of qualifications. They make it possible for users to decide whether or not qualification opens up opportunities both in the labor market and for further learning.

According to the ILO (Billorou & Vargas), a Qualifications Framework is a means of structuring existing qualifications as well as those emerging within a specific context (domestic, provincial, or sectoral). It indicates the comparability and interconnections between qualifications and how an individual can progress from one level to another, whether within the same occupation or sector, or between different occupations and sectors. QFs aim to serve as "containers" for all qualifications within their scope of coverage. From this definition, it follows that qualification frameworks can have varying scopes. They may be sectoral, defining the qualifications required for a specific sector of the economy, such as mining, or they can be domestic, encompassing all the qualifications present in the labor market of an economy.

Do we need a Qualification Framework? What for?

While it may seem like a bold question in this context, one of the main agreements during the workshop was that a Qualification Framework is a tool that, by itself, does not resolve all the issues of the education system, the labor market, or the relationship between the two. Additionally, an implicit conclusion from all presentations, experiences and exchanges among economies is that the development and implementation of DQFs require significant effort and resources from all involved parties: the business sector, the education system, and the political system. Based on these conclusions, it seems essential to define what a QF can contribute and what specific problems or challenges it can effectively address to ensure the efficient use of always finite resources. Given this, the question becomes fundamental. Having a clear diagnosis of the problem to be addressed and a well-defined understanding of what a QF is and what it can contribute are indispensable tools to answer a central question: Do I need a Qualifications Framework for the problem I have?

When designing a QF, the objective is to include and define qualifications based on standards, levels, and outcomes, regardless of how these qualifications were obtained, thus integrating education, training, and the recognition of competencies into a single unified system. Billorou & Vargas (2010) provides a guideline for the ILO of "dysfunctions" and issues related to qualifications, which can serve as a guide for developing a diagnosis to determine whether it is necessary to develop a QF as a response to a set of hypothetical problems presented below.

Dysfunction 1: Relevance

Question: Do social actors and stakeholders consider that qualifications do not align with the needs of the socio-productive environment? Do individuals find it difficult to locate education and training programs (and consequently qualifications) that meet their needs?

How a DQF Could Address Relevance Issues:

- Establishing consultation processes with employers and workers for the identification of competencies and the definition of qualifications.
- Creating structures and processes for the active participation of stakeholders.
- Implementing agile mechanisms for the review or inclusion of new qualifications at the initiative of stakeholders.
- Expanding the range of qualifications (e.g., new occupations, key competencies).
- Designing qualifications with a focus on social and gender equity to promote greater inclusion.
- Developing flexible designs for qualifications (e.g., modules and recognition of competencies).

Dysfunction 2: Accessibility and Progression

Question: Do individuals face difficulties or "barriers" in accessing qualifications? Do individuals find it challenging to progress within the education and training system?

How an QF Could Address Accessibility and Progression Issues:
- Serving as a vehicle for introducing new qualifications.
- Providing references for the recognition of prior learning and the certification of competencies.
- Improving the articulation and comparability between qualifications.
- Enhancing information and guidance for participants.
- Producing clear information for stakeholders.
- Creating a level structure that articulates and builds bridges between qualifications.
- Promoting flexibility and modularity in the design of qualifications.
- Timely creation of new qualifications to fill gaps.

Dysfunction 3: Quality and Coherence

Questions: Are there significant differences in the quality of education and training offered by various institutions? Are evaluations not based on coherent standards?

How a QF Could Address Quality and Coherence Issues:

- Requiring that all qualifications within the QF specify the required standards, developed with the participation of social actors and stakeholders.
- Introducing a system of monitoring or external evaluation.
- Mandating that all institutions offering qualifications within the QF be accredited by a domestic authority.
- Defining competency standards with common criteria and clear procedures that ensure the participation of social actors and stakeholders.

Dysfunction 4: Recognition

Question: Can domestic qualifications be recognized in other economies?

How a QF Could Address Recognition Issues:

- By developing QF levels, compare them with the reference levels of other domestic systems.
- Including international standards in the development of qualifications.
- Collaborating with neighboring economies to develop a Regional Qualifications Framework.

Guiding Principles for QF

To consider the challenges posed by new technologies and artificial intelligence, it is important to conceptualize the principles guiding the creation of a Domestic Qualifications Framework. The International Labor Organization (ILO, 2010) presents six principles:

1) Relevance

A key element of Domestic Qualifications Frameworks (DQF) is their ability to reflect the current needs of the entire productive environment and the labor market, as well as their connection with the economy's educational offerings at any given time. In this sense, relevance is expressed in the transferability of qualifications as a measure of their recognition by the labor market as being capable of addressing a real need of employers. Therefore, it is recommended that qualifications incorporate a forward-looking perspective that anticipates and includes new demands. To achieve this, it is essential that the framework or domestic qualifications system can guarantee effective and efficient dialogue and communication mechanisms between social actors, with a strong anticipatory capacity for updates.

2) Equity

The framework should promote equal opportunities for all individuals to access quality learning and have their competencies recognized, regardless of how and where they were acquired and developed. This necessitates an approach that considers territorial perspectives and is anchored in the specific characteristics of different economies, incorporating multicultural, immigration, and gender perspectives.

Due to the specific gender issues associated with AI, the inclusion of a gender equity approach in addressing qualifications and competencies is particularly relevant. The constant assignment of certain functions and activities to men and women based on supposedly natural "conditions" creates differing opportunities in terms of employment, recognition, and the development of competencies. Attributes assigned to men and women thus become "crystallized" as masculine and feminine competencies, as well as masculine or feminine tasks or job positions. Therefore, it is necessary to incorporate this perspective to avoid implicitly assigning a gender connotation to certain occupations and qualifications, as it will be discussed later IA poses specific challenges for this principle.

As highlighted throughout the forum discussions, a pertinent strategy for achieving gender equity is to include experts on the subject throughout the entire design and implementation process of the framework, as well as in the profile survey processes and sectoral dialogue tables or skill councils.

3) Inclusion

The DQF should facilitate opportunities for employability development and educational progression, emphasizing inclusion and social cohesion, especially focusing on groups that are temporarily or historically marginalized from training processes. From this perspective, a DQF aims to facilitate individuals' inclusion in learning and development processes, including a set of certifiable competencies and recognition mechanisms for formal, non-formal, and informal learning. In this regard, the recognition and certification of prior learning is a key element of the framework and implies an "open" approach to qualifications, which should offer a wide range of pathways and alternative "entry points." Another essential aspect related to this principle is a design aimed at eliminating unnecessary or "artificial" barriers to accessing qualifications or training pathways, insofar as they do not correspond to competency standards or learning prerequisites. Finally, to ensure its accessibility, the design and implementation of the DQF must be unequivocally user-oriented. Thus, to be effectively usable, a DQF and its internal relationships must be simple, comprehensible, and user-friendly.

4) Coherence

Coherence refers to the connection, relationship, or logical correspondence of elements within a whole. Qualifications, potential pathways, and certifications included in the framework should be structured and meaningfully correlated, ensuring that the overall structure remains coherent. This means the design should not create disruptions in individuals' mobility pathways and that the meaning of each qualification is clearly understood. A coherence analysis should be conducted in each case horizontally (within the same level), vertically (between levels), and diagonally (between levels and different sectors). This approach allows for equivalences between qualifications and competencies at the same level (horizontally) and sequential connections of qualifications and competencies (vertically and diagonally).

5) Reliability

The reliability of the framework is intrinsically linked to its quality and relevance, meaning that the various stakeholders involved must trust the qualification development processes as well as the training processes that ultimately support skill generation in the economy. Generally, critical factors related to safeguarding quality focus on the processes of identifying/describing competencies and defining qualifications, along with other complementary aspects, depending on the design adopted—such as the accreditation or auditing of training programs or providers and the procedures for evaluating and certifying competencies and qualifications.

6) Transparency

DQFs must provide all stakeholders with clear and precise information regarding both the structure and management of the framework. It is also crucial that the procedures associated with the implementation and functioning of the framework, whether in terms of identifying competencies, defining qualifications, or certification, access, and navigation, do not present ambiguities or lack of clarity.

The emergence of new technologies as previously defined puts some of these principles under pressure, and identifying this tension is key to developing strategies to address it. First and foremost, relevance, as the capacity of frameworks to remain up-to-date, is challenged by the rapid pace of technological development, posing a central question: How can the framework remain current in this context? This challenge is palpable and acknowledged by all economies, given that the renewal of a framework, the surveying of occupational profiles and qualifications, and the ability to generate relevant training are clearly slower than the speed at which new technologies have developed. If the relevance of Domestic Qualifications Frameworks is strained, their reliability is also compromised. DQF must establish trust among users by being perceived as pertinent tools that accurately reflect the primary demands of the labor market in terms of required skills. In this context, it is essential for these frameworks to facilitate efficient and agile interactions with employers. This capability not only helps in identifying emerging skill requirements but also in anticipating new technological developments through ongoing prospective or technological foresight activities at both the domestic and international levels. In an interconnected world where technological advancements spread rapidly, such proactive measures are crucial.

Inclusion and equity are also significantly challenged in a labor market that is set to offer new job opportunities in emerging occupations, which will demand higher and more advanced levels of training. The challenge is to ensure that no one is left behind in economies where a substantial portion of the population still has very low educational levels, high rates of informality, and elevated unemployment rates, especially among the youth and women. Not everyone starts from the same point when it comes to taking advantage of new opportunities. Therefore, DQFs are challenged to incorporate elements such as the recognition of prior learning, non-formal education, and the creation of flexible and navigable pathways for users—pathways that are especially comprehensible to enable better decision-making. Conceptualizing more modular educational pathways with micro-credentials that can construct tailored profiles in lifelong learning trajectories seems to be a central need. This approach will allow DQFs to include all individuals and, more importantly, to empower them as workers capable of seizing the opportunities that new technologies offer.

The Qualifications System: The Framework's Enhancer

"A DQF is just part of the puzzle" was a key concept emphasized by Andrea Bateman throughout her presentation. Moreover, she concluded her presentation by highlighting two key ideas that underscore the necessity of developing a comprehensive domestic qualifications system to ensure the success of frameworks and to effectively manage the challenges posed by technological change.

DQFs gain their strength, and make the greatest impact, if they are linked to quality assurance arrangements that complement and bring to life the aspirations expressed in the DQF policy instrument. Furthermore, they will have little impact on the quality of the qualifications system unless they are connected to other initiatives and strategies within the broader qualifications system. (Bateman, 2024)

As defined by the OECD (2006), "A national [sic] qualifications system includes all aspects of an economy's activity that result in the recognition of learning. These systems include the means of developing and operationalizing national or regional policy on qualifications, institutional arrangements, quality assurance processes, assessment and awarding processes, skills recognition, and other mechanisms that link education and training to the labor market and civil society. Qualification's systems may be more or less integrated and coherent. One feature of a qualifications system may be an explicit framework of qualifications."

Thus, qualifications frameworks are part of the system, a principal one as Andrea Bateman stated. They act as the coordinating element of the different components of the system (ILO, 2010). Similarly, as Bateman (2024) noted, the ILO (2010) emphasizes that Domestic Qualifications Frameworks will only achieve their intended impact if, beyond a proper initial diagnosis prior to their design, they are accompanied by a set of measures and policies that encourage and promote adoption and use by all stakeholders.

According to the ILO (2010), these systems encompass mechanisms for developing and implementing domestic or regional policies on qualifications, including institutional organization, quality assurance processes, evaluation procedures, financial resource allocation, standardization and certification of competencies and qualifications, and other mechanisms that link education and training with the labor market and civil society. In this regard, a Qualifications System extends far beyond a Qualifications Framework, which may constitute one of its component elements.

Complementary to qualifications systems, there are several public policies that have proven essential in developing the necessary framework to maximize their impact (ILO, 2010), which are summarized below:

- Coordination and harmonization of education and labor policies, manifested through the link and fluid coordination between the Ministry of Labor and the Ministry of Education.

- A regulatory framework that supports the achievements and contributes to the objectives of the DQF.
- Support and development of programs that enhance and encourage active participation from various stakeholders in social dialogue aimed at generating agreements.
- Policies focused on empowering training institutions to improve quality, develop human resources, provide technical resources for generating relevant educational offerings, and foster learning processes that lead to the defined qualifications.

Bateman (2024) presents the following image, illustrating the set of initiatives within the domestic qualifications system that the corresponding framework should link with to increase its impact.
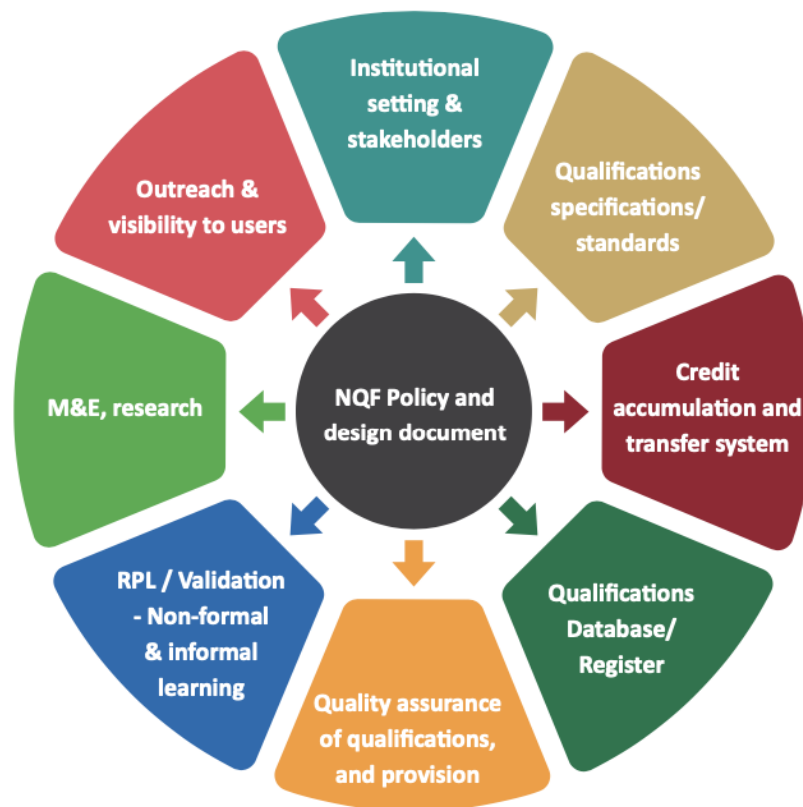
As the image shows, the Domestic Qualifications Framework is directly connected to a significant set of initiatives that go beyond its scope and place it within the context of a qualifications system. These links are grouped into quality assurance, recognition of learning regardless of where it occurs, and the development of standards for both the creation of qualifications and the learning processes that ensure their development.

An interesting approach, exemplified by Australia (that will be discussed further in), is the creation of a database of qualifications and authorized institutions to deliver them

through learning processes. Registers/databases are considered a critical tool for providing transparency and confidence in the qualifications system as entries on the register/database signal that the qualification or provider has met certain quality requirements (Bateman 2024). These registers include qualifications that meet the system's standards and institutions that comply with the quality requirements to offer training. In Australia, the register serves as a reference for individuals when choosing an institution to attend. Being listed in the register implies that the institution can offer quality training aligned with the framework, and this listing is seen as central to the decision-making process for users. Thus, the incentive to comply with the Domestic Qualifications Framework is driven by educational demand, which becomes a genuine motivator for educational institutions to adhere to the standards set by the DQF. The register also contributes to the creation of lifelong learning initiatives by marking the pathways for recognition of learning and qualifications obtained abroad.

Regardless of the policies or components of the system, a central element highlighted by these authors, and which became evident during the workshop, is that the domestic qualifications framework alone is insufficient to achieve profound changes unless it is part of a broader system, let alone keeping up with the speed of technological change. This system must be capable of driving processes that identify quality qualifications, support institutions in providing high-quality educational offerings, recognize learning regardless of where it takes place, and promote lifelong learning pathways. Such trajectories involve alternating between the labor market and training processes, reflecting the continuous demand from the labor market for professional development. Therefore, when discussing Domestic Qualifications Frameworks and their capacity to address the challenges posed by artificial intelligence, it is essential to consider the Domestic Qualifications System, including its various actors and tools.

Technological change, what is the scope of the change?

To assess the capacity of Domestic Qualifications Frameworks to address the new and disruptive technologies of our time, it is essential first to define and understand them. What do we mean when we speak of the Fourth Industrial Revolution? What are these technologies, and what do they entail? Is humanity embarking on its fourth, and according to some, already its fifth industrial revolution? Why is this one different from the previous ones?

Throughout history, we can identify several processes in which new technologies have revolutionized production methods, generating significant leaps in productivity and redefining labor and social relations. In each of these experiences, working methods and various occupations have been transformed or completely replaced. Simultaneously, this has created new demands for knowledge and occupations, which have also emerged as opportunities. The outcome of these processes has undeniably been the economic and human development of most economies around the world. From a long-term perspective, over the past 200 years, technological development has allowed more people to live longer and better lives, with increased access to essential goods. The growing life expectancy of those born today compared to those born 100 or 50 or 20 years ago is a tangible indication of humanity's progress, supported by technological advances. From the invention of the steam engine, electricity, and fuels, to the automation of production lines and the internet, working conditions and, consequently, people's lives have evolved in step with these powerful technological advancements.

None of these processes have been free from conflict and fear for their potential negative outcomes in the labor force. From the early Luddite movements, which carried out various acts of sabotage against industries and their machinery as a protest against massive job losses in early 19th-century industrial England, technological advancement and its impact on the world of work have consistently posed a challenge to social coexistence. Those early workers displaced by advancements in steam technology resisted losing their jobs to machines capable of performing manual tasks more efficiently, foreshadowing a long-standing tension between humans and machines. Today, the scenario is not, at least in essence, vastly different. This enduring tension resurfaces today with the advent of communication technologies and computers capable of performing increasingly complex tasks, which are no longer merely manual or routine (Autor et al., 2003 and 2013).

The potential impact of current technological advancements on the labor market, particularly on unemployment, has been extensively discussed (Autor et al., 2003 and 2013; Frey and Osborne, 2013, among other pioneering studies) and remains one of the main points of contention in contemporary public policy. This debate has long transcended purely economic considerations, touching upon broader societal implications.

Broadly speaking, two primary scenarios can be identified in the general predictions: The first scenario highlights the significant benefits for economic growth and human development due to the ability of new technologies to substantially increase the efficiency of production processes, reduce costs, and improve the availability of goods from a consumer perspective. Furthermore, many of these technologies are being employed to achieve substantial benefits in people's lives; applications in medicine are a clear example of this potential. According to a report by the World Economic Forum, the global economy is projected to be 14% larger by 2030 as a result of the effects of AI, representing an increase of approximately 15.7 trillion dollars.

Automation and artificial intelligence can enhance productivity and efficiency across various sectors, potentially driving global economic growth. According to estimates from the World Bank, digital technologies could add up to 2% to annual global GDP growth by 2030 if managed appropriately.

Moreover, technology can facilitate the creation of new markets and the expansion of emerging industries, such as the green economy, biotechnology, and renewable energy. These sectors not only have the potential to generate employment but also contribute to sustainable development. A report from the World Economic Forum estimates that the transition to a more sustainable economy could generate up to 395 million jobs by 2030.

Furthermore, digital platforms and remote work are creating new forms of employment, enabling more individuals to participate in the global economy, even from remote regions. This is also fostering greater flexibility in work arrangements, which could enhance quality of life and job satisfaction. The gig economy and new forms of flexible employment, driven by technology and also by the recent COVID-19 pandemic, are redefining the nature of work.

The second scenario is considerably less optimistic, focusing on the capacity of new technologies to displace an increasing number of employees as their tasks are progressively replaced by automation. Frey and Osborne (2013) distinguish between occupations at high, medium, and low risk of automation, estimating that approximately 47% of total employment in the United States falls into the high-risk category for automation.

Despite the challenges, technological advancement also presents significant opportunities for economic growth and job creation. While these models offer flexibility

and new opportunities for some, they also pose challenges in terms of job security, workers' rights, and access to social benefits. These dynamics are compelling governments and businesses to reconsider labor, social and educational policies to adapt to an evolving employment landscape.

Two additional elements stand out throughout the specialized literature regarding the type of adaptation that new technologies will demand from workers, but especially from the education system. The rapid emergence of new platforms, programming languages, automation systems, and spaces where AI is increasingly present suggests that the focus of training cannot remain on technical skills or the mastery of specific tools, as these will change ever more quickly, rendering purely technical training obsolete. Instead, soft or transversal skills are becoming increasingly sought after in the labor market. If we accept that learning occurs throughout life and that individuals will, on several occasions, need to abandon old ways of doing things to incorporate new methods and technologies, the ability to learn and unlearn may become one of the most critical capacities to be developed by the educational system.

Secondly, it seems clear that schools and training centers will face significant challenges in keeping up with technological advancements and infrastructure, if they ever manage to do so, or even if such a goal is desirable. In this regard, and within the context of lifelong learning, the workplace must be recognized by the education system as a complementary space for learning that enhances classroom education. Dual education systems, or work-study programs, along with the recognition of prior learning, appear to be indispensable tools for achieving this.

Lastly, it is expected that lifelong learning pathways will no longer be linear, but rather alternate between periods of formal schooling and work, depending on the needs and opportunities of each individual. This challenges us to design flexible educational systems and programs that allow for entry and exit points and recognize the learning that takes place in the workplace as part of the formal educational journey.

Which technologies are we talking about?

In her presentation, Marushka Chocobar emphasized four key technologies: Artificial Intelligence, Automation, the Internet of Things, and Blockchain. Without aiming to provide a highly technical overview, it is crucial to understand the basic concepts of these four predominant and in-demand technologies, not only in the context of the job market but also in terms of their potential to impact everyday life in the coming years. The following outlines each of these technologies:

> **Artificial Intelligence (AI): What Are We Talking About?**
> AI is not a single technology but rather a set of technologies that includes machine learning, natural language processing, computer vision, and robotics. The common denominator among these technologies is the ability of the computer systems that

constitute them to perform tasks typically associated with human intelligence, such as voice recognition, decision-making, and solving complex problems. These systems use algorithms to process large volumes of data, detect patterns, and learn from usage and human inputs to predict behaviors or events with high accuracy.

Where Can We See AI Today?
Virtual assistants like Siri, Alexa, Google Assistant, and the more recent ChatGPT are prominent examples of AI that we increasingly interact with in daily life. Content platforms like Netflix and Spotify also use a set of AI technologies, such as machine learning, to suggest content tailored to our preferences. AI is increasingly used in healthcare, with systems like IBM Watson Health capable of processing large volumes of medical data to help doctors make more accurate diagnoses. AI is also prevalent in financial decision-making and fraud detection. Autonomous vehicles represent a significant advancement with the potential to profoundly transform everyday life.

What Do We Need to Cope with AI in the Labor Market?
Basic competencies will include data literacy, analytics, and statistics for decision-making and interaction with algorithms. All "future workers" will need to master some programming language, such as Python or R. Advanced use of AI in the job market will require the development of creativity, ethics, and digital responsibility to address many of the privacy challenges posed by advanced AI. Lastly, AI will increasingly demand an interdisciplinary approach and the ability to interact with professionals from different fields, making assertive communication essential.

Automation: What Are We Talking About?
Automation refers to the use of technology to perform tasks with increasingly less human intervention. This process dates back to the first Industrial Revolution and the advent of looms, always in pursuit of improving the efficiency and precision of automated tasks. A novel feature of this new industrial or technological revolution is the growing capacity to automate non-routine cognitive tasks, such as drafting text or creating images. Automation can be present in large machines or through algorithms.

Where Can We See Automation Today?
Automation is prevalent in large industries and production processes, but it is also increasingly found in our homes: smart appliances that can be programmed for tasks such as cleaning or cooking, home irrigation systems that adjust to weather conditions, and in cars, banks, and retail where human interaction is diminishing as customers increasingly self-manage their shopping or inquiries. Chatbots, which are

increasingly common on websites to answer questions about services or products, are another prevalent example of automation in everyday life. Perhaps one of the highest points of automation in the future will be collaborative robots designed to work alongside humans in work environments or at home. Although still emerging, there are already restaurants in some parts of the world where cooking and service are performed by robots.

What Do We Need to Cope with Automation in the Labor Market?
Automation promises to free people from routine tasks so they can focus on more complex activities, deeply transforming occupations. Therefore, the ability to understand and perform these more complex tasks is foundational for future workers. Digital literacy to comprehend and use technological tools in increasingly diverse contexts, basic programming skills, and proficiency in specific automation software, such as robotics or integrated systems management, will be essential.

Internet of Things (IoT): What Are We Talking About?
The Internet of Things (IoT) refers to the ability to connect a network of devices via the internet so that they can collect, share, and interact with a set of data and signals without the need for human intervention. The range of devices is broad and growing, from household appliances like air conditioners and vehicles to industrial sensors and medical equipment. The core of IoT lies in developing an "ecosystem" of devices that can interact with each other to perform every day and productive tasks automatically.

Where Can We See IoT Today?
The Internet of Things is increasingly present in our daily lives, to the point where concepts like Smart Homes are emerging. Thermostats, air conditioners, and voice assistants (Google Home or Amazon Echo) allow us to automate tasks like heating, lighting, and security at home. Smartwatches that monitor physical activity, heart rate, sleep, and other health indicators (such as the Apple Watch or Fitbit) are now part of daily life, and they can also connect with healthcare equipment to provide real-time monitoring for better disease prevention. On a larger scale, IoT can be used to manage urban traffic signals to make city transit more efficient. In agriculture, IoT sensors can monitor soil moisture to manage irrigation systems and maximize crop yields or even help in stock management in warehouses.

What Do We Need to Cope with IoT in the Labor Market?
As IoT involves processing large volumes of data, data analysis and visualization tools will be fundamental for professional development. As the number and types of connected devices increase, a central issue in IoT is cybersecurity to prevent potential cyberattacks and user safety risks. Knowledge of networks, connectivity,

programming, software development, and basic mechanics will be crucial for IoT development. Finally, given the broad spectrum of activities where IoT is involved, the ability to work in multidisciplinary environments and teams will be essential.

Blockchain: What Are We Talking About?
Blockchain is a technology that enables the secure and transparent transfer of data, information, and even digital assets using a decentralized network. Through cryptography, it creates a chain that links blocks of information, which contain records of transactions and a link to the previous block, allowing the creation of a complete and verifiable history of transactions. Being decentralized, it does not rely on a central authority, making it less susceptible to manipulation and failures. It is a core technology for developing cryptocurrencies due to its ability to ensure security and transparency. Thanks to its design, transactions recorded on a blockchain are visible to all network participants and cannot be modified once added to the chain. This makes it ideal for financial transactions, smart contracts, and identity management.

Where Can We See Blockchain Today?
One of the most current examples of blockchain technology use is cryptocurrencies like Bitcoin and Ethereum, where blockchain enables fast, low-cost money transfers without the need for intermediaries like banks. In real estate, smart contracts could automate the property buying and selling process, releasing buyer funds to the seller only when all contract conditions have been met and verified on the blockchain. In supply chains, blockchain is used to track the origin and journey of products, from raw materials to the final product in the hands of the consumer.

Beyond general digital literacy, blockchain specifically requires skills in cryptography, developing and programming decentralized applications (dApps) using languages such as Solidity, especially on the Ethereum network. Cybersecurity skills will also be crucial, as blockchain-based systems, though secure by design, can still be vulnerable to attacks if not properly implemented. Professionals will need to understand how to protect private keys and other critical system components.

Gender Perspective: A Necessary Approach for AI and QFs

Why is it important to incorporate a gender perspective when addressing Qualifications Frameworks and Artificial Intelligence (AI)? Does AI pose specific challenges to gender equality, and furthermore, can QFs contribute to closing the gender gap? Although the magnitude of the challenge of achieving gender equality extends beyond AI and education—emphasized by the Sustainable Development Goals, which include it as a distinct objective—this document will focus exclusively on the perspectives related to AI and education.

One of the primary challenges described in the context of the knowledge economy and AI, as faced by public policy, is ensuring that no one is left behind. The rapid proliferation of digital technology and services has made digital skills a prerequisite for full participation in society. Today, lacking internet navigation skills poses significant disadvantages that are difficult to overstate (UNESCO, 2019). A substantial body of evidence suggests that when it comes to ICT and AI, women and girls are being disproportionately left behind.

UNESCO's document "I'd Blush If I Could" compiles recent data on the gender gap, including the following:

- In OECD economies, only 0.5% of girls at age 15 aspire to ICT-related careers, compared to 5% of boys.
- Women in numerous economies are 25% less likely than men to know how to use ICT for basic purposes, with the gap widening as tasks become more complex.
- Men are approximately four times more likely than women to possess advanced ICT skills, such as the ability to program computers.
- Across G20 economies, only 7% of ICT patents are generated by women, with the global average even lower at 2%.
- At Google, 21% of technical roles are filled by women, but only 10% of employees working on machine intelligence are female.
- Calculations based on attendees of the world's top machine-learning conferences in 2017 indicate that only 12% of leading machine-learning researchers are female.
- Recruiters for technology companies in Silicon Valley estimate that the applicant pool for technical jobs in AI and data science is often less than 1% female.

Although further evidence could be presented to demonstrate that the skills gap is a genuine challenge in the face of AI and ICT, this data sufficiently illustrates the scope of the issue and one of its core aspects: the gap begins at a very young age, grows over time, and extends into the labor market. Moreover, the low participation of women in ICT and AI jobs provides few role models to inspire young girls to bridge the gap and pursue educational pathways capable of narrowing it.

The risk of leaving women behind is not confined to ICT industries, skills, or occupations. Recent research by the IMF and the Institute for Women's Policy Research indicates that the majority of workers in clerical, administrative, bookkeeping, and cashier positions are women, and these are among the roles most likely to be automated in the near future.

Furthermore, there are other ways in which AI, if not specifically addressed, can marginalize women and girls and that is by reinforcing gaps and stereotypes. Simply put, AI is capable of utilizing, analyzing, and making predictions from massive datasets using algorithms. AI interprets these datasets, identifies patterns, and recommends actions based on "training" data provided by humans. The ability to improve these predictions through continuous training is known as Machine Learning. A central

aspect of this explanation is that AI learns from existing data and, consequently, it inherently learns with the biases and inequities present in reality, including gender biases and social stereotypes.

One of the greatest risks of stereotypes in AI is that they can be so subtle that they go unnoticed by the vast majority of people and, once pointed out, may be dismissed as irrelevant. This subtlety allows biases to persist and operate under the radar, leading to systemic issues that are often overlooked or underestimated, ultimately reinforcing existing prejudices in ways that are difficult to detect and address. A clear and controversial example can be found in virtual assistants that are increasingly integrated into everyday life: Siri (Apple), Alexa (Amazon), Google Assistant, Cortana (Microsoft), Bixby (Samsung), Alice (Yandex), and Nina (Nuance) are among the most widely used.
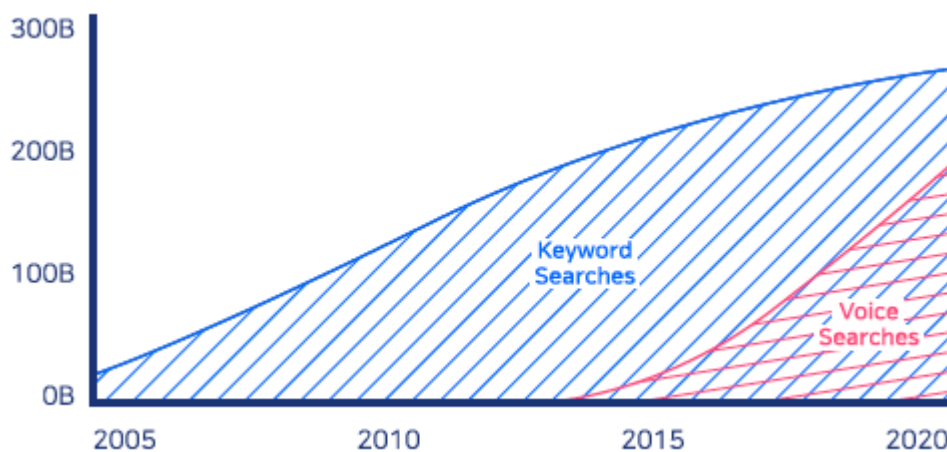
Source: UNESCO, 2019.

The data points to a potential paradigm shift where interactions with AI are becoming increasingly voice-oriented. Priya Abani, Amazon's Director of Alexa Voice Service, told Wired magazine: "We basically envision a world where Alexa is everywhere." Looking forward, human–computer interaction will be increasingly hands-free and reliant on voice (UNESCO, 2019).

A common feature of voice assistants is that they are programmed with female voices (at least by default) and a servile demeanor, which may reinforce gender stereotypes that depict women as assistants or caregivers. This has the potential to perpetuate traditional gender role expectations. UNESCO has criticized this practice for reinforcing gender stereotypes, highlighting that programming female voices as defaults in AI applications contributes to the perpetuation of these roles, thereby reinforcing existing biases and inequities related to gender.

Moreover, as AI systems are increasingly used in decision-making across various sectors—including criminal justice, financial lending, and healthcare—if developed

with biases, they can result in unfair decisions that may adversely affect women. For instance, Obermeyer et al. (2019) found that an AI algorithm used to recommend medical care systematically allocated less attention to Black patients and women, underestimating their need for treatment compared to their white and male counterparts. This finding underscores the critical issue of biased AI systems perpetuating existing inequalities and making discriminatory decisions in sensitive areas of public life. Similarly, a study by Buolamwini and Gebru (2018) revealed that AI facial recognition systems exhibit significantly higher error rates for women and individuals with darker skin tones, highlighting a clear gender and racial disparity in performance.

Education plays a central role in addressing these challenges in at least two ways: first, by developing digital skills in girls and building confidence in their abilities, and second, by identifying these stereotypes and helping young people reflect on them. The next two accompanying graphs powerfully illustrate this point: The gap exists in education and also education has the power to narrow it.

Global proportion of female enrolments by field of study
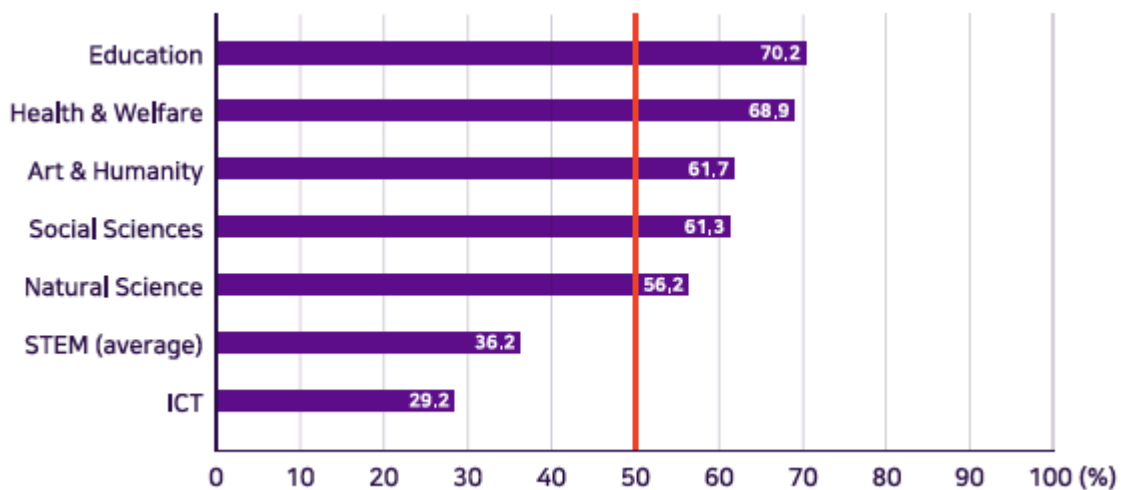
Source: Equals Research Group

Internet access by level of education

No formal education
Female internet access / Gender gap: 2%
Male internet access: 19%

Primary education
Female internet access / Gender gap: 11%
Male internet access: 24%

Secondary education
Female internet access / Gender gap: 43%
Male internet access: 58%

Tertiary education
Female internet access / Gender gap: 78%
Male internet access: 83%

Legend:
- Female internet access
- Male internet access
- Gender gap

World Wide Web Foundation

A close review of international literature on the subject reveals several recommendations that could guide educational policies as well as QFs:

Recommendations from UNESCO (2019)

- **Embed ICT in Formal Education**: A significant gender trend in digital skills education in the formal sector is the sharp decline in girls' interest starting in lower secondary levels and becoming more pronounced as education levels increase. Research in North America, for instance, found that girls who lack friends in their computing classes in secondary school are one-third less likely to study computing in college (UNESCO 2019). One solution is to make technology classes mandatory at the secondary level to avoid the 'secondary school trap' that causes many girls to lose interest in digital skills.
- **Support Engaging Experiences**: Girls and women should have diverse exposure to digital technologies, including opportunities to develop digital skills in informal as well as formal settings. After-school clubs, extracurricular activities, and ICT-focused camps can encourage girls' digital learning in a fun, relaxed environment.
- **Emphasize Meaningful Use and Tangible Benefits:** In formal education, project-based learning—a strategy beneficial for all learners—may be particularly effective for engaging female students with technology because of its focus on applying knowledge in real-world contexts. Emphasizing real-life applications for digital skills, incorporating hands-on experiments, and including field trips in the curricula can influence more girls to pursue or continue ICT studies, particularly during the transition from primary to secondary school
- **Create Safe Spaces and Meet Women Where They Are:** For adult women, informal learning may be the only available pathway to developing digital skills. Interventions should consider cultural norms and women's domestic responsibilities. For example, internet cafes and other ICT access hubs often cater to men or are located far from women's homes or in unsafe areas.

Female-friendly public access points, such as specially-designed libraries, parks, and community centers, are crucial in these contexts

- **Examine Exclusionary Practices and Language:** Representations of education, research, and work in the digital sector—including the language used to describe courses, majors, scholarships, careers, and job postings—affect women's and girls' perceptions of their place in the digital space
- **Promote Role Models and Mentors:** The importance of role models and mentors is frequently emphasized in the literature on gender and digital skills. In a North American survey, 62% of secondary school girls who had someone encourage them to study computing or coding said they were likely to major in this subject in college, compared to 15% of girls who did not receive such encouragement.

Additional Recommendations from Eliana Gallardo (presented during the workshop and specifically targeting professional training and DQFs):

- Ensure the participation of gender experts throughout the qualification system.
- Focus on competence and emphasize transversal or soft skills, and construct flexible learning paths.
- Review occupational classifications and designations, reevaluating those that are not recognized due to gender bias.
- Make training pathways more flexible to meet the specific needs of both women and men.
- Include maternity/paternity leave policies and support for the care of children, the elderly, and people with disabilities.
- Eliminate unconscious biases in hiring, retention, and professional promotion of women and men that hinder labor mobility.
- Integrate the unique needs of women and men as an integral dimension of training programs: planning, design, implementation, monitoring, and evaluation.
- Develop an awareness of equality as part of quality training.
- Incorporate practical knowledge and value the existing capabilities of both men and women.
- Reflect on traditional stereotypes and present

Lessons from the experience, what can we learn?

Australia, the answer is not in the framework, it is in the system

One of the most emblematic experiences when discussing domestic qualifications frameworks is likely that of Australia, due to its longevity and stability, but also for the deep integration it has achieved within the educational and labor systems.

The Australian Qualifications Framework (AQF), established in 1995, is one of the oldest domestic qualifications frameworks, developed following existing qualification descriptors for the higher education and Technical and Vocational Education and Training (TVET) sectors. It is the shared responsibility of the Australian Commonwealth, State, and Territory governments, as well as other key stakeholders, such as industry representatives.

Originally designed as an enabling framework, the AQF has evolved to adopt a more regulatory focus over time. Despite its significant impact on the TVET sector, the AQF initially had a neutral influence on higher education. A major feature of the Australian experience is that the framework itself is not directly legislated nor legally linked to a quality assurance agency, although it is referenced in other legislative contexts specifically and strongly in labor laws.

The AQF has undergone only one major revision occurring in 2011, which resulted in the current structure and policies that underpin Australia's education and training sectors. This major revision was implemented gradually, with a phased transition ending in 2015, and was followed by another comprehensive review in 2019. Nevertheless, it had several small reviews and revisions over the years.

Governance of the AQF has historically been managed by a council and a board, but it is currently overseen by the Australian Government Department of Education. The AQF stands as a comprehensive and detailed document, outlining key policies that support the economy's educational and training systems, and represents a collaborative agreement among the different levels of government and other key players in the sector.

The AQF is a comprehensive 10-level framework that ranges from the senior school certificate to the doctoral level. Each of these levels is defined by specific descriptors based on three key domains: knowledge, skills, and application. This framework is structured to outline learning outcomes for each level, ensuring a clear progression of qualifications and educational pathways. Traditionally, the Technical and Vocational Education and Training (TVET) sector covers levels 1 to 6, while higher education encompasses levels 6 to 10. However, there is some overlap between the sectors, as evidenced by TVET-focused qualifications like Graduate Certificates and Graduate Diplomas, which are typically associated with higher education levels.

The AQF also includes qualification type descriptors, which provide detailed specifications for the various qualification types within the framework. Additionally, the AQF outlines policy requirements related to the issuing of AQF qualifications, the establishment of linkages between qualifications, student pathways, and the criteria for adding or removing qualification types within the framework. Furthermore, the AQF includes definitions of terminology, encompassing both AQF-specific terms and terms derived from the broader education and training sectors. This detailed and structured approach ensures that the AQF remains a cohesive and adaptable framework that supports the diverse needs of Australia's education and training landscape.

Although it has a legislative basis, it is more broadly related to qualification accreditation and registration standards rather than being specifically legislated as a distinct domestic qualifications framework. The AQF is embedded in the standards and processes for qualification accreditation and institutional registration within both the TVET and higher education sectors.

Qualifications developed under the AQF must align with the specific outcomes defined for each AQF qualification type, and the issued certificates must adhere to AQF specifications. In the TVET sector, qualification accreditation ensures that the qualification meets the AQF requirements and quality standards, but it does not extend to approving a provider to deliver the qualification. In contrast, within the higher education sector, for non-self-accrediting providers, the approval process for qualifications is integrated with the provider's approval to deliver the qualifications.

A notable aspect of domestic qualifications frameworks, including the AQF, is their connection to quality assurance arrangements. The governance of quality assurance for qualifications in Australia is divided among three distinct sectors: post-secondary/compulsory education, vocational education and training, and higher education. Historically, Australia, as a federation of states and territories, delegated the responsibility for education and training to individual states and territories. Although agreed protocols and standards existed, a coherent domestic system for quality assurance has only been established within the last 14 years. Since 2011, there has been a transition to a unified approach where all legislation and processes for accreditation and approval to deliver qualifications now reference the AQF, providing a more integrated and standardized system across the economy. This evolution underscores the importance of the AQF in ensuring consistent quality and alignment of qualifications within Australia's diverse education and training landscape.

Three other key factors can be highlighted in the AQF: the focus is not on hierarchy – all qualification types are important; it encourages linkages and pathways – both horizontal and vertical for learners and it has a strong basis for lifelong learning – credit transfer and recognition of prior learning (RPL).

The primary purpose of a Domestic Qualifications Framework (DQF) is to locate and define qualifications within a system, specifically in terms of their complexity and

volume. The design of an DQF typically includes level descriptors that outline the qualifications' characteristics, such as knowledge, skills, and application. These descriptors must strike a careful balance between being specific enough to capture the current demands of changing technologies and emerging skills, while not being so specific that they require frequent revisions to keep the framework relevant.

In the case of the Australian Qualifications Framework (AQF), level descriptors focus on three key areas: knowledge, skills, and application. A critical challenge lies in balancing the need for flexibility, allowing the framework to adapt to technological advancements and new skill requirements, with the need for stability, ensuring that the framework remains a reliable and consistent reference over time.

A key issue for discussion in this document is the extent to which a DQF can and should remain flexible to accommodate changes in technology and the emergence of new skills and knowledge. The focus remains on how level descriptors can best support the accurate placement of qualifications within the overall system, without compromising the framework's stability and coherence. The fundamental question at hand is: how flexible can and should a DQF be in order to effectively respond to ongoing changes in the educational and occupational landscape?

The Australian Qualifications Framework (AQF) relies on robust quality assurance arrangements for qualifications to ensure their relevance, need, and alignment with identified outcomes. For example, in the TVET sector, the development of qualifications is based on defined learning outcomes and involves a comprehensive process that includes:

- Consultation with industry, community, and education stakeholders to ensure that the qualifications are relevant, appropriately scoped, and up-to-date.
- Involvement of an industry peak body responsible for the development and ongoing maintenance of the qualifications.
- Independent verification of the qualifications prior to their endorsement or accreditation by the Skills Ministers.
- Recognition by industry where applicable, ensuring that the qualifications meet the specific needs of the sector.
- Consideration of pathways, recognition of prior learning (RPL), and credit transfer to facilitate learner progression and mobility.
- Adherence to a consistent format to maintain clarity and uniformity across qualifications.

Through this quality assurance process, the AQF also addresses the incorporation of new technologies, artificial intelligence, and microcredentials, ensuring that the framework remains responsive to emerging trends and advancements in skills and knowledge.

While the AQF maintains a balance between the flexibility and specificity of its level descriptors, differentiating between the ten levels can sometimes be challenging. This

complexity underscores the importance of the AQF's reliance on quality assurance mechanisms to ensure that qualifications are appropriately categorized and meet the evolving needs of industries and learners alike. The adaptability of the AQF in recognizing new qualifications such as microcredentials is essential to keeping the framework relevant in a rapidly changing educational and occupational landscape.

Key quality assurance measures within the AQF encompass several critical components to ensure the integrity, flexibility and effectiveness of the system:

1. Quality Assurance of Qualifications: This involves the use of qualification quality standards, policies, and guidelines to ensure that each qualification meets the established benchmarks for relevance, accuracy, and alignment with the framework's objectives.
2. Registers and Databases of Approved Qualifications: To maintain transparency and accessibility, qualifications that have been approved under the DQF are systematically recorded in official registers or databases. These resources provide stakeholders with a reliable reference for the qualifications recognized within the framework.
3. Quality Assurance of Providers and Their Programmes: This measure ensures that the institutions and their educational programmes, which lead to qualifications under the DQF, adhere to quality standards, policies, and guidelines. This process helps verify that providers are capable of delivering the qualifications to the required standard.
4. Registers and Databases of Approved Providers: Similar to the qualifications, approved providers are listed in registers or databases managed by responsible bodies. This ensures that only institutions that have met the necessary quality assurance criteria are recognized and authorized to offer DQF-related qualifications.
These quality assurance measures collectively support the credibility and reliability of the DQF, ensuring that both the qualifications and the providers are held to consistent and rigorous standards.

One of the key insights from the Australian experience in addressing the challenges posed by new technologies is the emphasis on prioritizing educational programs and their strategies as a primary space for adaptation. To support this, the Higher Education Quality and Standards Agency (TEQSA) has developed a Higher Education Good Practice Hub[1], accessible via a dedicated webpage. This hub consolidates resources and information on a wide range of topics to promote best practices across the higher education sector.

The resources available on the hub are not only focused on managing risks but also on the proactive integration of artificial intelligence (AI) into educational settings. The hub offers valuable guidance to providers on various aspects of AI, including:

- AI and academic integrity and assessment.
- Incorporating AI into classroom instruction.

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[1] https://www.teqsa.gov.au/guides-resources/higher-education-good-practice-hub

- The role of generative AI in research.
- Strategies for engaging with students about AI and effectively integrating AI into teaching.

The hub provides a comprehensive array of materials, such as PowerPoint presentations, webinars, academic papers, and information on international approaches, all aimed at equipping providers with the tools and knowledge necessary to effectively incorporate AI and navigate the evolving technological landscape in education.

If we define a programme as a coherent set or sequence of educational activities designed and organized to achieve predetermined learning objectives or accomplish a specific set of educational tasks over a sustained period. Within an education programme, educational activities may also be grouped into sub-components variously described in contexts such as 'courses', 'modules', 'units' and/or 'subjects'. It makes sense that IA new technology is addressed there as well, and probably with more flexibility than in a DQF, which needs stability as small changes have big impacts in the Australian labor market. This hub policy can be easily replied to in other economies to help the education system to also cope with AI.

Lastly, the Australian experience points out some lessons that can be taken to other experiences. The Qualifications Framework (QF) serves as the principal policy instrument within an economy's qualifications system. It is essential that a QF is tailored to the specific historical and contextual circumstances of the economy, as it cannot simply be replicated from another system. The impact of a QF on the quality of the qualifications system is likely to be minimal unless it is effectively integrated with other initiatives and strategies within the qualifications system. Quality assurance systems play a crucial role in establishing this connection, providing a platform through which the goals and aspirations articulated in the QF can be realized. Policymakers must carefully consider these initiatives and strategies, ensuring that they are aligned and interconnected like pieces of a jigsaw puzzle. This approach will result in a coherent and effective qualifications system that fully leverages the potential of the DQF to enhance quality and consistency across the economy.

Chile, a third-generation challenge for the implementation: Using AI for forecasting

The Chilean Qualifications Framework has been on its developmental path since 2010, evolving from specific demands by institutions and sectors of the economy that initially sought a tool to link education with the labor market, to the current challenge of economy-wide implementation. The aim is to achieve a framework with domestic reach that includes all economic sectors and extends from technical education to university education.

The Chilean journey began in 2010 when ChileCalifica made the first proposal for the construction of a Domestic Qualifications Framework. The objectives of the framework are clearly stated on its website: to facilitate the development of educational and career pathways for individuals, as well as to strengthen the quality and relevance between educational offerings and the needs of the labor market, thus enhancing the understanding and clarity of the system. The Chilean case emphasizes the role of the framework as a coordinator, envisioned as a guiding and referential tool to organize and recognize learning in terms of knowledge, skills, and competencies. Therefore, the proposed objectives are to promote lifelong learning, to link the different levels of education, including formal and non-formal education, and to serve as a bridge between the world of work and educational offerings.

The foundation of any sound public policy lies in the use of high-quality evidence. In the context of the labor market, domestic qualifications systems make significant efforts to identify, and ideally anticipate, the competency demands employers face when hiring. Advisory committees, expert groups, and employer consultations are examples of these efforts. However, these tools are often time-consuming in terms of developing recommendations or identifying new trends.

A distinctive feature of this new industrial revolution is the speed of change; what is novel today may no longer be relevant next year. This poses a significant challenge in keeping frameworks and qualifications up to date. According to the workshop presentation, redesigning curriculum takes at least two years, and considering four more years for implementation and evaluation, we are looking at a six-year process. For context, six years ago, tools like ChatGPT did not exist. This implies that during the consultation with experts, the design of new offerings, and their implementation, many new technologies will likely emerge and impact the labor market. For this reason, several governments have developed forward-looking tools and methodologies to anticipate these demands by offering updated, firsthand information on labor market competency requirements.

In Chile, since 2020, the Job Vacancy Analysis System (SABE) has been developed, a digital platform that uses an artificial intelligence algorithm to extract information from job advertisements across various online job portals in Chile. By utilizing text mining techniques and machine learning, SABE collects, harmonizes, and analyzes job ads published on the main job portals, generating data on the occupations in demand by companies, the required educational level, type of work schedule, and offered salaries, among other aspects. SABE also identifies the job skills highlighted by employers in the job ads, making it a useful tool for detecting trends and informing decision-making in public policy design and implementation. The results are presented on a free-access platform that provides information at the four-digit occupation level and includes a methodological document detailing the information sources, data processing, and considerations for interpreting the indicators. Since March 2020, SABE has processed over 5.5 million job advertisements. The information provided by SABE is updated monthly and is built from job postings from the previous 12 months.

In the medium term, SABE is expected to detect skills described in job advertisements and classify the ads by economic sector, geographic location, and educational requirements of applicants. The SABE project is part of the SENCE Labor Observatory and is developed in strategic partnership with OTIC SOFOFA, executed by the Web Intelligence Centre (WIC) at the University of Chile under the umbrella of the Complex Engineering Systems Institute (ISCI). Collaborating institutions include the Faculty of Physical and Mathematical Sciences at the University of Chile (FCFM), the Faculty of Economics and Business at the Andrés Bello University, and the Institute for Market Imperfections and Public Policy Research (MIPP).

SABE is an excellent example of effective collaboration among key actors within the domestic qualifications system, providing relevant and high-quality information to support curriculum development and discussion processes. Online job portals are a privileged tool for labor market surveys and are increasingly used for this purpose. These portals capture valuable information directly provided by employers, identifying data on demanded technologies and skills associated with a broad set of occupations. A key advantage is that the information collected reflects genuine employer needs, as companies have all the incentives to express their true preferences. Moreover, these systems can rapidly update information and, once established, operate at a low cost.

Certainly, this source of information has some limitations, such as potential biases that could overemphasize certain occupations (Kurekova, 2015). Labor markets with high informality may exacerbate this bias, but it remains a valuable tool, especially when used alongside others, to inform discussions and the development of qualifications and educational offerings.

Lastly, SABE exemplifies the previously discussed point: while AI presents challenges, it also offers numerous opportunities that, when well-utilized, can become a central tool for enhancing public policy and specifically DQF.

Malaysia, flexible programs for labor market needs

The Malaysia Qualifications Framework (MQF), established in 2007, is a comprehensive system designed to integrate and classify qualifications across the academic, vocational, and skills sectors in the economy. The framework aims to standardize the qualifications system, promote lifelong learning, and provide a structure that facilitates the recognition of formal, non-formal, and informal education. By organizing qualifications from various sectors under one unified system, the MQF ensures transparency, quality, and flexibility in educational and professional pathways.

The MQF is organized into eight levels of qualifications, each defined by learning outcomes in several domains, including knowledge, practical skills, social skills, communication abilities, and ethical responsibilities. These levels provide a clear progression route from lower-level certificates to doctoral degrees.

Each qualification level in the MQF outlines specific criteria related to what learners should know, what they should be able to do, and the competencies they must demonstrate. These criteria allow individuals to move through the education system progressively, accumulating qualifications and skills as they advance. For example, qualifications begin with basic certificates and diplomas at lower levels and progress to advanced diplomas, bachelor's degrees, master's degrees, and doctoral qualifications at the higher levels.

A significant feature of the MQF is its use of a credit point system, where each credit represents 40 hours of student learning time. This system is employed to quantify the volume of learning required for each qualification, ensuring that all qualifications are based on a standardized measurement of educational effort, regardless of the discipline or sector.

One of the cornerstone principles of the MQF is the recognition of prior learning (RPL), which allows individuals to have their previous education, work experience, or informal learning experiences recognized as part of the qualification system. This mechanism supports flexibility in learning and encourages individuals to pursue further education and training by building upon their existing knowledge and skills. It also allows for credit transfer, which enables students to move between different educational institutions or switch from vocational to academic tracks without losing the credits they have already earned.

To ensure that qualifications under the MQF meet domestic and international standards, the framework is supported by rigorous quality assurance mechanisms. Two main bodies oversee this process: the Malaysian Qualifications Agency (MQA) and the Department of Skills Development (DSD). The MQA is responsible for accrediting programs within the higher education and technical/vocational sectors, while the DSD accredits skills qualifications based on the Domestic Occupational Skills Standards (NOSS). These standards are developed in consultation with industry stakeholders to ensure that training programs are aligned with the current needs of the job market.

Accreditation ensures that institutions offering qualifications meet specific criteria for quality and that their programs are relevant to both learners and employers. This guarantees that graduates possess the skills, knowledge, and competencies necessary to thrive in their chosen fields. Moreover, by adhering to the standards set by the MQF, Malaysian qualifications are more likely to be recognized abroad, facilitating greater mobility for students and workers.

A key feature of the MQF is its needs-based approach to designing qualifications. Qualifications are developed in response to the needs of the workforce, industries, communities, and individual learners. This approach ensures that qualifications are not only relevant but also flexible enough to adapt to changing economic conditions and technological advancements.

The MQF also emphasizes an outcome-based approach, meaning that qualifications are designed to specify the skills, knowledge, and attributes that learners should possess upon completing their studies. This clarity of outcomes helps improve the transparency of qualifications and supports comparability with other qualification frameworks internationally. It also provides learners with clear pathways to further education or employment opportunities, as it makes explicit what they can expect to achieve through their studies.

The MQF is designed to be highly flexible, allowing learners to achieve qualifications through various learning environments, including formal education institutions, workplace-based training, or through online and distance learning. This flexibility is essential in catering to the diverse learning needs of Malaysia's population and in supporting lifelong learning opportunities. By offering multiple pathways to achieve qualifications, the MQF ensures that education is accessible to all individuals, regardless of their background or previous educational experience.

As Malaysia aims to become a regional hub for education, the MQF plays a critical role in ensuring that Malaysian qualifications are globally recognized and comparable to international standards. The framework aligns with international best practices, making it easier for graduates to have their qualifications recognized in other economies, thereby enhancing their employment opportunities abroad.

Furthermore, the MQF supports lifelong learning by providing a structured and flexible pathway for individuals to continue their education and professional development throughout their lives. This approach is particularly important as the economy seeks to adapt to the demands of a rapidly changing global economy, where workers are expected to continuously update their skills.

In this context the 2u2i program in Malaysia is a strategic initiative under the Malaysian Education Development Plan 2015-2025 aimed at producing well-rounded, industry-ready graduates. It integrates academic study with practical industry experience, allowing students to spend two years at a university (the "2u") and another two years gaining hands-on experience in the industry (the "2i"). This approach seeks to bridge the gap between higher education institutions (HEIs) and industry requirements, ensuring that graduates possess the skills and competencies needed in the workforce.

The program emphasizes a holistic development of students by incorporating elements such as self-confidence, creativity, professionalism, and communication skills into the learning process. These attributes are crucial for students to thrive in a competitive global job market. Additionally, functional skills such as critical thinking, problem-solving, teamwork, social skills, emotional intelligence, and consulting abilities are enhanced through active and constructive learning experiences in real-world settings.

One of the core objectives of the 2u2i program is to enhance the employability of graduates by aligning educational outcomes with industry needs. By engaging

industries directly in curriculum development and student assessment, the program ensures that the education provided is relevant, up-to-date, and tailored to the evolving demands of the job market. This collaboration between universities and industries not only enriches the students' learning experience but also creates a seamless transition from academic settings to professional environments.

The program's "learn and earn" model is particularly beneficial for students as it allows them to gain valuable industry experience while still pursuing their academic qualifications. This dual exposure prepares them for the challenges of the workplace, making them more attractive to potential employers. The early immersion in industry work also helps students build professional networks and acquire a deeper understanding of their chosen fields, which can be advantageous for their career development.

Moreover, the 2u2i program addresses the common criticism that university graduates are often not "work-ready" upon completion of their studies. By providing students with extended industry placements, the program equips them with practical skills and business acumen that are difficult to obtain through traditional classroom-based learning alone. This experiential learning approach fosters a deeper engagement with the subject matter and a more profound understanding of its real-world applications.

Currently, five pioneer HEIs in Malaysia, including Universiti Malaysia Kelantan (UMK), Universiti Putra Malaysia (UPM), and Universiti Teknologi Malaysia (UTM), are offering the 2u2i study mode for certain undergraduate programs. The program's goal is to improve the graduate employability rate, which is projected to increase from the current 75% to over 80% by 2025, as outlined in the Malaysia Education Blueprint 2015-2025.

For students, the 2u2i program offers the opportunity to gain direct experience from industry practitioners within a real work environment. This approach not only integrates theoretical learning with practical application but also helps students develop essential soft skills and build professional networks. The program allows students to "learn and earn," providing financial support and improving their employability prospects. Higher education institutions benefit from the program through enhanced curriculum quality, stronger collaboration with industry partners, and increased appeal to motivated and high-quality students. The partnership with industries also enables universities to align their programs with market needs, ensuring that their graduates are well-prepared for the workforce. For industry partners, the 2u2i program reduces the need for extensive in-house training, lowers recruitment costs, and provides access to a pool of well-prepared graduates. Companies can also influence curriculum development, ensuring that graduates have the necessary skills and competencies. Furthermore, the program fosters a culture of corporate social responsibility and supports research and development initiatives.

In conclusion, the 2u2i program represents a transformative approach to higher education in Malaysia. By combining academic study with industry experience, it aims to produce graduates who are not only academically proficient but also equipped with the practical skills needed to succeed in the workplace. This innovative model of education holds great potential for enhancing the employability and professional readiness of Malaysian graduates, but also, as it combines on the job experience it can expose students to new technologies in a real environment at a faster pace than Qualifications Frameworks might be expected to.

New Zealand, frameworks in a multicultural context

New Zealand's first Domestic Qualifications Framework (DQF) was established in 1991 and initially consisted of domestic qualifications, including Domestic Certificates and Domestic Diplomas, comprising quality-assured unit and achievement standards at levels 1 to 6. In 2001, the New Zealand Register of Quality Assured Qualifications was introduced, incorporating both domestic qualifications and provider-based qualifications, such as university degrees. This register had 10 levels, a structure that remains in place in the current qualifications framework.

In 2010, the unified New Zealand Qualifications Framework (NZQF) was established, replacing both the DQF and the New Zealand Register of Quality Assured Qualifications. This new framework aimed to streamline and reduce the duplication of qualifications. As part of this reform, the terms "National" or provider names were gradually removed from qualification titles, with the exceptions being the Domestic Certificates of Educational Achievement (NCEA), which remain New Zealand's secondary school qualifications at levels 1 to 3. In 2022, micro-credentials were integrated into the framework, leading to its rebranding as the New Zealand Qualifications and Credentials Framework (NZQCF).

The NZQCF operates as a comprehensive, 10-level framework, with each level defined by three descriptors: knowledge, skills, and application. It is central to New Zealand's education and training system, encompassing all secondary and tertiary qualifications and credentials approved by the New Zealand Qualifications Authority (NZQA) or Universities New Zealand. These qualifications come with an assurance of quality, recognized both domestically and internationally.

The NZQCF serves multiple purposes. It helps individuals and organizations understand the skills and knowledge associated with each qualification or credential, making it easier to compare qualifications across economies and regions. The framework also plays a critical role in advancing Mātauranga Māori, ensuring that Māori knowledge and learning are recognized and supported. NZQA is responsible for maintaining the NZQCF and sets the rules that ensure the quality of qualifications listed on the framework. These rules apply to schools, tertiary education providers such as universities, Te Pūkenga, private training establishments, and wānanga.

University qualifications, in particular, are approved by the Committee on University Academic Programmes (CUAP) under Universities New Zealand.

The NZQCF is based on outcome-focused qualifications, described in terms of knowledge, skills, and attributes, and their application in various contexts. Administered by NZQA, it provides accurate information about all quality-assured qualifications, from senior secondary to tertiary education, and includes qualifications available to international students. The NZQCF outlines the knowledge and experience that holders of qualifications are expected to possess and the opportunities these qualifications lead to, including further education and employment.

The NZQCF is designed to maximize the recognition of educational achievement and its contribution to New Zealand's economic, social, and cultural success. Its core principles include flexibility, trust, collaboration, and lifelong learning. Qualifications are developed to meet the needs of individuals, industries, and communities, ensuring they remain relevant and aligned with workforce demands. The framework recognizes learning in various forms and settings, such as formal education, workplace learning, and online study.

NZQCF qualifications are based on the needs of the workforce and communities, with evidence required to demonstrate their relevance. They are designed with a focus on clear outcomes that articulate what graduates can "do, be, and know" upon completion. These outcomes make the purpose of qualifications transparent, allowing for international comparisons and enhancing the portability of qualifications.

The framework is underpinned by principles of lifelong learning, enabling individuals to pursue qualifications throughout their lives, in diverse environments. This flexibility ensures that learners can achieve qualifications in ways that best suit their educational, work, or cultural aspirations. Furthermore, the NZQCF promotes accountability and trust through collaborative qualification development, ensuring that all stakeholders, from government agencies to educational providers, work together in a transparent and reliable process.

Since its inception in 1991, the NZQCF has continued to evolve to meet the changing needs of New Zealand's education system. This includes periodic reviews of qualification types and definitions to ensure they remain fit for purpose. Any changes to the framework are made through consultation with stakeholders, ensuring it continues to support a high-quality, internationally comparable qualifications system that contributes to the success of New Zealand's diverse population.

A central challenge posed by new technologies in relation to domestic qualifications frameworks is centered around equity. Domestic qualifications systems must pay special attention to ensuring that all citizens have equal opportunities to access education and to receive recognition for the qualifications they acquire. In contexts marked by high inequality or poverty, the principle of equity is under pressure. Gender perspectives also play a critical role in ensuring fairness. However, in New Zealand,

as in other APEC economies, multiculturalism presents a particular challenge. A clear example of this is that much of the free and open artificial intelligence technology does not support translation into Māori. In this regard, New Zealand's qualifications authority acknowledges that "The education system is not yet delivering equitable outcomes for Māori. To remove barriers to equity in education, we are working with learners, their whānau, iwi, hapū, and other groups. We are making sure our products and services meet the needs of Māori. We're also supporting education providers to remove barriers to equity, to provide accessibility services, and deliver equitable outcomes for learners." Therefore, recognizing Mātauranga Māori within the domestic qualifications framework is a central challenge.

Mātauranga Māori refers to the body of knowledge that originates from Māori ancestors, encompassing Māori worldviews, cultural practices, values, and wisdom. It is a holistic and dynamic system of knowledge that includes everything from language, customs, spirituality, and ethics to science, history, and ecology, as understood and practiced by Māori communities in New Zealand (Aotearoa). Mātauranga Māori is passed down through generations and is deeply rooted in Māori experiences, cultural narratives, and interactions with the natural world. Mātauranga Māori includes:

- Whakapapa (Genealogy and History): The knowledge of ancestral lineage and the interrelationships between people, places, and the environment.

- Tikanga (Customs and Practices): Cultural protocols and practices that guide behavior in different situations.

- Kaitiakitanga (Guardianship): The Māori concept of environmental stewardship and the responsibility to protect and care for the land, water, and natural resources.

- Rongoā (Traditional Medicine): Māori traditional healing practices, which incorporate the use of plants, spiritual rituals, and holistic well-being.

In the context of New Zealand's education and qualifications systems, Mātauranga Māori plays an important role in recognizing and advancing Māori knowledge alongside mainstream education systems. It ensures that Māori perspectives and cultural heritage are valued and incorporated into domestic frameworks such as the New Zealand Qualifications and Credentials Framework (NZQCF). This approach helps create an inclusive educational environment that supports Māori success and acknowledges the contribution of Māori knowledge to New Zealand's broader social and cultural landscape.

Aromatawai practices refer to assessment and evaluation processes used in Māori education and learning contexts. Rooted in Māori cultural values and worldviews, aromatawai encompasses methods of assessing learning that are culturally appropriate and aligned with Māori approaches to knowledge, teaching, and development. These practices are not only about measuring academic progress but also about reflecting the holistic nature of learning within the Māori framework, which

includes spiritual, emotional, and social dimensions. Key Aspects of Aromatawai Practices:

1. Holistic Evaluation: Aromatawai assesses learners in a way that goes beyond academic achievement, taking into account their personal development, cultural identity, and well-being. It integrates Māori values such as mana (authority, respect), whakapapa (genealogy), and whānau (family).

2. Formative and Ongoing: Aromatawai is often a formative process, meaning it provides continuous feedback rather than being a final judgment at the end of a learning period. It allows learners to reflect on their progress and development throughout their educational journey.

3. Culturally Responsive: Aromatawai is designed to reflect Māori ways of knowing and learning, ensuring that the assessment respects and incorporates cultural knowledge and practices, such as the use of te reo Māori (the Māori language) and tikanga (customary practices).

4. Community and Collective Involvement: These practices often involve the learner's whānau (family) and hapū (subtribe) as part of the assessment process, recognizing the importance of collective learning and the support structures in Māori society.

5. Narrative and Reflective Methods: Aromatawai may use narrative-based assessments, where learners are encouraged to reflect on their learning experiences, share stories, and demonstrate their understanding through oral, visual, or practical means, rather than solely through written or standardized testing.

Aromatawai practices are becoming more widely recognized in New Zealand's education system, especially in kaupapa Māori (Māori-focused) settings, where culturally aligned teaching and assessment methods are crucial for supporting the success and well-being of Māori learners.

In this regard, as outlined in the Statement of Performance Expectations, the challenge of cultural equity is a central objective of the New Zealand Qualifications Authority (NZQA). One of the key objectives leverages the opportunities provided by new technologies to develop and promote a digital assessment system within a digital-first strategy. The foundation of this strategy, which uses digital platforms to improve access to the NZQF, is based on the following principles:

- Māori worldview: Assessments will enable students to use Te Reo Māori and Mātauranga Māori in their assessments, maintaining validity and contributing to equitable NCEA outcomes.

- Data as an asset: Digital external assessment services provide analytics that can be used to better inform the development of assessments, as well as teaching and learning processes.

- Adaptability: Digital external assessment services evolve in line with student and school readiness, allowing for the development of delivery modes and assessment types in response to teaching and learning needs.

- Accessibility and usability: The user experience for participants—students, examiners, markers, supervisors, and teachers—must be accessible and intuitive, ensuring that the effort to participate is no greater than under current arrangements.

- Digital-first: External digital assessment services are designed for end-to-end digital-first delivery.

The digital assessment strategy is foundational to weaving Mātauranga Māori into the qualifications system, which is a core goal of NZQA and a central part of its quality agreements. This strategy is a clear example of how new technologies not only present challenges, but also offer opportunities to eliminate inequities within domestic qualifications systems in multicultural contexts. By allowing individuals to engage with digital assessments in familiar environments, this approach has the potential to enhance performance and promote equity, and generate large volumes of valuable information to assess public policy implementation.

Peru, using AI to cope with AI

Peru's Domestic Qualifications Framework (DQF) is currently in its early stages of development, with the regulatory framework as its foundation. Unlike many other economies, Peru has opted to begin with regulatory mandates, a top-down approach, in the economic process of acceptance into the OECD. This decision is particularly suitable for a society like Peru, where the absence of legal or regulatory requirements can hinder progress. In 2021, a Supreme Decree was issued to establish the DQF and create the Domestic Commission responsible for its implementation, and a Ministerial Resolution later approved the basic structure of the DQF.

The framework was formally established by Supreme Decree No. 012-2021-Minedu, and its content and structure were approved through Ministerial Resolution No. 321-2021-Minedu. The governance of the DQF is currently overseen by the Domestic Commission for Monitoring the Implementation of the DQF, chaired by the Vice Ministry of Pedagogical Management under the Ministry of Education, with the technical secretariat led by the General Directorate of Technical-Productive, Superior Technological, and Artistic Education (DIGESUTPA). The commission also includes representatives from the Ministry of Labor and Employment Promotion, the Ministry of Production, the Domestic System for Evaluation, Accreditation, and Certification of Educational Quality (SINEACE), the Domestic Confederation of Private Business Institutions (CONFIEP), and the Private Competitiveness Council (CPC).

Peru's DQF consists of eight levels, with descriptors spanning across four dimensions. One of the notable aspects of the framework is the incorporation of ICT (Information and Communication Technology) in the skills sub dimension. The government has

also approved an implementation plan with a target completion date of 2030. The DQF derives its mandate from the Domestic Competitiveness and Productivity Plan (2019-2030), led by the Ministry of Economy and Finance. This is in line with international requirements, as one of the prerequisites for joining the OECD is the establishment of a Domestic Qualifications Framework.

The Ministry of Education (MINEDU) is the primary authority responsible for the development and leadership of the framework. However, it is not entirely clear whether this initiative reflects a genuine demand from various sectors within the economy. Political instability, coupled with the lack of consistency within business confederations, poses significant challenges to maintaining continuity in the framework's development. Additionally, there is a high level of distrust towards the public sector, and differences in operational pace between the private and public sectors making it difficult for businesses to convince their members of the DQF's benefits.

Businesses are often asked to provide detailed data, such as timelines for qualification mapping and the resources required for implementation. However, these figures remain unavailable as the framework has yet to begin its substantive population or implementation phase.

The Domestic Qualifications Framework of Peru (MNCP) is conceived as a domestic framework applicable across all productive sectors, in accordance with the regulations that define its governance. Given its functions and content, it is recommended that the MNCP serve as a referential framework. This means it will act as an organizing and coordinating tool for educational and training offerings, benefiting both institutions responsible for issuing curricular guidelines and quality assurance standards, as well as public and private entities that provide programs.

Once the governance structure of the MNCP is established, its scope can be reviewed in light of the institutional framework created and the competencies granted to the governing body. The MNCP is expected to encompass all educational and training levels that are officially recognized within the Republic of Peru.

The MNCP is structured into eight qualification levels, organized in ascending order of complexity, and it will facilitate the recognition of prior learning acquired through experience or practice, as well as through education and professional training obtained either domestically or abroad.

The Certification Information Management System (SIGICE) is a platform developed by SINEACE, which serves as the official source of information regarding the evaluation and certification of competencies conducted by SINEACE and authorized certification entities. This virtual platform supports the management of information related to certification processes, including details on authorized certifying entities, certification processes, competency standards, evaluators, and candidates. It enables

tracking certification processes, generating structured information, producing analysis reports, and providing detailed data for informed decision-making.

Although still in the early stages of implementation, Peru has highlighted two key experiences where new technologies have been leveraged within the certification processes managed by SINEACE. The COVID-19 pandemic accelerated the need to use platforms for conducting various processes, including certification, to meet the demands of different users. In this context, SINEACE initiated a process to redesign the platform, enabling virtual evaluations where users can upload evidence in various formats, such as videos, from their homes or workplaces.

The transformation involved the following phases:

1. Review of Certification Regulations and Technology Use: Multidisciplinary analysis sessions were held with evaluation and certification teams, information management experts, as well as legal and IT departments to optimize the regulatory framework and execution times for certification processes.

2. Analysis of Certification Processes and Regulatory Adjustments: A mapping of processes was conducted to identify improvements in the platform's capacity, leading to the construction of procedural workflows within the virtual platform. After approval of the new procedure, adjustments were made to the regulatory framework, which included directives that made SIGICE the only support system for competency certification.

3. Technological Review and Interface Design: In coordination with SINEACE's IT department, an analysis of technological capabilities and resources was carried out. This resulted in the design of interfaces, operational logic, control points, functionalities, and reporting features for the platform.

4. Implementation, Operation, Training, and Promotion: The platform's development followed a software development cycle to ensure functionality and usability. Virtual training sessions were held to familiarize users with the system, and practical guides were shared. A promotional event was held in August 2022 to showcase SIGICE, which was attended by citizens and public and private entities.

SIGICE allows the execution of online certification processes, from candidate registration, evidence submission, and evaluation, to the issuance of certificates. The platform provides access, transparency, and data security, enabling users across the economy with internet access to participate in certification processes efficiently, reducing operational costs for all stakeholders (candidates, evaluators, authorized certification entities, and SINEACE).

The platform enables the following functions:

- Monitoring certification processes.
- Generating structured information.

- Producing official internal and external reports.
- Providing analysis reports for informed decision-making.

Since its launch in October 2020, the online certification processes conducted through SIGICE have achieved significant results, including the certification of 1.229 individuals at the local level. The platform has greatly improved efficiency, as evidenced by the following comparisons:

- Between 2010-2019, four certification processes were conducted annually in person, evaluating around 100 candidates. In 2020-2022, only one online certification process was required to evaluate the same number of candidates.

- In 2019, an average of 22 candidates were evaluated per process. By 2022, this number had increased to 169 candidates per process.

- From 2010-2019, a competency evaluator participated in four certification processes annually in only two regions. By 2020-2022, a single evaluator participated in one online process, covering the entire economy.

Training for SINEACE staff to utilize SIGICE and guide certifying entities through online certification processes was provided through practical meetings led by SINEACE's IT department and information management specialists. Five key staff members, responsible for evaluation and certification, were involved in these sessions.

In a separate initiative, SINEACE and the Peruvian Medical Association have begun authorizing the use of robotic simulations in the evaluation of competencies. These simulations replicate high-risk medical situations such as complicated childbirths, deep cuts, or CPR procedures. These "simulation teams," authorized by SINEACE, demonstrate how new technologies can enhance the relevance of evaluations, particularly in areas like medicine where real-life evaluation contexts may be unfeasible. This experience can be further enhanced by introducing AI for creating and programming new high-risk medical situations considering the hardware capabilities.

The Philippines, from qualifications to skills

The Philippine Qualifications Framework (PQF) established in 2012 was designed to create a unified domestic system that standardizes the recognition of qualifications acquired through various learning pathways. This framework aims to ensure that educational qualifications align with the economy's development goals and international standards, providing clear pathways for progression and lifelong learning. The PQF encompasses eight qualification levels, ranging from National Certificates I-IV, overseen by the Technical Education and Skills Development Authority (TESDA), to higher education degrees under the Commission on Higher Education (CHED). Each level is associated with specific learning outcomes related to knowledge, skills, and values, supporting the diverse learning and employment needs of the population.

The primary purpose of the PQF is to integrate and harmonize the economy's education and training systems. It serves as a tool for both individuals and organizations to understand the skill levels associated with different qualifications, making it easier to compare them with other domestic and international frameworks. This alignment facilitates the mobility and employability of Filipino workers, both domestically and globally. The PQF also supports the recognition of prior learning (RPL), which allows individuals to obtain formal qualifications based on their work experience and non-formal learning, thus providing a more inclusive and flexible approach to education and skills development.

The PQF is governed by the PQF-National Coordinating Council (NCC), which is composed of representatives from key government agencies, including DepEd, TESDA, CHED, and the Professional Regulation Commission (PRC). The NCC is tasked with overseeing the implementation and management of the PQF, ensuring that it is integrated across different educational sectors and aligned with the labor market's needs. However, despite this structured governance, the PQF faces several challenges in implementation. One significant issue is the lack of coordination among the various agencies involved, each of which has its own mandates and priorities. This fragmentation can lead to overlaps and inefficiencies, particularly in areas where TESDA and CHED responsibilitiesCHED's responsibilities intersect, such as in the recognition of TVET qualifications for higher education entry.

Another challenge is the limited awareness and understanding of the PQF among key stakeholders, including employers, educational institutions, and the general public. This lack of awareness hinders the adoption and utilization of the framework, especially in terms of its potential to enhance labor mobility and employability. To address this, there is a need for more capacity-building initiatives that can help educators and employers understand how to use the PQF effectively in curriculum development, recruitment, and workforce planning. Additionally, there is a call for a clearer delineation of responsibilities and more robust support from the government to ensure the successful implementation of the PQF across all sectors.

The PQF also aims to align educational outcomes with labor market demands, thereby enhancing the employability of graduates and supporting economic development. To achieve this, the framework encourages the active involvement of industry representatives in the development and review of qualifications. This industry linkage is crucial for ensuring that the skills and competencies specified in the PQF are relevant and up-to-date. However, gaps remain in this integration. For example, while the framework provides a clear structure for qualifications, it does not fully address the need for more flexible and responsive training programs that can quickly adapt to changing labor market conditions. There is also a need for better data on labor market trends and skill shortages, which can inform the ongoing development and revision of qualifications within the PQF.

The PQF's quality assurance system plays a crucial role in maintaining the integrity and credibility of the qualifications it encompasses. This system includes the accreditation of educational institutions and the certification of training providers, ensuring they meet established quality standards. The PQF also supports the international comparability of the Philippines' qualifications by aligning its levels and learning outcomes with global frameworks, such as the ASEAN Qualifications Reference Framework (AQRF). However, the quality assurance system itself faces several challenges, such as the need to streamline the accreditation process to reduce duplication and inefficiencies. There is also a lack of a comprehensive mechanism for monitoring and evaluating the impact of the PQF on education and employment outcomes. Strengthening these areas will be essential for building trust in the framework and ensuring that it serves its intended purpose.

Moving forward will require ongoing collaboration between the government, industry, and educational institutions to ensure that the framework remains relevant and effective. Key areas for future development include expanding the recognition of prior learning, enhancing the integration of non-formal and informal learning pathways, and developing more flexible qualification types, such as micro-credentials. Additionally, there is a need to strengthen the governance structure, develop an official Operations Manual, and conduct pilot projects to test the framework's flexibility and effectiveness.

To realize the full potential of the PQF, it is also crucial to address the current challenges in stakeholder engagement and awareness. This includes increasing efforts to raise awareness among employers, educational institutions, and the general public about the benefits and applications of the PQF. There should also be initiatives to enhance the capacity of educators, employers, and other stakeholders to utilize the PQF effectively in various contexts, such as curriculum development, recruitment, and workforce planning.

An actual effort in The Philippines, which implies a change of scope, is the The Philippine Skills Framework (PSF) represents a significant step forward in the economy's efforts to upskill and reskill its workforce in response to the evolving demands of Industry 4.0. This initiative, launched through a multi-agency collaboration, aims to provide a structured approach to workforce development by mapping out essential skills and competencies needed across various sectors. Its core objective is to ensure that the Filipino workforce is equipped with the skills necessary to thrive in the rapidly changing job market driven by technological advancements, including artificial intelligence, automation, and other Industry 4.0 technologies.

The PSF complements the existing Philippine National Qualifications Framework (PNQF) by providing a more granular focus on the specific skills and competencies required in different industries. While the PNQF sets the broader structure for educational qualifications across levels and sectors, the PSF dives deeper into the particular skills needed for specific job roles within industries. This alignment helps

bridge the gap between education and employment by ensuring that the workforce is not only academically qualified but also industry-ready.

The PSF was developed as a joint effort between various government agencies, including the Department of Trade and Industry (DTI), the Technical Education and Skills Development Authority (TESDA), and The Philippine Trade Training Center – Global MSME Academy (PTTC-GMEA), along with nine other government entities. This collaborative initiative was inspired by Singapore's SkillsFuture initiative, which has been instrumental in transforming Singapore's workforce to meet the challenges of the future economy.

In response to the increasing need for skilled labor in The Philippines, particularly in high-demand sectors such as information technology, healthcare, and manufacturing, the PSF was designed to offer a clear pathway for skills development and career progression. It provides detailed maps of the skills required for various occupations, the impact of technology on these roles, and the competencies that individuals need to acquire to remain competitive. The framework also identifies potential career pathways, helping individuals plan their careers and make informed decisions about their education and training.

The PSF is structured around several key components. Industry Transformation Maps (ITMs) outline the anticipated changes in each industry due to technological advancements and other factors. They provide a roadmap for how industries can adapt to these changes, focusing on the skills and competencies needed to remain competitive. The ITMs serve as a guide for both employers and employees to understand the future landscape of their respective industries.

Occupational Skills Frameworks detail the specific skills required for various job roles within each industry. They include both technical skills, such as programming or data analysis, and soft skills, such as communication and problem-solving. By clearly defining the competencies needed for each role, the PSF helps individuals and employers align their training and development efforts with industry needs.

Skills Pathways provide a roadmap for skills development that shows how individuals can progress from one role to another within their industry. These pathways are designed to encourage lifelong learning and continuous professional development, enabling workers to adapt to changing job requirements and advance in their careers.

The framework also includes guidelines for training providers and assessors to ensure that the skills being taught and assessed are relevant and up-to-date. This helps maintain the quality of training and ensures that individuals are acquiring the skills that are in demand in the job market.

The PNQF serves as the overarching framework for all qualifications in The Philippines, covering formal education, technical-vocational education and training (TVET), and informal learning. It is designed to ensure that all qualifications are

standardized and quality-assured, making it easier for individuals to progress through different levels of education and training.

The PSF complements the PNQF by providing more specific guidance on the skills and competencies required for particular job roles within industries. While the PNQF provides the broader structure for qualifications, the PSF offers a detailed breakdown of the skills needed for specific occupations. This helps to align educational and training programs with the actual needs of employers, reducing the skills mismatch that has been a persistent issue in The Philippines.

For instance, in the field of information technology, the PNQF might outline the qualifications needed for a career in IT, such as a diploma or degree in computer science. The PSF, on the other hand, would provide a detailed map of the specific skills required for roles such as software developer, data analyst, or cybersecurity specialist, along with the competencies needed at each level of these roles. This enables educational institutions and training providers to tailor their programs to meet these specific requirements, ensuring that graduates are not only qualified but also job-ready.

One of the key challenges that the PSF aims to address is the rapid pace of technological change associated with Industry 4.0. As automation, artificial intelligence, and other technologies continue to transform industries, the skills required for many jobs are evolving. The PSF helps to address this challenge by providing a flexible framework that can be updated as new technologies emerge and industry needs change.

The framework also supports the development of digital skills, which are increasingly important in today's job market. By mapping out the specific digital competencies needed for various roles, the PSF ensures that workers are equipped with the skills required to succeed in a digital economy. This includes not only technical skills such as coding and data analysis but also digital literacy and the ability to work effectively in a technology-driven environment.

Lifelong learning is a critical component of the PSF, as it encourages individuals to continuously update their skills and knowledge throughout their careers. The skills pathways outlined in the framework provide a clear roadmap for career progression, helping individuals identify the skills they need to acquire to advance in their chosen field. This supports a culture of continuous learning and helps workers stay relevant in a rapidly changing job market.

The PSF also promotes the recognition of prior learning (RPL), which allows individuals to receive credit for skills and knowledge they have acquired through work experience or informal learning. This makes it easier for workers to gain formal qualifications and advance in their careers without having to go through traditional education and training pathways. By recognizing the value of informal learning, the

PSF helps to ensure that all skills and competencies are valued, regardless of how they were acquired.

The successful implementation of the PSF requires strong collaboration between various stakeholders, including government agencies, industry associations, educational institutions, and training providers. The framework is designed to be a collaborative tool that brings together these different groups to ensure that the skills being taught and assessed are aligned with industry needs.

Industry partners play a crucial role in the development and implementation of the PSF, as they provide valuable insights into the skills and competencies required for different job roles. By working closely with industry, the PSF helps to ensure that the framework remains relevant and responsive to the changing needs of the job market.

The PSF is still in its early stages of implementation, but it has the potential to significantly improve the alignment between education and employment in The Philippines. By providing a clear and detailed map of the skills required for different roles, the framework can help to reduce the skills mismatch and improve the employability of Filipino workers.

As the PSF continues to evolve, it will be important to regularly update the framework to reflect changes in technology and industry needs. This will require ongoing collaboration between stakeholders and a commitment to continuous improvement. The success of the PSF will also depend on the willingness of employers to engage with the framework and use it as a tool for workforce planning and development.

The Philippine Skills Framework represents a major effort in the economy's strategy to develop a skilled and adaptable workforce that is prepared for the challenges of Industry 4.0. By complementing the existing Philippine National Qualifications Framework, the PSF provides a more detailed and targeted approach to skills development, helping to ensure that Filipino workers have the competencies they need to succeed in the future economy. Through its focus on industry alignment, lifelong learning, and collaboration, the PSF has the potential to transform the landscape of skills development in The Philippines and support economic growth and competitiveness.

Singapore, a modular approach.

The Singapore Workforce Skills Qualifications (WSQ) System, introduced in Singapore in 2005 as part of a government initiative, aims to enhance the competitiveness and adaptability of the workforce in a constantly evolving global market. Developed and implemented by the Workforce Development Agency (WDA), now part of SkillsFuture Singapore (SSG), the primary objective of the WSQ is to establish a competency-based qualification system that aligns with industry-specific needs and fosters lifelong learning and skills development.

Although the WSQ functions similarly to a qualifications framework, it stands out due to its modular and competency-based approach, which diverges from the traditional numeric level models seen in other Domestic Qualifications Frameworks (DQFs). The design of the WSQ emphasizes flexibility, allowing individuals to acquire relevant industry skills through specific learning modules, or "bite-sized" units, which can be accumulated and combined rather than following a strictly linear progression. This approach, while innovative, presents some challenges, such as a lack of clarity in progression. Without clearly defined levels, it may be difficult for individuals and employers to understand how competencies align with specific roles or career advancement. Additionally, the WSQ's strong focus on practical skills, with less emphasis on theoretical or academic education, may limit its applicability in sectors that value more traditional forms of education. The modular nature of the WSQ also risks fragmenting learning, with individuals completing isolated modules without necessarily connecting skills coherently for broader progression.

The WSQ system operates as a domestic credential framework that trains, develops, assesses, and certifies skills and competencies for the workforce. Courses accredited by WSQ are aligned with the Skills Frameworks, which outline the necessary job roles and skills to perform various tasks and ensure skill transferability across roles. The WSQ is underpinned by a robust quality assurance framework, applying stringent criteria to all aspects—from the development of technical skills and competencies to the approval of training providers and the awarding of WSQ qualifications. This structured system supports the development of a strong training infrastructure that enhances Singapore's workforce capabilities.

WSQ is designed based on domestic standards created by the Singapore Workforce Development Agency in collaboration with industry partners. It aims to professionalize industries, especially where recognition of Continuing Education and Training (CET) qualifications is limited, and to improve labor mobility, facilitating the recruitment of skilled workers in growing industries while enhancing opportunities for workers to enter these fields. Through WSQ, individuals are trained, developed, assessed, and recognized for key competencies sought by employers, making it a practical, accessible, and affordable platform for individuals to manage their career advancement. It also serves as a powerful tool for businesses to maintain a skilled workforce, boosting their competitive edge.

The establishment and functions of the WDA, including the authority to award qualifications, are defined under the Singapore Workforce Development Agency Act. This is further supported by the Skills Development Levy Act, which mandates that employers contribute to a skills development levy. The funds collected are used to promote, develop, and upgrade the skills and expertise of individuals preparing to join, rejoin, or remain in the workforce, as well as to provide financial assistance through grants and loans.

The WSQ frameworks are developed in consultation with industry through the Industry Skills and Training Councils (ISTCs), which include industry players, training institutions, and unions. These councils identify the skills needed in various sectors and develop industry-specific WSQ frameworks, regularly reviewing learning outcomes to ensure they remain current and relevant. Although there is no legislation governing the design, development, and implementation of WSQ frameworks, certain industries adopt these frameworks to meet specific legislative requirements. For instance, the Occupational Hygiene Professionals WSQ was developed in partnership with the Ministry of Manpower (MOM) and the Workplace Safety and Health Council (WSH) to support the National Workplace Health Framework, which aims to enhance workplace health standards and train competent Occupational Hygiene professionals.

The WSQ also establishes rules and parameters for the design of qualifications, including the measurement of learning volume, which is composed of core, elective, and other relevant competency units. Credit transfer and recognition of prior learning between WSQ and non-WSQ qualifications, as well as across education sectors, are facilitated at the institutional and qualification levels. For example, a Mutual Recognition Arrangement between the Institute of Technical Education (ITE) and WSQ has been in place since 2008, allowing individuals with ITE or WSQ qualifications to pursue skills upgrading with credit exemptions under either system.

The SkillsFuture Movement, launched in 2015, is a broader domestic initiative that aims to promote lifelong learning and skills development among all Singaporeans, regardless of their age or career stage. This initiative is part of a larger government strategy to prepare the workforce for the challenges of the global economy and to adapt to rapid technological and labor market changes. The SkillsFuture Movement emphasizes the importance of continuous learning through formal education, technical courses, and workplace skills development, aiming to cultivate a highly skilled workforce capable of thriving in emerging and technically advanced sectors such as artificial intelligence, cybersecurity, and advanced manufacturing.

In support of individualized career pathways, SkillsFuture provides resources and support for individuals to explore different career options and develop relevant skills, enabling them to progress in their careers or switch sectors. It also fosters collaboration between the government, industry, and education providers to ensure that training programs remain aligned with market needs. Key components of the SkillsFuture Movement include the SkillsFuture Credit, which provides all Singaporeans aged 25 and above with an initial credit to invest in approved courses, thereby encouraging continuous education and skill enhancement. Other components include professional development and career programs, the SkillsFuture Earn and Learn Programme for young graduates, and a variety of subsidies and scholarships to support learning, particularly in critical growth areas for Singapore's economy.

Another significant initiative under SkillsFuture is the TechSkills Accelerator (TeSA), launched in 2016 to address the growing demand for advanced technological skills in

the digital economy. TeSA aims to equip Singaporeans with the necessary skills to excel in emerging and high-demand technology roles, such as artificial intelligence, cybersecurity, software development, and data science. By enhancing the employability of local workers in the tech sector, TeSA aligns their competencies with market needs and facilitates career transitions into tech-related roles. The initiative includes a range of training and certification programs, developed in collaboration with educational institutions and leading tech companies, as well as placement opportunities, internships, and intensive reskilling programs for mid-career professionals. TeSA also offers financial support and subsidies to reduce the costs of training, making skills development more accessible. Below are the main programs offered:

1. TeSA Mid-Career Advance

This program is designed for mid-career professionals seeking to transition into tech roles. It provides intensive training and job placement opportunities for workers aged 40 and above, allowing them to acquire new technological skills and secure employment in the tech sector with the support of employers committed to providing on-the-job training.

2. Company-Led Training (CLT)

The CLT is an industry-driven training program where companies lead the upskilling of their employees in key technological competencies. Companies collaborate with TeSA to design training programs that cover specific skills such as software development, cybersecurity, and data analytics. This program enables employees to gain relevant skills while working.

3. CITREP+ (Critical Infocomm Technology Resource Programme Plus)

CITREP+ supports continuous learning and certification acquisition in advanced technological fields. This program provides subsidies for courses and certifications in areas such as cybersecurity, artificial intelligence, data analytics, and other key digital competencies. It is available to working professionals as well as students and recent graduates.

4. TeSA Digital Leaders Programme

This program aims to develop digital leaders within organizations by equipping them with advanced skills in technology management and digital transformation. It is designed to prepare senior professionals to lead digital and strategic initiatives within their companies, promoting effective adoption of emerging technologies.

5. TeSA Training and Placement Programmes

TeSA offers various training and placement programs in collaboration with employers. These programs are designed to provide participants with specific tech training

followed by placement in tech roles within partner companies. This ensures that participants not only acquire the necessary skills but also have direct employment opportunities in the tech sector.

6. TeSA for ITE and Polytechnics Alliance (TIP Alliance)

This program focuses on students from Institutes of Technical Education (ITE) and Polytechnics, providing specific training pathways in advanced technological skills and facilitating the transition of students into tech roles after graduation. It includes internship programs, mentorship, and practical industry learning opportunities.

7. Infocomm Professional Conversion Programme (PCP)

The PCP is designed to help professionals transition into new careers in the tech sector. It offers intensive training and job opportunities in tech roles for those seeking to change careers. The program covers key areas such as software development, cybersecurity, and data science.

8. TeSA Tech Immersion and Placement Programme (TIPP)

The TIPP offers technical immersion and placement programs that allow participants to acquire practical skills in specific technologies, such as application development and data analytics. Upon completion of the training, participants are placed in tech jobs with partnering companies.

Each of these programs is tailored to address different workforce needs, from training new talent to retraining experienced professionals. Through these initiatives, TeSA aims to bridge the technological skills gap in Singapore and ensure that the workforce is equipped to meet the challenges of the global digital economy.

Overall, the WSQ system, the SkillsFuture Movement, and the TechSkills Accelerator form a comprehensive approach to workforce development in Singapore. These initiatives collectively aim to equip Singaporeans with the skills needed for the future, promote a culture of lifelong learning, and ensure that Singapore's economy remains competitive in an increasingly dynamic and technology-driven world.

Thailand, DQF in a challenging context: Recognition of Prior Learning to foster lifelong learning

The Thailand Qualifications Framework (TQF) was first approved by the Cabinet of Ministers in 2013. A new version was released in 2017, and it was subsequently approved and proposed again to the Cabinet of Ministers. Since then, efforts have been made to implement the mechanisms of our Qualifications Framework (QF) across the economy, involving cooperation with various government agencies, as well as private and public sectors.

The management of the TQF is overseen by the Office of the Education Council under the Ministry of Education. This is done in consultation with other relevant government agencies and private councils. The primary objectives of the QF are to serve as a

mechanism for educational reform by aligning workforce quality demands with the educational qualification system, in order to keep pace with global changes, disruptive technologies, and evolving educational standards. This alignment is intended to enhance the quality of education, making it compatible with international standards. Additionally, the framework aims to strengthen lifelong learning—a critical issue in Thailand—and broaden educational participation, thereby building workforce capacity for socio-economic development.

Another significant objective of the QF is to develop linkages with other economies. This serves as a mechanism to enhance workforce mobility, competitiveness, and economic integration. Furthermore, the framework seeks to increase the value of individuals possessing functional competencies by validating their educational qualifications through recognition of prior learning (RPL). This includes establishing pathways for career development and individual progress, ensuring that educational qualifications are effectively aligned with the needs of the labor market.

In addition to the QF, the Thailand Professional Qualification Institute (TPQI) plays a crucial role in supporting the framework by addressing the significant gap between the education sector and the labor market. This gap has been a longstanding issue in Thailand, as well as in other sectors and economies. The TPQI was established in 2011 to bridge this divide, developing a professional qualification system that sets occupational standards in collaboration with industries, associations, and stakeholders within specific sectors and occupations. TPQI oversees approximately 500 assessment centers across Thailand, which vary depending on the occupation, and serves as the sole organization authorized to issue professional qualifications that meet these occupational standards.

TPQI also collaborates with international organizations, other training providers, and non-government agencies to promote the system and ensure its relevance in a global context. The professional qualification framework encompasses eight levels, which are aligned with the Thailand Domestic Qualifications Framework. These levels range from basic skills at level one to advanced management and innovation roles at level eight, including positions for researchers who are professionally engaged in innovation. This framework includes classification and coding systems for each occupation, supported by certification and quality assurance systems, along with a comprehensive workforce database in Thailand.

The heart of the system lies in the occupational standards and qualifications, which determine the specific levels of proficiency required for various roles. For instance, a hairdresser or a mechatronics technician may begin at level three and progress through levels four, five, and even six, depending on their skill level. Standards are developed to reflect Thailand's needs and strategic goals, such as those outlined in the Thailand 4.0 initiative, which emphasizes reskilling and upskilling the workforce to meet the challenges of automation and robotics.

TPQI plays a facilitating role, bringing stakeholders together to jointly develop competency standards. These standards can encompass an entire qualification or specific sets of competencies, and they are utilized by TPQI assessment centers to evaluate candidates, workers, and learners against established occupational standards. Individuals who meet the competency requirements receive professional qualifications or certificates of attainment. They have the option to earn credits incrementally until they achieve the full qualification. If individuals do not meet the standards, they can seek further training, gain additional experience, and return for re-assessment to qualify.

Occupational standards are also integrated into enterprise in-house training programs. TPQI accredits training providers that use these standards as the basis for their curricula, ensuring that learners and candidates meet the competency requirements set by industry demand. Educational institutions, including vocational colleges and universities, also use these standards. This approach provides a shortcut for aligning their programs with industry needs without the need for separate consultations with enterprises. This alignment supports the development of a demand-driven, competent workforce.

Additionally, TPQI has implemented a competency credit bank, allowing individuals to accumulate and store credits for competencies gained throughout their careers. This system supports lifelong learning and career development, enabling individuals to build on their skills and qualifications over time.

The impact of emerging technologies, particularly artificial intelligence (AI), presents both opportunities and challenges. In response, Thailand has been proactive in developing standards and training for digital literacy, e-commerce literacy, and digital skills for government transformation. This initiative is essential for ensuring that all government officials are equipped with the necessary skills to navigate the evolving technological landscape. In addition to these skills, there is a broader focus on integrating AI literacy and related competencies across various roles and sectors. Specific focus areas include AI enhancement for data analysts and scientists, human-machine teaming managers, and AI ethics and policy specialists.

While Thailand does not emphasize developing AI experts, due to a lack of highly specialized skills in this area, the economy prioritizes equipping all citizens and workers with the ability to use AI as a productivity tool in their respective jobs. The goal is to ensure that individuals can harness AI to enhance their work, rather than be replaced by it.

Thailand also faces challenges in workforce training, particularly in the areas of lifelong learning, training supply, and training effectiveness. Many working-age individuals do not pursue further training due to barriers such as time constraints, cost, and lack of motivation. Addressing foundational skills, which are essential for developing future skills, is critical. A significant proportion of adults, particularly those aged 40 and above

or without tertiary education, lack foundational skills. This is a growing concern as employers increasingly demand skills like emotional intelligence, digital skills, learning enthusiasm, problem-solving abilities, and language proficiency.

In response to these challenges, Thailand introduced the e-Workforce Ecosystem (EWE) platform as part of the Domestic Reform Plan on Culture, Sports, Tourism, Labor, and Workforce Development in 2020. The platform aims to promote lifelong learning and provide opportunities for all citizens. It includes features such as job matching, a digital competency credit bank, and systems for e-portfolios, allowing individuals to document and build on their learning and professional experiences from a young age throughout their careers.

At the core of the platform lies a robust training infrastructure that offers a wide range of online courses, workshops, and resources focused on high-demand digital skills. These include areas such as data analytics, cybersecurity, cloud computing, and programming, enabling workers to acquire the knowledge and expertise required to thrive in the Industry 4.0 era. Furthermore, the EWE Platform serves as a job-matching marketplace, connecting skilled workers with employers seeking digital talents. This function not only assists companies in fulfilling their talent requirements but also provides opportunities for skilled individuals to find suitable employment opportunities aligned with their expertise. Recognizing the rapidly changing job market landscape, the platform also offers upskilling and reskilling programs, empowering existing workers to adapt and acquire new skills in response to evolving industry demands.

The EWE platform also incorporates a digital coupon system, providing financial subsidies for training. Individuals can receive an e-coupon, which they can use to access training programs and later be reimbursed for the costs. Additionally, the platform offers a dashboard for labor market information, enabling TPQI and the government to track workforce trends and needs.

Target individuals, students, job seekers, freelancers, retired seniors, vulnerable citizens, employers, and government agencies can benefit from the EWE Platform through the official website of TPQI, which connects workforce data from each agency into big data and creates six key features: a digital competency credit bank to gather knowledge and work experiences; career guidance and skill check to assess users' skills; an e-coupon to support those in need of upskilling, reskilling, or creating new skills through digital wallet (Paotang); an e-portfolio to record experiences; job matching to connect employers and skilled workers; and labor market data for planning workforce policy for future domestic improvement.

Overall, the EWE platform aims to enhance workforce skills and qualifications, enabling individuals to progress in their careers. TPQI's efforts include providing self-assessment tools for various professions, recognizing prior learning, and aligning qualifications with occupational standards to ensure training meets industry needs. Moreover, TPQI collaborates internationally to benchmark Thai standards against

global standards, ensuring alignment and access to best practices. This comprehensive approach aims to create a competent, adaptable workforce capable of meeting the demands of Thailand's evolving economy and positioning the economy for success in the global market.

Viet Nam, a domestic approach to AI

The Viet Nam National Qualifications Framework approved in 2016 (VNQF) is an ambitious initiative aimed at unifying the educational and vocational training systems in Viet Nam under a comprehensive structure that ensures quality, transparency, and alignment with both domestic and international labor market demands. Established to address the fragmented and sometimes inconsistent approach to qualifications in Viet Nam, the VNQF delineates eight levels of qualifications. These levels range from certificates to doctoral degrees, and each level specifies the expected competencies, skills, and knowledge that individuals must acquire to progress within the framework.

The governance of the VNQF is managed through a collaborative effort between the Ministry of Labor, Invalids and Social Affairs (MOLISA) and the Ministry of Education and Training (MOET). MOLISA is responsible for the development and implementation of vocational education and training policies, while MOET oversees formal education. The coordination between these two ministries is crucial for the effective functioning of the VNQF, as it aims to integrate various forms of education and training into a single, cohesive system. The VNQF also establishes a governance committee that oversees its implementation, ensuring that all educational and training programs are aligned with the framework's standards.

A significant aspect of the VNQF is its quality assurance system, which is fundamental to maintaining the credibility and recognition of Vietnamese qualifications. The framework includes the establishment of dedicated accreditation agencies that operate under the supervision of MOLISA and MOET. These agencies are tasked with evaluating and certifying institutions and training providers, ensuring that they adhere to the established quality standards. The stringent quality assurance measures are designed to foster trust in Vietnamese qualifications, both within the economy and internationally.

One of the key goals of the VNQF is to facilitate educational and occupational mobility by creating a clear and standardized system for the recognition of qualifications. This system allows individuals to move more easily between different educational pathways and into the labor market. The framework also supports the recognition of prior learning, providing a mechanism for individuals to gain formal recognition for skills and knowledge acquired through work experience or non-formal education. This is particularly important in a rapidly changing economy, where the ability to adapt and recognize new skills is essential.

The VNQF is aligned with Viet Nam's broader socio-economic strategies, particularly the Educational Development Strategy 2011-2020 and the Human Resources Development Strategy 2011-2020. These strategies emphasize the need for a high-quality, integrated education system that meets the needs of an evolving labor market. The VNQF plays a critical role in these strategies by providing a framework that supports lifelong learning and continuous skill development, which are essential for economic growth and social stability.

Despite the progress made, the implementation of the VNQF faces several challenges. One of the most significant challenges is the need for better coordination between MOLISA and MOET, as the current overlap in responsibilities can lead to inefficiencies and inconsistencies in policy implementation. Additionally, there is a general lack of awareness about the VNQF among employers and the general public, which limits its effectiveness in facilitating labor mobility and improving educational outcomes. Furthermore, the terminology and structure of the vocational training system need to be harmonized to better align with international standards and practices.

The VNQF also faces challenges related to the integration of traditional education with vocational training. While the framework aims to create a seamless pathway for students and workers to move between different types of education and training, there are still significant gaps in the system that need to be addressed. For instance, the inclusion of micro-credentials and digital learning opportunities is still in its early stages, and more work is needed to ensure that these innovations are fully integrated into the VNQF.

In response to these challenges, the Vietnamese government has made concerted efforts to raise awareness about the VNQF and its benefits. This includes initiatives to improve communication and collaboration between MOLISA, MOET, and other stakeholders, as well as efforts to promote the framework among employers and educational institutions. The government is also working to develop tools and policies that will facilitate the implementation of the VNQF and ensure that it remains relevant and effective in a rapidly changing economic and social environment.

While there are still challenges to be addressed, the VNQF has the potential to play a transformative role in Viet Nam's socio-economic development by providing a framework that supports lifelong learning, enhances the quality of education, and promotes greater alignment between education and employment. The continued development and refinement of the VNQF will be essential to achieving these goals and ensuring that the Vietnamese workforce is equipped with the skills and knowledge needed to succeed in the global economy.

The Digital Transformation Program in Vocational Education in Viet Nam is a key component of the economy's broader National Digital Transformation Programme, which aims to modernize the educational system and equip the workforce with the necessary digital skills to meet the demands of the digital economy and Industry 4.0.

This program is part of Viet Nam's strategic efforts to transform its educational landscape by integrating technology into vocational training, thereby enhancing the quality, accessibility, and relevance of vocational education.

The initiative focuses on several core areas to ensure that the vocational education system is aligned with the digital transformation goals. First and foremost, the program emphasizes the digitalization of all aspects of vocational education, including the digitization of learning processes, management systems, and certification procedures. By 2030, it aims to have 100% of vocational institutions fully digitized. This involves creating a digital ecosystem that integrates data into a domestic digital environment and developing a digital map of vocational institutions to facilitate management and planning.

To support this digital ecosystem, the program includes the development and upgrading of the vocational education data center, creating a large, comprehensive database for vocational education, and building digital platforms for teaching and learning. These digital platforms are intended to synchronize with domestic data systems related to employment and social security, ensuring that the vocational education system is seamlessly integrated into the broader domestic digital framework.

A crucial aspect of the program is the development of digital skills among students, educators, and administrators. The curriculum is being adapted to include both basic and advanced digital skills, with a particular focus on high-demand areas such as information technology, artificial intelligence, and digital technologies. This is designed to ensure that graduates possess the necessary competencies to thrive in a digital economy and meet the skill requirements of Industry 4.0.

To achieve this, the program provides targeted training for educators and administrators, focusing on new digital knowledge, adaptive learning technologies, and the use of digital materials and virtual classrooms. This is intended to foster a culture of continuous professional development and innovation within the vocational education sector.

The program also emphasizes the importance of public-private partnerships to support the transformation of vocational education. These partnerships are crucial for developing the necessary digital infrastructure and fostering innovation. By involving private enterprises and international organizations, the program aims to create a more dynamic and responsive vocational education system that can quickly adapt to changing technological and labor market conditions.

In terms of policy and governance, the program involves multiple government ministries and agencies to ensure effective implementation and coordination. The Ministry of Labor, War Invalids, and Social Affairs is the primary coordinating body, working closely with the Ministry of Information and Communications, the Department of Planning and Investment, the Department of Finance, and provincial governments.

These bodies collaborate to allocate resources, develop infrastructure, and monitor the progress of the program at both domestic and local levels.

The linkage between the Digital Transformation Program and the Vietnamese Domestic Qualifications Framework (DQF) is pivotal. The DQF serves as a benchmark for the skills and competencies required for various qualifications and ensures that educational programs are aligned with the needs of the labor market. By incorporating digital competencies into the DQF, Viet Nam aims to standardize the skills and knowledge necessary for the digital economy, making it easier for vocational institutions to design relevant curricula and for employers to assess the qualifications of graduates.

One of the innovative components of the program is the implementation of digital management systems across vocational institutions. This includes the digitization of learning processes, outcomes, and diplomas, as well as the integration of these data into a unified domestic system. The development of a digital map of vocational institutions is part of this effort, which aims to improve the management and planning capabilities of the vocational education system.

The program also focuses on enhancing the digital infrastructure of vocational institutions. This involves upgrading the existing vocational education data center, creating a large-scale database for vocational education, and building digital platforms for teaching and learning. These platforms are intended to support the digital management of vocational education and ensure that all data is synchronized with domestic systems related to employment and social security.

In addition to improving digital infrastructure, the program seeks to develop digital skills among both students and educators. The curriculum is being adapted to include basic and advanced digital skills, with a focus on high-demand areas such as information technology, artificial intelligence, and digital technologies. The aim is to ensure that graduates possess the necessary skills to succeed in the digital economy and meet the demands of Industry 4.0.

To support this goal, the program provides targeted training for educators and administrators, focusing on new digital knowledge, adaptive learning technologies, and the use of digital materials and virtual classrooms. This training is intended to foster a culture of continuous professional development and innovation within the vocational education sector.

The program also emphasizes the importance of public-private partnerships to support the digital transformation of vocational education. These partnerships are crucial for developing the necessary digital infrastructure and fostering innovation. By involving private enterprises and international organizations, the program aims to create a more dynamic and responsive vocational education system that can quickly adapt to changing technological and labor market conditions.

Security is another key component of the program. The initiative includes measures to ensure digital platforms' and data's safety and security. This involves periodic assessments of safety and security levels to protect the integrity and confidentiality of educational data. This is particularly important given the increased reliance on digital platforms and the potential risks associated with cyber threats.

Overall, the Digital Transformation Program in Vocational Education is a comprehensive initiative that aims to modernize Viet Nam's vocational education system by integrating digital technologies into all aspects of vocational training. This initiative is closely linked to the Vietnamese Domestic Qualifications Framework (DQF), which serves as a benchmark for the skills and competencies required for various qualifications and ensures that educational programs are aligned with the needs of the labor market. By incorporating digital competencies into the DQF, Viet Nam aims to standardize the skills and knowledge necessary for the digital economy, making it easier for vocational institutions to design relevant curricula and for employers to assess the qualifications of graduates.

The program's comprehensive approach to digitizing vocational education is designed to foster a digitally competent workforce capable of leveraging advanced technologies. It supports Viet Nam's broader strategy to become a leading digital economy in the region, with a particular focus on improving productivity, competitiveness, and innovation in the vocational education sector. This initiative represents a significant step forward in Viet Nam's efforts to modernize its education system and prepare its workforce for the challenges and opportunities of the digital age.

Final Reflections

The rapid advancement of technology and its pervasive influence across various sectors have profoundly transformed the global economic landscape. In this context, economies are increasingly acknowledging the imperative to equip their workforces with the relevant skills and competencies to navigate these changes effectively. The advent of Industry 4.0, characterized by the integration of artificial intelligence (AI), automation, the Internet of Things (IoT), and blockchain, has accelerated the demand for a highly skilled and adaptable workforce.

Domestic Qualifications Frameworks (DQFs) emerge in this context as a widely adopted tool, particularly across Asia-Pacific Economic Cooperation (APEC) economies, to address the identified challenges and to foster the development of high-quality human capital for economic growth and societal well-being. However, there is no universal solution, and each economy navigates this journey within its own unique context, history, and capabilities. This reality means that each one faces the challenge with different strategies of varying scope: from comprehensive domestic strategies to small-scale, high-impact programs. This underscores a recurring theme echoed by all stakeholders: the DQF cannot be copied and pasted as a one-size-fits-all solution. Each economy must conduct its own diagnosis and analysis of the needs it intends to

address with a DQF, because while it is a powerful tool, it is merely a tool whose design and implementation demand significant resources and effort. Therefore, the first lesson learned is that the framework alone does not solve everything.

Nevertheless, some elements appear as common denominators across all experiences: the need to reduce skills mismatches, to establish mechanisms that validate and signal competencies beyond academic credentials, and to recognize skills acquired beyond formal schooling and training periods as part of lifelong learning. All the experiences analyzed, regardless of their scale, seek to address some of these aspects of the challenge.

The Qualifications Framework acts as a coordinating mechanism, a common language for all stakeholders in the educational and labor market systems. However, it is nothing more than that: a facilitator between actors. Focusing on these actors, on how they interact, and on the rules and institutional arrangements that enable this interaction is a necessary perspective to understand the qualifications system. This is the second lesson: the qualifications system itself is as important as, or even more important than, the framework in addressing the challenges posed by AI. Quality assurance mechanisms with rigorous standards for the approval of qualifications, educational institutions, and public registers of these qualifications are key.

This has been the path taken by Australia, which has emphasized the need for flexibility in programs and the stability of the DQF as key to its ability to serve as a reference for the labor market and educational institutions. Australia's focus lies more on the system than on the framework itself to address the challenges posed by AI, particularly in the Quality Assurance of Qualifications: This involves the use of qualification quality standards, policies, and guidelines to ensure that each qualification meets established benchmarks for relevance, accuracy, and alignment with the framework's objectives, as well as maintaining registers and databases of approved qualifications. Quality Assurance of Providers and Their Programs ensures that institutions and their educational programs adhere to quality standards, policies, and guidelines, supported by registers and databases of approved providers. One of the key insights from the Australian experience in addressing the challenges posed by new technologies is the emphasis on prioritizing educational programs and their strategies as primary spaces for adaptation, as exemplified by TEQSA through the Higher Education Good Practice Hub, accessible via a dedicated webpage. Hence, the second counterintuitive takeaway is that the solution may lie not in the framework itself but in the system. Moreover, excessive flexibility in the DQF could be counterproductive and interpreted by stakeholders as lacking the stability necessary to be considered a reliable reference. As in many other areas, there are no magical solutions, only trade-offs, and Australia's experience highlights a central one for this compendium: Stability-Flexibility.

In this sense, Viet Nam provides further evidence that the framework alone is not sufficient but can also be used as part of a more ambitious domestic economic

development strategy. The VNQF is aligned with Viet Nam's broader socio-economic strategies, particularly the Educational Development Strategy 2011-2020 and the Human Resources Development Strategy 2011-2020. These strategies emphasize the need for a high-quality, integrated education system that meets the needs of an evolving labor market. The VNQF plays a critical role in these strategies by providing a framework that supports lifelong learning and continuous skill development, which are essential for economic growth and social stability. A crucial aspect of the program is the development of digital skills among students, educators, and administrators. The curriculum is being adapted to include both basic and advanced digital skills, with a particular focus on high-demand areas such as information technology, artificial intelligence, and digital technologies. This is designed to ensure that graduates possess the necessary competencies to thrive in a digital economy and meet the skill requirements of Industry 4.0.

Another recommendation from the reviewed experiences is to focus on the education system, specifically on teachers and school management. AI undoubtedly presents a challenge for domestic qualifications frameworks, but paradoxically, it can also be a powerful tool for modernizing the education system: AI can be used to address the challenges posed by AI. This is the case in Chile, where web scraping, data mining, and natural language processing are used to analyze job search portals to anticipate the emergence of new skill demands as part of a domestic foresight and technological surveillance strategy. Similarly, in Peru, automated robots enable more realistic assessment scenarios in professions where it is virtually impossible, such as medicine. Additionally, in Peru, the use of virtual platforms has significantly improved the reach and efficiency of the Peruvian Medical Association's assessment system in a short period. Thailand introduced the e-Workforce Ecosystem (EWE) platform as part of the National Reform Plan on Culture, Sports, Tourism, Labor, and Workforce Development in 2020. The platform aims to promote lifelong learning and provide opportunities for all citizens. It includes features such as job matching, a digital competency credit bank, and systems for e-portfolios, allowing individuals to document and build on their learning and professional experiences from a young age throughout their careers. Beyond these documented experiences, all economies have invested in enhancing certain aspects of their qualifications systems using technology. Thus, another insight for this compendium should be that technology can be a powerful ally in keeping up with technological advancements. Rather than merely defending against it, qualifications systems and educational institutions should understand and leverage technology.

Flexibility seems to be a key term across all experiences, and much of the focus is placed on the educational offerings and training centers, which are ultimately responsible for developing the qualifications enshrined in the framework. The rapid pace of technological change also presents a challenge, and what may initially appear to be a problem could, in fact, become an ally. Many of the experiences highlight the challenge of bridging education and work and generating effective collaborations in

terms of competency development. In this context, Malaysia's 2u2i program is a strategic initiative under the Malaysian Education Development Plan 2015-2025 aimed at producing well-rounded, industry-ready graduates. It integrates academic study with practical industry experience, allowing students to spend two years at a university (the "2u") and another two years gaining hands-on experience in the industry (the "2i"). This approach seeks to bridge the gap between higher education institutions (HEIs) and industry requirements, ensuring that graduates possess the skills and competencies needed in the workforce. While there are many options for doing so, bringing the world of work closer to education seems central to coping with the pace of AI. If learning is to last a lifetime, most of that life will be spent at work rather than in the classroom. Therefore, domestic qualifications systems must develop mechanisms to include this: dual or alternating training, as well as the recognition of prior learning, are two prominent tools that emerge from the analyzed experiences.

Singapore offers a cutting-edge perspective on frameworks, as it does not officially have a qualifications framework but rather a skills map that, while fulfilling some of the framework's functions, is not exactly the same. Nevertheless, given its robust quality assurance system, it maintains a powerful qualifications system that has inspired others, such as The Philippines, to follow the path of skills maps. Essentially, skills maps can be more flexible than frameworks and, when accompanied by systems for recognizing prior learning, can be an optimal strategy for adapting to new technologies.

To expand the capacity to address the challenges posed by new technologies, Singapore is implementing a comprehensive program that highlights the importance of designing specific programs aimed at training in specific skills from multiple angles, including intensive training and job placement opportunities for workers aged 40 and above, industry-driven training programs where companies lead the upskilling of their employees in key technological competencies, and subsidies for courses and certifications in areas such as cybersecurity, artificial intelligence, data analytics, and other key digital competencies. Moreover, the development of digital leaders within organizations by equipping them with advanced skills in technology management and digital transformation through the TeSA Digital Leaders Programme, detailed assessments through the Infocomm Professional Conversion Programme designed to help professionals transition into new careers in the tech sector, and the TeSA Tech Immersion and Placement Programme, which offers technical immersion and placement programs that allow participants to acquire practical skills in specific technologies such as application development and data analytics.

Finally, certain instruments and concepts are transversal to all the economies analyzed. A gender perspective is an indispensable pillar for the effective inclusion of all inhabitants of the economies, not only to prevent AI from perpetuating and amplifying biases but also to ensure that the frameworks are genuinely inclusive. In this regard, including specialists in the design and implementation teams appears to be a readily achievable recommendation for all economies. Regarding inclusion, many

of the analyzed economies operate in multicultural contexts, which must also be considered as part of the knowledge to be recognized by the frameworks, as well as the contexts and methods of transmission that each culture may have.

Recognition of prior learning as a tool to make the framework more flexible and to include many people who have acquired valuable knowledge outside of formal schooling is another tool highlighted by all economies. In the same vein of flexibility, micro-credentials and more modular training structures, like those in Singapore and the projected framework in The Philippines, are also directions that can enhance lifelong learning. Another strategy identified in several economies and in the workshop in Lima is to incorporate at least one programming language and computational thinking principles early in educational pathways as a foundation for the minimum skills needed to advance in future AI-related trajectories.

In summary, the Domestic Qualifications Framework is a widely used tool with significant potential to strengthen the link between education and work and to promote lifelong learning. However, it is clear that, on its own, it cannot engage all involved actors, and a major mistake would be to expect it to solve problems it cannot address. In this regard, focusing on the qualifications system to enhance its quality, reliability, and flexibility to recognize learning and provide high-quality training that is relevant to the needs not only of AI but also of people, are key elements that must accompany the framework, which requires considerable effort for its implementation but is, by itself, insufficient.

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