International scan of approaches taken by select economies to build the digital skills of the existing workforce in response to the digital transformation of industry

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for
Australian Industry Standards

April 2020
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Authors’ Note

The Australian labour market—how we work and how our systems are responding—are changing rapidly as the COVID-19 situation continues to develop.

Some data included in this scan cover reference periods before the introduction of significant emergency control measures for COVID-19 and should therefore be used and interpreted with caution.
Acknowledgements

The research team would like to acknowledge and sincerely thank the people who have assisted us in collecting the material for this project and putting it all together into the final product. Ms Allegra Schermuly, an Early Career Researcher at Monash University, helped with the collection of the initial information that we built upon in later stages. Mr Salvatore Ferraro, a PhD student at RMIT University, who put in an extraordinary amount of effort, dedication and commitment, often working late at night and weekends, to help us put it all together within the tight timelines. Finally, we appreciate the important input from the team at the Australian Industry Standards, particularly Mr Morteza Hajizadeh, who provided reviews of the report as well as developing the entirety of chapter eight.
Executive Summary and Key Policy Considerations

Digital transformation and rapid technological change are impacting on every country in a range of ways. The implications of these technological changes for workers, skills and workforce development are of growing concern for policy makers, organisations, workers, and worker representatives throughout the world.

The objective of this report is to identify lessons from an analysis of international practices with a special focus on digital skills. The analysis followed a case study methodology, whereby digital skills development strategies and initiatives across five countries and the European Union (EU) were examined. These case studies are Singapore, Sweden, Germany, the United Kingdom (UK), Canada and the EU. The five countries were chosen because they are commonly highlighted in the academic and policy literatures as countries that have made great advances in digital transformation and have adopted successful training programs to prepare their citizens and workers for the emerging digital future. The EU is included because of its policies for transforming Europe into a successful digital society, including provision of significant financial support for training in digital skills across its member states.

This report, therefore, presents a scan of how Singapore, Sweden, the UK, Germany, Canada and the EU are responding to emerging digital skills needs in the following key areas:

- the policy settings in place as well as the roles of various actors that enable the country’s workforce to upskill or reskill in response to digital transformation of the workplace;
- lifelong learning strategies interfacing the vocational sector with the schools, higher education and training sectors;
- how the upskilling and reskilling of existing workers is funded in critical digital skills development areas;
- processes used to identify digital skills and knowledge requirements; and
- notable public, private and community digital skills development initiatives and interventions.

The review identified key policies and strategies; the funding available for skills update and development; the regulation of training and assessment standards; and the credentialing and recognition of digital skills and competencies that might inform Australia’s approach towards workforce digital transformation. Key considerations arising from the scan are that:

- Policy settings to enable digital transformation of a country’s workforce are faced with fragmentation and administrative overlap as a result of multiple public and private agencies participating in different initiatives. Australia could consider the merits of a central agency to re-organise and consolidate the
efforts by various state, territory and federal agencies and units that are involved in formulating and implementing workforce upskilling for the digital future. Important lessons could be learnt from, for example, Singapore, which has established SkillsFuture Singapore as a national one-stop agency responsible for coordinating all matters relating to skills development. Further, the Skills Framework developed by SkillsFuture Singapore provides a central instrument for ensuring uniform standards for training, assessment and credentialing of skills and competency for the whole country. The Industry Transformation Maps developed by the Ministry of Trade and Industry to drive the future economy include ‘jobs and skills’ pillars to connect policy across government.

- **A formal digital or industry transformation strategy** should be considered to set out Australia’s approach to ensuring that citizens and the workforce have the skills they need to participate fully in the digital economy. The need for a central point for coordinating policy on digital transformation has been recognised in countries such as Germany, where the responsibility is delegated to the Federal Ministries for Economic Affairs and Energy; Interior; and Transport and Digital Infrastructure. Likewise, in Sweden, two ministries—Education and Research, and Enterprise, Energy and Communication—take the lead in coordinating national digital transformation policy, including workforce digital transformation. Such central policy coordination ensures greater coherence in strategy and tends to be more efficient. Admittedly, the Australian administration is much more fragmented than many, with significant autonomy granted to the states and territories. Nevertheless, Germany might provide a good comparison case.

- **Building strong public–private–community partnership at all levels** of government (federal, regional and local) is important to ensure (i) the relevance of the skills produced (for life as well as work) across the country; (ii) adequate resourcing of skills transformation efforts; and (iii) coordinated strategies, initiatives and programs to maintain uniform standards. Lessons could be learnt, for example, from Sweden where the Digital Skills and Jobs Coalition has been created and is managed by the government, but brings together various key stakeholders including public agencies, the government’s Digitalisation Council, industry representative bodies, the Swedish National Agency for Education (Swedsoft), the Association of Swedish Engineering Industries, and the Swedish IT and Telecom Industries. The purpose is to collectively ensure that the country’s digital skills transformation is successful, not just for the workforce but for society in general. Similar coordinated collective efforts are evident in relation to Singapore’s SkillsFuture, the UK’s Digital Skills Partnership, and Germany’s Work 4.0 strategy to which both government and private companies contribute.

- **Continuous learning will have to take place among all individuals as new technologies are introduced into the workplace and jobs themselves evolve in**
response. To help get this message across and build a continuous learning culture, the language could change form ‘workforce skills’ to ‘skills for life and work’. This will be strong acknowledgement that to have an adequately and appropriately skilled workforce, there must be a national pool with a strong basic and essential skills base. Increasingly, this includes digital literacy. To date, Australia has mostly talked about workforce digital skills in the context of the skills needed for specific types of work. In contrast, Germany and Sweden, following the ‘digital society’ concept promoted by the European Commission, first consider digital skills for all, and then workforce digital skills. In Sweden, for example, the target is to equip every person of working age to have good digital skills to be employable or be able to start up and run a business. In Germany, the policy aim is for digital skills to be imparted throughout one’s life and education.

- In a related fashion, although the concept of lifelong learning has informed Australia’s vocational education and training system for some time, it has not been articulated as a policy priority in the same way as it has been in countries like Singapore, Germany and Sweden. In these countries, education and training programs are underpinned by the concept of equity and inclusivity. In Germany, for example as highlighted above, it is intended—and expressly constructed into policy—that education and training should be accessible throughout one’s work and life. Equally, in Singapore, lifelong learning is the central guiding approach in Singapore’s SkillsFuture strategies for skilling the country. Such clear and express articulation means that training for adult and senior citizens is adequately funded.

- Across the case countries, it is widely accepted that a digital skills gap exists. There is also consensus that these skills range from basic through intermediate to advanced. Nevertheless, there is little agreement on what are the actual skills and competencies that contribute to the gap and therefore little agreement on how to address the skills gap and credential them. In particular, digital skills required for upskilling and reskilling in many occupations remain poorly understood and the available frameworks remain too heterogeneous.

- Australia could consider developing a coherent national digital skills and recognition framework that is reflective of its socio-economic and technological context by learning from the experiences of the UK’s National Standard for Digital Skills, the EU’s Digital Competence Framework for Citizens and the global standard, Skills Framework for the Information Age. A benefit of this approach is that it will promote a national standard for delivering and recognising digital skills that is comparable across the training organisations that are expected to deliver it. In adopting such a framework, however, there should be a clear view of how such skills are to be recognised - either as core foundational skills embedded in the education and training system at all levels, and therefore automatically considered in the mainstream assessment and certification; or as a separate stream of credentials and qualifications. It
appears that in Germany, Sweden and Singapore the former approach is in place, based on the view that everyone should have adequate digital skills. This means that education and training at all stages and levels is set up to impart all necessary skills for life and work for all.

- The final chapter of this report explores the various intervention initiatives adopted by multilateral fora, including the EU, the Organisation for Economic Co-operation and Development, the G20 (group of 19 individual advanced countries plus the European Union), the Asia–Pacific Economic Cooperation and the United Nations to help member states prepare for and optimise the opportunities associated with digital transformation. The major areas of emphasis across the different fora include enhancement of digital infrastructure capacity access; equity and inclusion; cyber security; workforce skills preparedness through appropriate education and training, and lifelong learning strategies; digital innovation; and strengthening of national policies and legislation around digital transformation.
# List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ACEG</td>
<td>Advisory Council on Economic Growth (Canada)</td>
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<td>ADaPT</td>
<td>Advanced Digital and Professional Training (Canada)</td>
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<td>AHVE</td>
<td>Agency for Higher Vocational Education (Sweden)</td>
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<td>AI</td>
<td>Artificial Intelligence</td>
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<td>AIDER</td>
<td>APEC Internet and Digital Economy Roadmap</td>
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<td>APEC</td>
<td>Asia-Pacific Economic Cooperation</td>
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<tr>
<td>BA</td>
<td>Federal Employment Agency (Germany)</td>
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<td>BMAS</td>
<td>Federal Ministry of Labour and Social Affairs (Germany)</td>
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<tr>
<td>BMBF</td>
<td>Federal Ministry of Education and Research (Germany)</td>
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<td>BMI</td>
<td>Federal Ministry of the Interior (Germany)</td>
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<td>BMJV</td>
<td>Federal Ministry of Justice and Consumer Protection (Germany)</td>
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<tr>
<td>BMVI</td>
<td>Federal Ministry of Transport and Digital Infrastructure (Germany)</td>
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<td>BMWi</td>
<td>Federal Ministry of Economic Affairs and Energy (Germany)</td>
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<td>CTB</td>
<td>Canada Training Benefit</td>
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<td>CTC</td>
<td>Company Training Committee (Singapore)</td>
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<td>DESI</td>
<td>Digital Economy and Society Index</td>
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<td>DigComp</td>
<td>Digital Competence Framework for Citizens (Europe)</td>
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<td>DigEuLit</td>
<td>Framework for Digital Literacy (Europe)</td>
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<td>DRWP</td>
<td>Building a Digital Ready Workforce Program (UK)</td>
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<td>DSJC</td>
<td>Digital Skills and Job Coalition (Europe)</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<td>EI</td>
<td>Employment Insurance (Canada)</td>
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<td>EQF</td>
<td>European Qualifications Framework</td>
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<td>ESDC</td>
<td>Employment and Social Development Canada</td>
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<td>ESDQ</td>
<td>Essential Digital Skills Qualification (UK)</td>
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<td>ESFA</td>
<td>Education and Skills Funding Agency (UK)</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FEC</td>
<td>Future Economy Council (Singapore)</td>
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<td>FLMM</td>
<td>Forum of Labour Market Ministers (Canada)</td>
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<tr>
<td>FSQ</td>
<td>Functional Skills Qualification (UK)</td>
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<tr>
<td>G20</td>
<td>Group of 19 individual advanced countries plus the European Union</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GOS</td>
<td>Government Office for Science (UK)</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>ICTC</td>
<td>Information and Communications Technology Council (Canada)</td>
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<td>IMDA</td>
<td>Infocomm Media Development Authority (Singapore)</td>
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<tr>
<td>IoT</td>
<td>Internet of Things</td>
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<td>IRDLL</td>
<td>Index of Readiness for Digital Lifelong Learning</td>
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<td>ITU</td>
<td>International Telecommunications Union</td>
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<tr>
<td>ISP</td>
<td>Innovation and Skills Plan (Canada)</td>
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<tr>
<td>ITM</td>
<td>Industry Transformation Map (Singapore)</td>
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<tr>
<td>LLP</td>
<td>Lifelong Learning Plan (Canada)</td>
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<td>LMDA</td>
<td>Labour Market Development Agreement (Canada)</td>
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<tr>
<td>LMIC</td>
<td>Labour Market Information Council (Canada)</td>
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<tr>
<td>MSME</td>
<td>Micro, small and medium-sized enterprise</td>
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<td>NESTA</td>
<td>National Endowment for Science, Technology and the Arts (UK)</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service (UK)</td>
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<tr>
<td>NTUC</td>
<td>National Trade Unions Congress (Singapore)</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>OLES</td>
<td>Office of Literacy and Essential Skills (Canada)</td>
</tr>
<tr>
<td>PCP</td>
<td>Professional Conversion Programme (Singapore)</td>
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<tr>
<td>PPWE</td>
<td>Policy Partnership on Women and the Economy</td>
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<tr>
<td>SCT</td>
<td>Skills and Competencies Taxonomy (Canada)</td>
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<tr>
<td>SFA</td>
<td>Skills Funding Agency (UK)</td>
</tr>
<tr>
<td>SFA</td>
<td>Skills Framework for the Information Age</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium-sized Enterprise</td>
</tr>
<tr>
<td>STEM</td>
<td>Science, technology, engineering and mathematics</td>
</tr>
<tr>
<td>TeSA</td>
<td>TechSkills Accelerator (Singapore)</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>VET</td>
<td>Vocational Education and Training</td>
</tr>
<tr>
<td>WiD</td>
<td>Women in Digital Strategy (EU)</td>
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<tr>
<td>WIL</td>
<td>Work-Integrated Learning</td>
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Glossary

**Artificial Intelligence (AI)** The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, routine decision making and translation between languages.

**Big Data** A data analytics technology that facilitates the fast and efficient processing of vast amounts of information. Big data has been used to identify common skills and competencies in demand by applying text search algorithms to millions of online job ads.

**Digital Readiness** The ability of workers to reskill and upskill to adapt their skill sets to evolving employer demand for digital skills.

**Dual VET System** Common to Germany, the dual Vocational and Education Training (VET) system emphasises both theoretical knowledge as taught by vocational schools and practical work skills as taught by educational companies. See also in this Glossary, the social partnership model.

**Endowment Fund** An investment fund established by a foundation that makes consistent withdrawals from invested capital, which would include any income earned and in some cases a drawdown on the capital base.

**Folk High Schools** Operates in Sweden and offers independent and free-of-charge courses that are based on individual needs to enable people to catch up to an upper secondary level of knowledge and qualify for higher education.

**Industry Transformation Map (ITM)** Developed in Singapore, ITMs identify the digital (and other) skills and knowledge requirements across 23 industry sectors grouped into six broad clusters: manufacturing; built environment; trade and connectivity; essential domestic services; modern services; and lifestyle.

**Internet of Things (IoT)** Refers to an ecosystem of connected devices that can communicate with other connected devices, such as in the ‘smart home’.

**Lifelong Learning** An approach to education and training that extends beyond a person’s formal education and encourages workers to reskill and upskill over the course of their careers through formal and informal education and training opportunities.

**Digital Literacy** Includes foundational skills such as the ability to source, interpret and use information online, and set up and maintain passwords in a secure online environment. Emerging as a right
to which citizens across some of the countries in this international scan are entitled, alongside language literacy and numeracy. The United Kingdom, for instance has legislated the right to digital literacy, which includes access to accredited courses at no cost.

**Digital Skills Framework**

Offers a way to categorise the types of digital skills that are relevant for the workforce. Different countries have developed different frameworks that highlight various aspects of digital skills. The *Skills Framework for the Information Age* (SFIA) uses three categories of digital skills relevant to the world of work: digital literacy or foundational digital skills; generic Information and communications technology (ICT) skills (including, e.g., competency around office productivity software) that are applied in a vast range of occupations; and advanced digital skills that are necessary among ICT specialists.

**Digital Skills Shortage**

A situation where employer demand for digital skills exceeds the supply of those skills. Assertions of such shortages are typically based on projected strong growth of demand for ICT specialists or employer surveys where respondents communicate difficulty in hiring workers with relevant digital skills.

**Digital Transformation**

A process in which digital technologies create disruptions triggering strategic and policy responses from organisations and governments to alter their value creation paths while managing the structural changes and barriers that affect the positive and negative outcomes of this process.

**Hackathon**

Facilitates collaboration and problem solving within participant teams responding to a common challenge in a time-constrained format.

**Industry 4.0**

A common term to refer to the fourth industrial revolution associated with the uses of transformative technologies (e.g. advanced automation and robotics; collaborative robots or ‘cobots’; machine-to-machine and human-to-machine communication; AI and machine learning; sensor technology; and data analytics) to connect the physical world with the digital world.

**ICT Professionals**

Individuals who typically have graduated with a bachelor degree or higher in the information systems and/or computer science fields, and are working in an ICT industry sector or applying their skills and knowledge in other sectors including banking and finance.
**Mittelstand**
Encompasses small–medium enterprises in Germany.

**Reskilling**
The process of a worker acquiring new skills and developing new competencies for a different occupation, typically done through formal education and training.

**Skill-biased Technological Change (SBIT)**
Technological change that favours workers with more skills, education and relevant experience.

**SFIA Foundation**
A not-for-profit global organisation that for the past two decades has overseen the production and use of the SFIA, designed to reflect the evolving digital requirements of its global users. The latest version, published in June 2018, lists skills that are relevant to ICT, digital transformation and software engineering. It is based on a process of collaboration and consultation with up to 30 partners from significant organisations worldwide, including major users of SFIA; higher education institutions; SFIA partners who offer training and consultancy around digital skills; and professional or industry bodies (https://www.sfia-online.org/en).

**Skills Taxonomy**
A detailed framework that matches the skills and competencies that are necessary across occupations.

**Social Partnership**
A model used in countries such as Germany and Sweden where there is close collaboration around the development and delivery of VET among employers and worker representatives such as trade unions. Worker-integrated learning (refer to this Glossary) represents an important dimension of social partnership models.

**Soft Skills**
A broad set of skills in the workplace that extend beyond technical knowledge and considered complementary to digital skills, including communication; ability to negotiate with and persuade people; and commercial acumen.

**Transversal Skills**
A subset of soft skills that includes the abilities to think critically, problem solve and work with others.

**Upskilling**
The process of a worker building on their base of skills and competencies for more advanced roles in the same or related fields to their current occupation. This can be done by either formal education and training, or informal avenues such as learning on the job.

**WIL**
An educational or training qualification that incorporates work placements with employers.
1 Background

Rapid innovation in Information and Communications Technologies (ICTs) and Industry 4.0 trends poses tremendous opportunities and challenges to countries around the world. A key challenge is how to ensure that workers remain equipped when jobs—particularly those that involve cognitive and non-cognitive routine tasks—are increasingly vulnerable to automation risk. The prospect of widespread application of robotics and automation, artificial intelligence (AI), big data, distributed ledger technologies such as blockchain, and the Internet of Things (IoT) is expected to exacerbate workers’ vulnerability to the risk of automation.

As digital transformation intensifies throughout industry sectors and enterprises, the type of skills required to succeed in the future workplace is expected to change. Notably, the trend towards strong growth in high-skilled occupations (where digital skills are most required) is expected to continue while middle- and low-skill jobs are likely to remain susceptible to automation. In recognition of this issue, many countries around the world are seeking to redesign their schooling, education and training systems in ways that embed lifelong learning to facilitate upskilling and reskilling of the workforce.

It is for this purpose that the Australian Industry and Skills Committee has established the Digital Transformation Expert Panel to ‘provide advice on how Australia’s Vocational Education and Training (VET) system can most effectively respond to digital change underway across industry and its impact on the nation’s workforce’.

As part of the panel’s methodology, the Skills, Training and Industry Research Network at RMIT University has undertaken an international scan of approaches employed by select economies to build the digital skills of their existing workforces in response to the digital transformation of industry.

In developing this international scan, it is essential to first establish what is meant by digital skills. There is little agreement on the language to describe the occupational digital skills needed in the workforce and labour market. Available frameworks are too heterogeneous; and leave out or mix up many digital skills, competencies, tools and jobs. Gekara et al. (2019) undertook an extensive review of how digital skills are defined internationally. They drew particularly on

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the analysis developed by ECORYS and the Organisation for Economic Co-operation and Development (OECD), to identify three broad categories of digital skills:

- **Category 1**: Foundational digital literacy skills that are pitched at a basic level and should be easily accessible to all citizens at no cost. These would include a basic understanding of productivity software such as work processing and spreadsheeting skills, as well as using the internet and being familiar with social media. Category 1 digital skills should be considered foundational because they are necessary to build Category 2 and Category 3 skills.

- **Category 2**: These digital skills (also known as intermediate) are more advanced than Category 1 but not specific or unique to ICT industries. They would be relevant in the application of, and adaptation to, new and emerging ICT innovations. These would include an understanding around the application of software such as SAP (for human resources and payroll, among other functions), Photoshop and Illustrator (for fashion design) or Stata and EViews (for statistical applications), for instance.

- **Category 3**: These digital skills are specialist and necessary for ICT professionals. The Skills Framework for the Information Age (SFIA) has developed a taxonomy of six broad digital skills categories: strategy and architecture; change and transformation; development and implementation; delivery and operation; skills and quality; and relationships and engagement.

As this international scan focuses on the workforce in general, the scope of the definition of digital skills cuts across all sections of the typology above, but with more emphasis on Categories 1 and 2. In this report, we adopt Gekara et al.’s (2019) working definition of digital skills as a combination of:

- digital knowledge (theoretical comprehension and understanding);
- cognitive knowhow (involving the use of logical, intuitive, innovative and creative thinking in the digital space);
- practical knowhow (including the use of digital tools such as hardware, software, information and security systems);
- competence (ability to learn, adapt and apply digital knowledge in a new setting; and
- ‘digital’ attitude (value and beliefs), which workers need to master and demonstrate in the digital age.

### 1.1 Scope and Method

The report presents a scan of how Singapore, Sweden, the United Kingdom (UK), Germany, Canada and the European Union (EU) are responding to the skills implication of industry digital transformation guided by the following five broad questions:

1. What are the key policies and initiatives in place to enable digital transformation of the country’s workforce? What are the key roles of the various actors in the digital transformation skills challenge?
2. How does the country approach lifelong learning and interface the vocational sector with the schools, higher education and training sectors in the digital space?
3. How is the upskilling and reskilling of existing workers funded in critical digital skills development areas?
4. What processes are used to identify digital skills and knowledge requirements, and gaps?
5. How is the upskilling of existing workers funded in critical areas such as digital transformation?

The analysis followed a case study methodology. The five countries and the EU were chosen because as Table 1 and other academic and policy literature indicate, these jurisdictions provide comparative insights in digital transformation and adoption of training programs to prepare citizens and workers for the emerging digital future.

Table 1: Rankings of Cases alongside Australia on Digital Competitiveness, Readiness, Lifelong Learning, Economy and Society

<table>
<thead>
<tr>
<th>Country</th>
<th>IMD World Digital Competitiveness Ranking 2019³</th>
<th>Network Readiness Index 2019⁴</th>
<th>Digital Lifelong Learning in Europe (EU-27) Rank 2019⁵</th>
<th>International Digital Economy and Society Index 2018 (Score Out of 100)⁶</th>
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<tbody>
<tr>
<td>Canada</td>
<td>11</td>
<td>14</td>
<td>-</td>
<td>67</td>
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<tr>
<td>Germany</td>
<td>17</td>
<td>9</td>
<td>27</td>
<td>64</td>
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<tr>
<td>Singapore</td>
<td>2</td>
<td>2</td>
<td>-</td>
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In undertaking the analysis, the authors were aware that the broader education and training systems found within the countries/region, as well as local social, political and economic contexts influence the approach to digital skills transformation. The scope of the report, however, does not include background overviews of the education and training system of each country. Instead, it

concentrates on the digital skills initiatives being pursued, the drivers for these initiatives and the contextual factors that facilitate or constrain their success.

Relevant materials for the analysis were identified through a digital desk research process using several combinations of keywords, as follows:

- [Country/Region name] + digital transformation policy
- [Country/Region name] + digital transformation + Workforce upskilling and reskilling
- [Country/Region name] + lifelong learning
- [Country/Region name] + funding workforce digital skills development
- [Country/Region name] + digital skills need analysis
- [Country/Region name] + digital skills development
- [Country/Region name] + interfacing between schools, Higher Education and VET.

1.2 Report Structure

The rest of the report is structured into six chapters. Each case study represents a chapter starting with the Singapore case, followed by Sweden, Germany, UK and Canada and then the EU.

Within each chapter, the first section begins with an overview centred on the key lessons to emerge from the case that are of most relevance to Australia. The second sections of each chapter consider the country/region’s key policies and strategies for digital skills development. The third sections of chapters assess lifelong learning. This is followed by how education and training for digital skills are funded in the fourth sections and how digital skills are assessed and recognised in the fifth. After featuring some of the notable initiatives in the sixth sections, the chapters conclude with observations emerging out of the cases.
2 SINGAPORE

2.1 Overview

Singapore is one of the countries considered highly advanced in its planning for, and implementation of, skills for the future of work. A skilled workforce has always formed a key pillar in the country’s economic development, with significant resources being allocated towards continuous updating of workforce skills. Thus, digital skills training currently forms a core component of education for all, beginning from the earliest schooling age.

Being a planned economy, Singapore adopts a centralised approach to digital upskilling, with the government as the key coordinator. This approach helps address the common problem of policy fragmentation. The private sector, including employers and workers’ unions, is expected to actively contribute to continuous workforce skills development and upgrading, including allocation of funding for general workforce training, in addition to in-house training programs. As observed by Rushbrook (2019), a key factor in Singapore’s success in its workforce skills development is the embeddedness of workplace-based learning in which employer participation is an essential ingredient.

The national coordination of skills development is delegated to SkillsFuture Singapore, which oversees the development and implementation of various

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policies and strategies, and monitors standards of training and assessment. SkillsFuture Singapore works closely with a range of government ministries and departments, and with employers and workers’ unions, to ensure that the policies and strategies adopted and the programs developed for skills development are coherent, consistent and inclusive.

2.2 Key Policies and Strategies

Workforce skills development in Singapore is coordinated and implemented by SkillsFuture Singapore, a statutory board under the Ministry of Education specifically established to ‘promote a culture and holistic system of lifelong learning through the pursuit of skills mastery and strengthen the ecosystem of quality education and training in Singapore’.

Its role is to chart Singapore’s workforce skills future and coordinate the efforts of key stakeholders, including government, industry, training providers and unions in ensuring resourcing and standards. Singapore’s key current national policy to enable digital transformation of its workforce and economy is the Smart Nation policy (Smart Nation and Digital Government Office, 2018). This overarching policy is framed as a nation building exercise, pursuing the dual goals of improving quality of life for Singaporean citizens and promoting the nation’s economic development. To this end, Smart Nation has three pillars: a digital economy, digital government and digital society.

The Future Economy Council (FEC)—chaired by the deputy prime minister and comprised of members from government, industry, unions, and educational and training institutions—has leveraged national partnerships between government, firms, trade associations and chambers, and unions to address key issues across industries, and identify digital skills and knowledge requirements. To that end, the FEC has developed Industry Transformation Maps (ITMs) for 23 industries in six clusters: manufacturing; built environment; trade and connectivity; essential domestic services; modern services; and lifestyle.

11 https://www.skillsfuture.sg/
13 https://www.ssg-wsg.gov.sg/about.html?_ga=2.70903257.878226385.1584520332-1139064648.1584520332
14 https://www.mti.gov.sg/Transforming-Industries/For-Individual
‘Jobs and skills’ is one of four pillars within the ITMs developed to ensure interconnected policy across government and clearly aligned training effort. Sector-specific Industry Digital Plans, developed by the Infocomm Media Development Authority (IMDA)—a statutory body that regulates the ‘infocomm’ and media sectors—and sector-led agencies support the digital transformation journey of small and medium-sized enterprises (SMEs). The role of Industry Digital Plans is to support the ITMs to bring about digital transformation in each industry according to whatever technological change is relevant to that sector.\(^{15}\)

Digital skills of the workforce and society in general is a core pillar of the Smart Nation policy and ITMs. To address this, the Government of Singapore has taken a centralised approach:

As the industry transforms, the nature of work and the skills required will change quickly. Individuals will need to continuously deepen and refresh their skills to stay relevant and take advantage of new opportunities. To facilitate this process and ensure that the skills which individuals develop can be applied to their jobs, the Government has launched two nationwide schemes—SkillsFuture Singapore and Adapt and Grow.\(^{16}\)

The programs under Adapt and Grow facilitate the ability for workers to explore new career opportunities and assist workers who are transitioning to a new job

2.2.1 SkillsFuture

SkillsFuture is Singapore’s flagship initiative developed with inputs from industry bodies, employers, government departments, education providers and unions to address the often-fragmented nature of workforce skills development through a central framework, funding and platform.\(^{17}\) SkillsFuture is the banner under which national skills training is organised and has four key goals:\(^{12}\)

- ‘Help individuals make well-informed choices in education, training and careers
- Develop an integrated high-quality system of education and training that responds to constantly evolving needs
- Promote employer recognition and career development based on skills and mastery
- Foster a culture that supports and celebrates lifelong learning’.

The training available via SkillsFuture Series programs\(^{18}\) is oriented towards fulfilling the goals of the Smart Nation strategy. Therefore, there is an emphasis on digital skills focused on eight identified priority areas for the future Singapore economy: (i) data analytics, (ii) finance, (iii) tech-enabled services, (iv) digital media, (v)


\(^{16}\) https://www.mti.gov.sg/te-IN/Transforming-Industries/For-Individual

\(^{17}\) https://www.skillsfuture.sg/AboutSkillsFuture

\(^{18}\) https://www.skillsfuture.sg/series
cyber security, (vi) entrepreneurship, (vii) advanced manufacturing and (viii) urban solutions. In addition, SkillsFuture facilitates continuous learning and adapting to a changing economy more generally and for all Singaporeans.

SkillsFuture allows citizens to plan their future training and identify what skills and training they need to access. The strategy acknowledges, among other imperatives, that digital upskilling of Singaporean citizens, of all ages and occupations, is a key priority for the Government of Singapore and industries. For example, one of the training programs in SkillsFuture is the Digital Workplace initiative. The purpose of this national initiative is to bolster the basic digital skills of Singaporean employees with the aim of making them ‘digital ready’ in the workplace and in life more broadly.\(^{19}\) Another is the Basic Digital Skills curriculum, which articulates a set of basic digital skills everyone needs to enjoy greater convenience and participate meaningfully in a digital society, and develop a ‘mindset and basic functional skills to prepare for the future economy’. The four core skills taught as part of the curriculum are (i) managing information and communication, (ii) transacting digitally, (iii) accessing government services and (iv) staying safe online.\(^{20}\) It is designed for all adults, including those planning on returning to the workforce, and considers individuals and employers. Overall, SkillsFuture defines Singapore’s approach to enabling lifelong learning, creating a common skills assessment language for individuals, employers and training providers, funding and regulation. Each of these is briefly described below.

2.3 Lifelong Learning

Lifelong learning is framed in Singapore as a civic responsibility in Singapore.\(^{21}\) SkillsFuture encourages Singaporeans to adopt a mindset of lifelong learning and upskilling in relation to their careers, jobs and personal lives (CFE, 2017, pp. 6 & 22; Smart Nation and Digital Government Office, 2018, p. 22). This is enabled through the My SkillFuture Singapore Portal\(^{22}\) and Professional Conversion Programmes (PCPs). The portal offers Singaporean citizens and permanent residents a personalised account where they can browse and sign up for training opportunities at different levels, keep a record of their own completed training, look for jobs and find career-related information. In addition, through the PCPs, professionals, managers, executives and technicians including mid-career

\(^{20}\) https://imsilver.imda.gov.sg/test-my-digital-skills/basic-digital-skills
\(^{22}\) https://www.mySkillsFutureSingapore.sg/content/portal/en/index.html
switchers are provided opportunities to ‘undergo skills conversion and move into new occupations or sectors that have good prospects and opportunities for progression’. These enablers facilitate and track lifelong learning.

In addition, TechSkills Accelerator (TeSA), another SkillsFuture initiative, supports both existing ICT workforce and non-ICT professionals to continuously upskill in response to the continually changing demands of the digital economy envisaged in Smart Nation. It does this by working with other agencies such as the IMDA, employers and industries themselves to coordinate, provide information about, deliver and certify training in the digital skills required. Training and support around digital reskilling and upskilling for non-ICT workforces is also part of its remit, again, in partnership with organisations such as the IMDA, Workforce Singapore and SkillsFuture Singapore. TeSA has three primary roles (IMDA, 2018a, pp. 45–46):

- **Skills Framework for ICT:** For each ICT-related role, TeSA provides details around the job description, critical work functions and key tasks, as well as the technical and generic skills and competency requirements. Both employers and individuals can use the Skills Framework to assess their skills, develop career maps and articulate areas for future development.
- **Skills Acquisition and Validation:** The Singapore government, through modular and certifiable skills courses, coordinates the efforts of companies, coding schools, and continuing education and training providers. These are designed to enable the existing employed workforce to upskill to stay relevant with technology changes.
- **Integrated Career Services:** This is a public–private–trade union partnership career support ecosystem for job matching, group mentoring and leadership programs for people looking to join, or develop their careers in, ICT.

Further, to ensure the success of Smart Nation, one of the key priorities for government is that the Singaporean public sector workforce is digitally skilled and thus able to lead the way for everyone else in the country, both by setting a good example and by being in a position to help other citizens with any problems they may face as a result of the rollout of the three strands of digital government, economy and society encompassed by Smart Nation. The government has been building its technical capabilities through a Centre of Excellence, which hosts capability development centres in AI, geospatial technologies, the IoT, ICT infrastructure, app development, sensors, data science and cyber security. These specialities provide the structure under which the government can deliver Smart Nation by upskilling and providing support for the public sector workforce.

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benchmark for the centre is to upskill all employees in the public sector workforce to be digitally literate by 2023 with 20,000 of them additionally trained and upskilled in data analytics and data science (Smart Nation and Digital Government Office, 2018, p. 31).20

2.4 Funding for Digital Skills Development

In Singapore, a dual approach is used to both subsidise the provision of training on the supply side, and provide credit for individual training accounts to inspire and empower learners on the demand side. For example, according to a 2017 World Economic Forum report, Singapore invested over $400 million annually on supply side efforts versus $37 million in learning credits. Notable skills funding initiatives to support the Smart Nation and Industry transformation are:

- **SkillsFuture Credit:**25 Introduced in 2015, SkillsFuture Credit is a Government of Singapore funding initiative for individuals to help pay for training courses to upskill or reskill. The initiative aims to realise the vision of continuous learning inherent in Smart Nation and is effectively an individual learning account. All Singaporean citizens and permanent residents aged 25 years and over are eligible for $500 initially. To encourage continuous learning and upskilling relevant to the future economic needs of Singapore, the government tops up the funds of various cohorts depending on perceived skills and training needs at the time. SkillsFuture Credit can be used for courses via the My SkillsFuture Singapore Portal and other relevant courses. It is not only for courses in digital skills; rather it is a general initiative like the portal. However, as it comes under Smart Nation, there is an emphasis on digital and ‘future’ skills and encouragement for lifelong learning.

- **Smart Nation Scholarship:**26 This scholarship, introduced under Smart Nation, is provided by the Cyber Security Agency of Singapore, the Government Technology Agency and the IMDA. It is for Singaporean citizens to assist them to pursue an ICT-related university degree. The goal of the scholarship program is to increase and nurture technology expertise in the public sector.

- **Smart Nation Fellowship:**27 This fellowship was introduced to attract to Singapore high-performing individuals from overseas with joint academic–industry technology backgrounds for either short-term or medium-length consultancy contracts to collaborate with the Government of Singapore on programs and interventions related to the Smart Nation strategy, such as cyber security, blockchain, AI, the IoT and cloud computing.

- **Lifelong Learning Endowment Fund:** This fund was established in 2001 by the Singapore State with a view to using the accumulated interest to resource skills initiatives over time, both by subsidising individual training, such as via SkillsFuture Credit, and by funding training providers (World Economic Forum, 2017, p. 3). In line with the lifelong learning philosophy of Smart Nation, the Government of

26 https://www.smartnation.sg/resources/smart-nation-scholarship
27 Ibid.
Singapore also allocates **equal funding to all high school students** regardless of their choice of post-secondary education (vocational or tertiary). This policy has encouraged higher-performing high school students to undertake VET, and is concurrently elevating the standard and prestige of vocational programs (OECD, 2012). Essentially though, government funding and subsidisation is key to the funding model in Singapore.

In addition to a strong government-driven strategy to address digital skills, firms are also future proofing their own workforce. For instance, Singtel has invested S$45 million to further develop the digital skills of its 12,600 employees. PwC Singapore will also invest S$10 million over the next 2 years to develop the digital skills of around 3,500 employees.

**2.5 Digital Skills Assessment and Recognition**

It appears that assessment and recognition of digital skills in Singapore is mostly through mainstream qualifications. Within the existing system, SkillsFuture Singapore has developed the *Skills Framework*,\(^28\) which provides a common skills language for individuals, employers and training providers. The *Skills Framework* is an ITM initiative. As described in Section 2.3, the framework provides information about the qualifications needed for individual careers, particularly those that have been flagged as relevant to the future economy of Singapore and requiring digital skills. The framework enables employers and individuals to assess skills and identify gaps that require future development. It also develops guidelines that facilitate skills recognition and supports the design of training programs for skills and career development.

The framework also includes a list of training options available to re/upskill for existing employment opportunities, listed by industry/occupation. Many careers and industries have already developed a skills framework, and more are underway according to the *Skills Framework* website. For example, the Skills Framework for ICT Employers uses the SkillsFuture Singapore framework to develop career maps and articulate job requirements, while individuals can use it as a guide to identify their skills and identify areas in which they can develop to stay relevant.

The *Skills Framework* therefore acts as the central point for assessing training needs, guiding the packaging of training programs and facilitating recognition of competency. Thus, even where individual organisations seek to develop their own training and offer certification—for example the Worker 4.0 Digital Readiness

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Certificate developed by the National Trades Union Congress (NTUC)—they are guided by the Skills Framework.

Although digital skills and competencies are formally recognised as part of mainstream qualifications, there is a growing view, recently promoted by the NTUC, that employers must begin to encourage and accept ‘bite-sized training which may not lead to any certification’; that is, provide training that is not necessarily part of or leading to a mainstream qualification but serves to achieve continuous skills upgrade within the company.

2.6 Notable Initiatives in Digital Skills Development

One great strength of the Singapore system of skills development is the central role of SkillsFuture Singapore as the sole coordinating agency. From this central point significant attempts are made to bring together various stakeholders, including industry unions and employers, to develop and/or facilitate skills development efforts and initiatives. The following are just some of the initiatives that illustrate this.

The Microsoft Partnership: Microsoft has entered into a partnership to deliver courses under the SkillsFuture Singapore initiative (Majumder, 2019). Microsoft’s involvement with SkillsFuture Singapore is in four parts:

- The Tech Intensity Roadmap is a plan over three years to encourage and assist SMEs to make the shift to digital technologies where appropriate in their business with suitable training for affected individuals included.
- It will work with SkillsFuture Singapore to change the workplace culture of SMEs (among Microsoft’s partner SMEs in Singapore) towards one of continuous learning, flexibility to change and enthusiastic embrace of new digital technologies in the industries concerned, with a view to retaining skilled staff.
- Microsoft will house its own certified (free) courses on the My SkillsFuture Singapore Portal including accreditation by Microsoft upon completion of the course, which covers subjects such as AI and data analytics. Microsoft materials and course content will also be included in the SkillsFuture Singapore for Digital Workplace course.
- Microsoft’s PowerApps Platform will be included in the SkillsFuture Singapore initiatives courses and training materials. This platform allows a business to build apps for its own needs, and learning to use it is considered a highly valued future skill, hence its adoption here (Goh, 2019).

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The Worker 4.0 Digital Readiness Certificate: This initiative was introduced by the NTUC in partnership with SkillsFuture Singapore to equip technicians and associated professionals with the necessary digital skills to enable them to operate productively in their changing workplaces. This is based on the acknowledgement that digital training taking place to date had largely focused on the professional, managerial and executive levels, leaving those at the shopfloor operational levels unequipped. The training consists of up to 17 short modules and covers three areas: digital equipment and devices; new technologies and their applications; and fundamental software and programming skills. Although introduced by the NTUC, the initiative brings together various stakeholders, including LearningHub, the Employment and Employability Institute, ITE and SkillsFuture Singapore.

Company Training Committees (CTCs): This is another initiative of the NTUC. CTCs are created within participating companies to help in implementing company strategies for enhancing their workers’ skills. Within each company, the CTCs are made up of management staff and union leaders. To date, 50 CTCs have been formed in organisations and industries as diverse as Wildlife Reserves Singapore, real estate, hotels and telecommunications. The aim is for 1,000 CTCs to be established by 2022. The CTCs are a management–union collaborative effort to ensure that effective training programs are developed and that financial resources are made available to ensure that the company’s workers are well trained. It was under this initiative, for example, that the Singtel S$45 million digital skills development investment was launched, along with the S$5 million CapitaLand commitment.

Digital Readiness Blueprint: One of the main barriers to Singapore’s aim of achieving Smart Nation in full has been identified as the varying digital literacy of the Singaporean population, both within and outside the workforce. Therefore, within Smart Nation, strategies have been introduced to respond to potential access and inclusion issues under the auspices of the Digital Readiness Blueprint. These include the Silver Infocomm Initiative for Singaporeans over 50 years old and the Enable IT Program for Singaporeans with disabilities.

The Silver Infocomm Initiative: The IMDA offers a separate program of digital skills development focusing on seniors. The IM Silver Portal provides online guides, content and resources aimed at helping all seniors and mature adults (over 50 years of age, irrespective of whether they are in the workforce) learn how to use

mobile and digital technologies effectively for daily activities. It also provides a tool for seniors to test their own level of digital skills. There are four key areas of training that focus on allowing seniors to benefit from Singapore’s digital services: e-communications, digital transactions, government digital services, and cyber security. This initiative encompasses different methods of encouraging this cohort to use digital technologies, including annual events, training hubs, intergenerational digital skills boot camps, digital clinics, peer mentors and basic digital skills training via SkillsFuture (IMDA, 2018b).

The Enable IT Program:35 Also administered by the IMDA, this initiative is targeted at people living with a disability and aims to enable this cohort of individuals to take up specific assistive technologies that can support activities of daily living, education and employment as well as provide support to upskill in using basic digital technologies that will become ubiquitous as a result of Smart Nation (IMDA, 2019).

2.7 Concluding Observations

- Singapore follows a centralised Smart Nation strategy to address digital upskilling policy fragmentation. It disaggregates digital skills from digital transformation and automation, which means there is a clear and direct focus on developing digital skills rather than conflating it with broader technology disruption.
- Singapore is not only responding to the demand for digital skills, but is being proactive and addressing future demand for potential growth areas such as AI. Through an analysis of ITMs, Singapore has established the impact of industry digital transformation on the nature of work and skills changes. To ensure that the skills that individuals develop are applicable to their jobs, the government has launched a nationwide scheme entitled SkillsFuture.
- Singapore’s proactive approach to future proofing its workforce also involves galvanising industry to work collaboratively with government and unions. Tech giants like IBM and Microsoft work with SkillsFuture Singapore, universities and colleges in developing and delivering workplace training for digital skills across multiple levels of citizens, workers and employers.
- SkillsFuture defines Singapore’s approach to enable lifelong learning, create a common skills language for individuals, employers and training providers; funding; and regulation.
- Singapore frames lifelong learning as a civic responsibility. The SkillsFuture Singapore for Digital Workplace provides an accessible one-stop shop for individuals and employers to engage with digital skills training.

35 https://www.imda.gov.sg/programme-listing/enable-it
In Singapore, a dual approach is used to both subsidise the provision of training on the supply side, and provide credit for individual learning accounts to inspire and empower learners on the demand side. In addition to a strong government-driven strategy to address digital skills, firms are also future proofing their own workforce.
3 SWEDEN

3.1 Overview

Sweden enjoys the status of an ‘advanced digital economy’. The country has transitioned rapidly into an effective knowledge economy. According to available reports, around half of its population have advanced digital skills and a third possess basic digital skills. In addition, it has the second highest number of ICT specialists and ICT-related problem solving among OECD countries. At the same time, Sweden has very high job security with a very high back-to-work rate for displaced workers: around 80–90% of laid-off employees find new work within 8 months. This is the highest rate in the OECD. This is an indication that even in the context of changing technologies and systems of work, displaced workers in Sweden have the necessary skills to secure re-employment.

An important characteristic of the Swedish state, which has a bearing on the management of its digital transformation, is its social partnership approach whereby key policy decisions are made in a tri-partite consultative process involving government, unions and industry. To illustrate, Rusten and Hermelin (2017) describe how a high school–industry partnership on VET in upper secondary schools created an environment where training effectively met industry skills needs. It is the same social partnership approach that, for example, led to the high re-employment rates mentioned above whereby little government intervention or direct state funding was required. Rather, this was a result of the work of Job Security Councils, which are non-profit organisations that

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40 https://www.oecd-ilibrary.org/employment/back-to-work_23063831
41 https://www.elgaronline.com/abstract/edcoll/9781788116282/9781788116282.00017.xml
operate on the basis of collective agreements between social partners; that is, employers and unions. The employers pay 0.3% of the company payroll towards the councils’ work while the councils ensure there is a stable and continuous delivery of training and upskilling services to re-educate workers for the changing job market.

3.2 Key Policies and Strategies

The regulation and policy setting for education and training in Sweden involves three ministries: Education and Research; Employment, Enterprise and Innovation; and Justice. Their efforts are coordinated in such a way that the Ministry of Education and Research develops strategies and programs for the education system in conjunction with universities and higher vocational education, while the Ministries of Employment, Enterprise and Innovation, and Justice translate the outputs and outcomes of the education system into an effective labour market skills supply.

With specific regard to e-skills, various government agencies and non-governmental stakeholders are involved. These include the National Agency for Education, the Swedish Research Council and the Swedish Governmental Agency for Innovation Systems. The non-governmental stakeholders include IT&Telekomföretagen, the association representing the interests of the ICT sector; Almega, the employer and trade organisation for the service sector; and the trade unions.

Digital learning is widely embedded in the school curriculum as part of the Schools Act 2011 with the specific target outcome that, ‘Every pupil, on completing primary and lower secondary school, must be able to use modern technology as a tool for knowledge-seeking, communication, creation and learning’. This policy also covers teacher and preschool teacher training programs.

As one of the most advanced digital societies, Sweden’s Information Society Strategy has a long history, dating back to the 1980s when concerted digital awareness programs were launched. The first comprehensive strategy was the Digital Agenda for Sweden adopted in 2011. Its target was mostly school education and it aimed to grow the proportion of young people—especially girls and young women—entering ICT-related subjects and programs in higher education. However, it underscores the ‘need to develop skills in the world of work and organisations in general’ beyond secondary schools digital learning,

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43 Walter (n.d.), op. cit.
44 https://www.nesta.org.uk/blog/digital-frontrunners-spotlight-sweden/
45 https://www.nesta.org.uk/blog/digital-frontrunners-spotlight-sweden/
46 http://www.regeringen.se/content/1/c6/18/18/01/509f1b0c.pdf p. 33
47 http://www.valjit.se/website1/1.0.1.0/442/Kompetensbrist_rapport_mars2012.pdf
as well as the role of universities and adult education. This strategy was updated in 2015 with the *ICT for Everyone—A Digital Agenda for Sweden* document, which placed greater emphasis on the need for ‘everyone of working age [to] have good digital skills to be employable or be able to start up and run businesses’. Further, the *Swedish Innovation Strategy* was published in 2012, and increased the emphasis on digital skills for the workforce to enable ‘innovation, creativity and entrepreneurship throughout life’, implying the importance of lifelong learning.


Its primary aim is to guide Sweden towards leveraging opportunities in the digital economy (Government Offices of Sweden, 2017; OECD, 2018b). One of the five target areas within the 2017 *Digital Strategy* to enable this process is referred to variably as the digital skills/digital literacy/digital competence goals. Despite the lack of clarity around terms (which could be due to translation issues), the digital skills target of the strategy broadly defines its goal as ensuring that all citizens in Sweden have the opportunity and capacity to develop and use their digital skills in the digital transformation of the economy and society (Government Offices of Sweden, 2017).

An initiative of the European Commission (EC), the Digital Skills and Jobs Coalition (DSJC) brings together member states, companies, social partners, non-profit organisations and education providers, who take action to tackle the lack of digital skills in Europe. As part of the implementation of this digital skills-specific goal in the strategy, the Swedish Government in 2018 launched its DSJC. It is comprised of public agencies and industry representative bodies, including the government’s Digitalisation Council, the Swedish National Agency for Education, Swedsoft, the Association of Swedish Engineering Industries and the Swedish IT and Telcom industries. There are now 19 national DSJCs across Europe. The coalitions’ objective is to:

work on actions such as developing public sector leadership skills, implementing the national strategy for the digitalization of the school system, raising interest in IT among young people and women, skills uptake and life-long learning as well as immigration and integration and digitalized society available and usable for all citizens.

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The DSJC works on actions such as:

- developing public sector leadership skills;
- implementing the national strategy for the digitalisation of the school system;
- raising interest in IT among young people and women;
- skills uptake and lifelong learning;
- immigration and integration; and
- creating a digitalised society available and usable for all citizens.

One of the approaches adopted by the coalition is to work with universities to develop and administer short courses to reskill professionals with digital skills in industries particularly affected by digitalisation (EU, 2018; National Endowment for Science, Technology and the Arts [NESTA], 2018). At the same time, it aims to launch an open digital platform that provides comprehensive training for schools around digital skills such as programming. In the short term, however, the coalition seeks to explore immigration policy as a means to address digital skills gaps while other more sustainable initiatives are developed (EU, 2018). Under the 2017 Digital Strategy, there are a number of other ways in which digital skills are set to be achieved, targeting both formal compulsory education as well as VET sectors.

3.2.1 Modernising the Education System

Compulsory education at primary and what is referred to as lower secondary level begins at the age of six and ends at the age of 16. At the next level—upper secondary, which normally lasts for three years—students choose between an academic and a VET pathway. The eligibility criteria for an academic pathway are pass marks in 12 compulsory subjects, while the eligibility criteria for a vocational pathway are pass marks in eight compulsory subjects. Twelve of the 18 upper secondary programs are vocational and all are offered either as a school-based program or as an apprenticeship. The programs that attain the largest VET enrolments are building and construction; electricity and energy; and vehicle and transport.51

As part of the overall project of digital transformation, Sweden is attempting to overhaul the school education system. Thus, the National Digitalisation Strategy for the School System was rolled out by the Swedish Government in July 2017 (OECD, 2018a), with three primary areas:

- **Digital literacy** for everyone in the school system; that is, leaders, teachers and other staff, as well as students of all ages.

• Equal access and use of digital technologies throughout the school system, attuned to the differing needs of each cohort and staff group.

• Research and evaluation of digitalisation opportunities in schools, such as the impact of digital technologies on teaching and learning.

As part of this process, content such as programming skills, digital media evaluation and problem solving using digital technologies is being introduced into the secondary school curriculum.

3.2.2 Digitalisation of Industry

The 2017 Digital Strategy draws upon, and incorporates, the 2016 Smart Industry Strategy whose aims are to:

• enable companies in Sweden to access and leverage the potential opportunities afforded by digital technologies whatever their size, industry or locale; and

• support and encourage the adoption of digitalisation in industries where it is likely to have the most benefit for a successful future digital economy in Sweden.

From a workforce skills perspective, the Smart Industry Strategy encourages companies to prepare for the flexibility required in a future digital economy through lifelong learning (Government Offices of Sweden, 2016, p. 21). There are four areas of focus within the strategy—the most relevant here being the ‘Industrial skills boost’ (Government Offices of Sweden, 2016, pp. 3 & 33). It was created to ensure that the system for supplying skills in Sweden must flexibly respond to the changing skills needs inherent in digital transformation and not only deliver these skills, but also shape adaptive individual mindsets. Its stated aims are (Government Offices of Sweden, 2016, p. 33):

• increasing interest in science and engineering and increasing the attractiveness of industrially relevant study programs;

• improving the matching between the industrial sector’s labour requirements and the education system at all educational levels;

• ensuring that the education system provides students with not only the right knowledge, but also with the right capabilities and skills required in the knowledge society and for the transition to a digitalised and circular economy;

• improving the conditions for lifelong learning; and

• promoting career changes and mobility between the higher education sector and the business sector.

Both the Digital Strategy and Smart Industry Strategy call for closer matching of the education system with industry’s digital skills needs by augmenting collaboration between upper secondary schools, higher education, research and industry—such as that which already takes place within training provided by the Agency for Higher Vocational Education (AHVE). Higher VET programs provide mid-level post-secondary vocational qualifications involving up to two years of full-time study. Education providers, in collaboration with employers—
which is a pre-requisite—propose such programs to the AHVE, which decides whether to provide funding. The proposed programs must involve placements with employers.\textsuperscript{52}

3.2.3 e-Skills Council

Establishing the demand for digital skills in Sweden is as an integral part of the national system for skills assessment and anticipation exercises. These are carried out in virtually all OECD countries to better align skills demand and supply although approaches differ markedly among countries. The process within Sweden, under the auspicious of Statistics Sweden and the Sweden Public Employment Service uses multiple data sources including surveys, forecast models, focus groups and round tables, and involves other key stakeholders such as trade unions and employer organisations.\textsuperscript{53}

Gap analysis for advanced digital skills is also conducted by both government and industry. For instance, the Ministry of Enterprise, Energy and Communications and the Swedish ICT and Telecom industries run a regular analysis. The analysis was first undertaken in 2012 and has since been updated in 2015 and 2017.\textsuperscript{54} An important goal of the e-Skills Council (IT-Kompetensrådet), created by IT&Telekomföretagen (an IT sector employer association) is to develop joint activities for meeting business and public sector long-term e-skills needs. As part of this, it has, since 2010, actively developed intelligence on the supply of and demand for ICT practitioner skills in Sweden, based on in-depth interviews and group discussions with human resources managers, employment offices, and representatives of universities and training institutions. Based on this analysis, a detailed mapping of e-skills training and workforce needs is produced to guide policy on e-skills development.

3.3 Lifelong Learning

It is clear that the Swedish education and training system considers lifelong learning as one of the important aspects of skills development for a digital society. As early as the early 1990s, Sweden was well advanced in its development towards adopting a lifelong and life-wide approach to education and training. It started by combining preschool and compulsory school with adult education and training to create a seamlessly interfaced system that enables people to build skills progressively throughout their lives.

\textsuperscript{52} Ibid.
\textsuperscript{53} http://www.oecd.org/employment/getting-skills-right-sweden-9789264265479-en.htm
Currently, there is a well-developed adult education system in place at the VET level, as well as a comprehensive nationwide folk high school system that provides adults and seniors with the opportunity to retrain or upskill to access new jobs.\textsuperscript{55} The Swedish folk high schools offer independent and free-of-charge courses that are based on individual needs to enable catching up to an upper secondary level of knowledge and qualify for higher education.

ICT skills training has always been a major focus of folk high schools and the VET sector, with the aim of ensuring that people have appropriate skills at all ages and times. For example, the Digidel 2013 initiative, whose aim is to increase the share of people using digital tools and services, places great emphasis on older people and seeks to ensure that they have the necessary digital literacy and skills. The initiative is available to all elderly people, whether they are in or out of the workforce.\textsuperscript{56}

### 3.4 Funding for Digital Skills Development

The DSJC and the majority of the initiatives listed in Section 3.6 involve significant funding, some of which is from government, and some from private organisations like IT&Telekomföretagen, considered the most active private organisation in digital skills training efforts. The contribution of employers towards the work of Job Security Councils (0.3% of the company payroll) is a good example of private sector contribution towards workforce skills development, since an important aspect of the councils’ work is to help people acquire the skills necessary for re-employment.

Although we were unable to obtain specific figures for funding for digital skills development, there is evidence in the above analysis of specific initiatives that the government remains the major sponsor. Nevertheless, the private sector is also actively involved in funding e-skills training. For example (see also Section 3.6), through professional skills co-development initiatives such as Expertkompetens and PROMPT,\textsuperscript{57} Sweden has invested more than 9.3 billion SEK in more than 2,500 projects.\textsuperscript{58} As part of the workforce digital transformation of government, the Swedish government has made available 10 million SEK for the digital skills education of local and regional council officials and employees across Sweden’s 290 municipalities.\textsuperscript{59} Further, some 40 million SEK was provided in

\textsuperscript{55} https://www.folkhogskola.nu/globalassets/dokument-och-filer/folkhogskola_eng_engelska.pdf
\textsuperscript{56} Ibid.
\textsuperscript{57} http://www.kks.se/om-oss/in-english/
\textsuperscript{59} https://digital.di.se/artikel/regeringen-lagger-10-miljoner-pa-digital-kompetens-for-lite-kunskap
the 2018–19 budget to establish and run the AI Advanced Tech Education platform (see Section 3.3).

3.5 Digital Skills Assessment and Recognition

As highlighted above, Sweden has the highest share of ICT practitioners in the EU. It is also one of the most advanced societies where ICT awareness and e-skills are concerned. This is a result of (i) consistent proactive government efforts in designing comprehensive policies in this space; (ii) active collaboration among key stakeholders, including government, unions and employers, in digital skills development efforts; (iii) continuous assessment of digital skills gaps and needs to provide effective responses; and (iv) a strong and well-embedded digital training program across all levels of education and training, including a strong adult education program.

Since 2018, digital skills are taught as an essential part of Sweden’s national curriculum in compulsory and upper secondary schools. In doing so, digital skills are integrated into a range of other compulsory subjects. This means that, other than the normal mainstream qualifications awarded in schools, universities and the vocational training system, there are no separate formal credentials offered for digital skills. As discussed in Section 3.3, Swedish folk high schools offer a pathway for adults to catch up on upper secondary level education and deliver a wide range of vocational courses. It is generally expected that graduates from the different levels of education and training will be equipped with the necessary digital skills.

3.6 Notable Initiatives for Digital Skills Development

As highlighted above, policy making and governance in Sweden follows a social partnership approach involving key stakeholders, including government, unions and employers. In the same spirit, there is a shared view that workforce digital skills, as well as a generally digitally literate population, are key to an efficient, prosperous and inclusive society. Private sector initiatives in this space are, therefore, commonplace. A few notable ones are highlighted here.

The VäljIT (‘choose IT’) initiative: Introduced by the government in 2009, this initiative aims to attract more young people to study and work in ICT, for the IT industry, as well as in IT jobs in other business sectors and the public sector. Its objectives are to increase the number of applicants to university places in ICT and increase the share of women among applicants to at least 40%. Because of

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60 https://eacea.ec.europa.eu/national-policies/eurydice/content/digital-skills-enter-sweden-schools_en
its initial success, the initiative was relaunched in 2011, leading to several outreach activities including collaborative partnerships between schools and businesses in e-skills education. The target group appears to be primarily young people who are still at school. The project’s base funding is modest (€50,000 in 2011 and €20,000 per year since). It does, however, benefit from the support of various stakeholders, including IT&Telekomföretagen. Sweden already has a good foundation for digital skills, having the second highest number of ICT specialists among OECD countries\(^\text{62}\) and a strong IT industry that is thirsty for more skilled personnel. Therefore, the focus of this initiative on ICT professionals is a reflection of the workforce en masse already being digitally skilled to a high level.

**Kickstart Digitalising\(^{63}\)—deepening the tech competence in SMEs:** This is the largest project funded by the Swedish Agency for Economic and Regional Growth. It was launched in 2016 and continued to 2019, with government funding of €8.1 million.\(^{64}\) It aimed to strengthen the digitisation and competitiveness of industrial SMEs by helping them to ‘kickstart’ their process of digitalisation. The focus was on manufacturing SMEs and the implementation of social media, cloud, mobile services and IoT.\(^{65}\)

The structure of the SME training incorporates a short online course, individual coaching for SMEs (up to 65 hours) and vouchers to complete a feasibility study to prepare for digitalisation.\(^{66}\) SMEs have reported the benefits of this process in helping them on their digitalisation journey; for example, by stepping them through which of their business processes could be digitalised, leading to efficiency improvements.\(^{67}\)

By 2018, over 300 SMEs had participated in the initiative. An evaluation showed that 95% of SMEs said that *Kickstart Digitalising* had given them better insights and ideas about digitalisation; 60% had initiated digitalisation projects; and 35% said that the initiative had helped them to speed up processes and their work within ongoing digitalisation projects.\(^{68}\)

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\(^{63}\) https://www.kickstartdigi.se/


\(^{65}\) Ibid.

Kickstart Digitalising was part of a continuous effort to support the digital needs of manufacturing SMEs; for instance, it followed on from Produktion 2030 (2013) and digitalisation pilot (2016)\textsuperscript{69} initiatives.

A competence centre for AI—for advanced tech education\textsuperscript{70} This recently launched initiative is associated with the government's AI jigsaw to improve education in AI. Its aim is to develop AI expertise in education and innovation and become an attractive environment for world-leading AI researchers. Together, seven universities, led by the Chalmers University of Technology, have undertaken the initiative after being commissioned by the government to provide training in AI to professionals. A budget of 40 million SEK for 2018–19 has been allocated to establish and run the new platform. This initiative follows on from political statements highlighting Sweden’s goal of becoming a leader in AI, addressing key issues such as the need to develop capacities and skills among citizens to use AI, and the need to maximise the benefits of AI in the public sector. It also underlines the importance of education, research and business innovation by enabling the right context for the adoption and use of these technologies.\textsuperscript{71}

Digicreate—boosting digital skills in the creative sector: This regional growth project examines how digitalisation will affect future tasks in cultural and creative industries with regard to gender equality, accessibility and equal treatment. Entrepreneurs in cultural and creative industries in the Borås region have launched the project to enhance the digital skills of entrepreneurs and employees through the network’s Creative Cluster. Through networking meetings, contact mediation, skills development and consulting, the Creative Cluster’s purpose is to help companies in the creative and cultural industries to develop and increase turnover, but also to foster ideation.\textsuperscript{72}

Participants can sign up to a range of workshops. For instance, in 2020 workshops focus on leadership in the age of digitalisation as well as more specific skills such as building skills on search engine optimisation. Workshops are free (except for a nominal non-attendance fee). Participants in this initiative must complete and sign a time report and a certificate of state support.\textsuperscript{73}

Skills360 Hackathon\textsuperscript{74}—towards a data-driven public sector: Launched by the Swedish Agency for Government Employers, the Skills360 Hackathon represents

\begin{itemize}
\item \textsuperscript{69}Ibid.
\item \textsuperscript{70}https://www.chalmers.se/en/centres/chair/Pages/default.aspx
\item \textsuperscript{71}Government Offices of Sweden (2018), National Guidance for Artificial Intelligence, https://www.regeringen.se/49a828/contentassets/844d30fb0d594d1b9d96e2f5d57ed14b/2018ai_webb.pdf
\item \textsuperscript{72}https://creativecluster.se/kontakt/
\item \textsuperscript{73}https://creativecluster.se/
\item \textsuperscript{74}https://books.google.com.au/books?id=ARSXDwAAQBAJ&pg=PA99&lpg=PA99&dq=Skills 360+Hackathon&source=bl&ots=fHaPLpucP&_sig=ACfU3U0SR28jOcxuYX_4vsEfWfH4jf_Gjw&
one of the few initiatives designed to increase the digital skills of public servants.\textsuperscript{75} The program aims to gather together representatives of the entire labour market—the state, business, academy, start-ups and associations—to address challenges stemming from digitalisation. Hackathons facilitate collaboration and problem solving in participant teams by setting a common challenge in a time-constrained format; they aim to build the foundation towards training public officials in data analytics.\textsuperscript{76} According to the organisers, the \textit{Skills360 Hackathon} is a ‘knowledge hack’ (rather than a programming hack), meaning that its purpose is to share knowledge and ideation across agencies.

The focus on training the public sector is also demonstrated by the Swedish Government making available ten million SEK to local and regional council officials and employees across Sweden’s 290 municipalities for digital skills education.\textsuperscript{77}

### 3.7 Concluding Observations

From this analysis, there is little doubt that Sweden is one of the leading societies in digital transformation. Not only is the workforce highly skilled with necessary digital skills at different levels; the whole of society has high levels of digital literacy.\textsuperscript{78} It is also way ahead of other like economies in its digital skills development and general ICT awareness. A few key observations can be made about Sweden’s digital transformation, and especially workforce digital skills development, which to a large extent make Sweden one of the most advanced digital societies:

- Sweden’s social partnership administrative model allows for effective \textbf{tripartite collaborative efforts in its digital transformation} journey, including the development and implementation of policy. This has enabled active contribution from all key industry stakeholders including government, employers and workers’ unions to ensure that workforce skills development effectively meets the employability needs of workers as well as the requirements of industry.

- Because of the social partnership model, Sweden’s \textbf{private sector is an active sponsor}—including financially—of workforce training. As the example initiatives show, businesses are actively sponsoring initiatives to promote digital skills development, not just for their workers but within society generally.

\textsuperscript{76} Ibid.
\textsuperscript{77} https://digital.di.se/artikel/regeringen-lagger-10-miljoner-pa-digital-kompetens-for-lite-kunskap
\textsuperscript{78} Digital Economy and Society Index (2018), op. cit.
Digital skills training is embedded as an essential and integral part of the training system at all stages. This follows the view that all citizens must be equipped with at least the basic digital skills. It is also based on the principle that education and training should be accessible to all and be inclusive.

Sweden’s education and training system also strongly supports lifelong learning and the capacity for citizens to acquire new skills or enhance existing skills at any stage in their lives. The combination of a strong and accessible VET system and the unique folk high school system gives adults and seniors the opportunity for continuous learning (see Section 3.3).

Recognising the importance of digital skills and the need to ensure that relevant and appropriate digital skills are produced, the DSJC has been established, comprised of public agencies and a wide range of industry representative bodies. It acts as the central coordinating agency to ensure that the training system provides people with the right skills and promotes access and inclusivity.
4. GERMANY

4.1 Overview

Germany’s digital policy is underpinned by the significance of manufacturing, which accounts for around 15 million jobs (EC, 2017). Emphasis has therefore been on structural digitalisation of industry and how to best leverage the opportunities presented by digital transformation. As a consequence, there is strong focus on leveraging the new markets opened up by the IoT and cyber–physical system services, which are the two key areas in which Germany’s government envisages major benefits for German manufacturing industries (EC 2017).

Germany’s reliance on manufacturing and industrial innovation means that it has always maintained an extensive, well-designed and well-equipped VET system, also known as the dual training system. Renowned as one of the most advanced in Europe, it has been emulated internationally as best practice in countries such as Mexico and Indonesia. The dual approach refers to practical occupational skills being taught by an approved company, and theoretical knowledge being taught by a vocational school. Trainees/apprentices are therefore employees and pupils simultaneously. A key feature of the German VET system is the ‘rise of work-based academic education, which has led to a hybrid system that integrates work-based vocational training into higher education. This helps to produce work-ready higher education graduates as well as providing clear pathways and interface between higher education and VET.

Germany enjoys a relatively high supply of digital skills to meet the high demand generated by an industry pivot towards digital innovation. As in other parts of Europe, ICT specialists make up a significant part of the workforce (3.7%), but demand exceeds supply. Yet, according to the Digital Transformation Monitor—an agency of the EC that monitors key trends in digital transformation among its member states (EC, 2017, p. 4)—less emphasis has been placed on skills acquisition and more on transitioning to using new digital technologies in industry. This might seem contradictory, but is better understood when considering that Germany’s approach is to holistically enhance the quality of its education and training system to produce the skills needed for an efficient, prosperous and

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79 https://academic.oup.com/cjres/article/11/2/373/4975528
80 file:///Users/victorgekara/Downloads/GermanyEDPRcountryprofile.pdf
equitable society. In recent years there have been calls for policy action to further improve innovation policy and firms’ uptake of the latest technologies, including boosting investment in digital skills and improving opportunities for lifelong learning to smooth the digital transition. A key policy approach is to embed digital skills in all stages of a person’s development through the education and vocational training systems, as reflected in the Digital Policy for Business, Work and Consumers (see Section 4.3).

Like Sweden, Germany adheres to the social partnership administration model, whereby, to the extent possible, decisions of economic importance are made following comprehensive tripartite consultation between government, industry employers and labour unions. This model has influenced success in galvanising the support and contribution of the private sector in the country’s skills development agenda, leading to, for example, the dual technical VET system. This is also evident in the key stakeholder collaboration leading to the successful implementation of the various aspects of the country’s ‘Industrie’ 4.0, in which major companies including BMW, Volkswagen, Audi, Bosch, Siemens, Adidas and Thyssenkrupp are involved. This approach to industry engagement and training is embedded in the culture, with research showing that German companies are among the most likely in the EU to train their workers in ICT (28% do so).

4.2 Key Policies and Strategies

4.2.1 The Federal Government Digital Agenda

Germany has an elaborate agenda, which was rolled out in 2014 and sets out the guiding principles for its digital transformation policy according to determined national socio-economic priority areas:

- digital infrastructure;
- the digital economy and digital workplaces;
- innovative government;
- digital environments in society;
- education, science, research, culture and media;
- security and protection and trust for society and business; and
- European and international dimensions of the Digital Agenda.

Although all ministries are responsible for the implementation of the agenda in their own areas, three have been charged with the responsibility of overseeing the overall implementation of the agenda. These are the Federal Ministries of Economic Affairs and Energy (BMWi); Interior (BMI); and Transport and Digital Infrastructure (BMVI). The agenda is assessed, evaluated and updated at regular intervals to track the degree to which the set milestones are being met. Digital education and workforce skills development through schools and further education programs is a key priority in the agenda.

Under the umbrella agenda, several strategies have been developed by different ministries to drive the seven key priority areas listed above. In 2017, the BMWi, along with the Federal Ministries of Labour and Social Affairs (BMAS), and Justice and Consumer Protection (BMJV) jointly developed the Digital Policy for Business, Work and Consumers (BMWi, BMAS & BMJV, 2017, 11 & 12).85

Ten key priorities were identified for implementation as part of the Digital Agenda, two of which are ‘growth and employment with industry 4.0’ (priority one) and ‘strengthening digital competence at all levels’ (priority four). Particularly under priority four, comprehensive and multi-level training approaches are articulated with a focus on (i) individuals building self-assurance in using digital devices and applications; and (ii) helping individuals to adjust to changes that emerge because of the use of new technologies and new ways of working, but also because of the structural change in the economy.86

Since 2014, several strategies have been adopted to drive the implementation of the Digital Agenda. Some of the key strategies and how the workforce digital transformation priority is articulated are set out below.

4.2.2 The High-Tech Strategy 2025

As part of the overarching Digital Agenda, the BMWi in 2018 outlined its High-Tech Strategy 2025 (HTS).87 This is the flagship framework for the implementation of the federal government’s research and innovation policy strategy under the Digital Agenda. It identifies 10 steps focusing on infrastructure development, moving towards Industry 4.0 and education in the context of digital transformation. It is this strategy that informs the federal government’s commitment to invest 3.5% of Gross Domestic Product (GDP) on research and development by 2025.88

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86 Ibid.
The HTS focuses on grand societal challenges and is based on an understanding of how digitalisation of the economy and society is managed, and the real repercussions for social cohesion. There is clear recognition of the importance of a digitally skilled workforce to drive the envisaged innovation. This is covered under priority two, ‘developing Germany’s future competencies’ (p. 14), which states that:

In order to find solutions to the major challenges, we will systematically and continuously develop Germany’s future competencies. This is taking place on a three-tiered basis through technology, skilled workers and the participation of committed citizens. Through the three major science pacts ‘Pact for Research and Innovation’, ‘Contract for the Future of Higher Education and Teaching’ and ‘Innovation in Higher Education’, we will fund universities and research institutions with more than 160 billion euros over the next ten years. These three pacts set a decisive course for the scientific and research system in the coming decade.

4.2.3 Strategy Work 4.0

Strategy Work 4.0 was developed in the Re-Imagining Work White Paper produced by the Federal Ministry for Labour and Social Affairs in 2017. The strategy is based on the acknowledgement that ‘the future of work will be different from today’s’ [and] ‘is about future perspectives, scenarios and opportunities—to shape work in a way which benefits people and advances our economy’ (p. 5). The strategy, among other core objectives, aims to, ‘promote lifelong learning and every worker’s right to continuing vocational education and training, because jobs are changing to an unprecedented extent’ (6).

The paper presents five essential elements in its vision for work in a digital age:

- income and social security;
- access to quality jobs;
- retaining the quality of work;
- variety as the new normal: a life-phase approach rather than rigid models of work; and
- considering co-determination, participation and corporate culture as a whole.

Underlying this vision is the need for equitable access to quality education and continuous skills development opportunities to enable people to access and flexibly move across occupations, jobs and roles as their life circumstances change. The policy objective is to ensure that the education and training system

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provides people with the appropriate skills to maintain individual employability amid the rapid transformations that are likely to characterise the future of work.\textsuperscript{90}

**4.2.4 Digital Strategy 2025**

*Digital Strategy 2025* was developed by the BMWi with the objective of informing the development of capabilities and abilities to use new tools to achieve a smart Germany. One of the 10 priority objectives is to ‘introduce digital education to all phases of life’. This is presented as a key priority for transforming Germany into a smart knowledge society, by ensuring the development and maintenance of a strong national skills base interfacing schools, VET, higher education and workplace. The strategy notes that:

- Digital work will be more demanding and more complex.
- More and better training and skill development will be key.
- Tasks involving mostly routine activities will not be needed.
- Flexibility and knowledge of methods for using digital technologies will become more important.
- Every school pupil will have basic knowledge in information science, how algorithms function and in programming. To achieve this, appropriate courses must be required in lesson plans in the primary and secondary schools and in teacher education and continued training.
- The workplace should be the number one place to acquire the newest IT knowledge.

An important and central proposition is the strengthening of the digital content across all levels of primary and secondary school, university and professional continuing education, including the dual system of vocational training.

The dual system of vocational training is seen as particularly important (see Section 4.3.1). This system is characterised by an effective interface in education between vocational schools and workplace training in companies. The aim is to ensure that everyone has the necessary basic skills for contemporary social interaction but also skills that are immediately relevant in the world of work. This will be achieved by:

- aligning the vocational training with the demands of a digital economy;
- ensuring high-quality digital training at all continuing education centres;
- ensuring that the vocational training for IT jobs focuses on the required practical skills to make their graduates appealing to employers; and
- ensuring that the need to adapt existing occupations and to create new trades is continually identified and implemented with input from experience in the field.

These objectives of Digital Strategy 2025 are further enhanced by the Federal Ministry of Education and Research (BMBF)’s digital strategy, called the Digital Strategy of the Ministry for Education and Research,\(^91\) which was introduced in 2019 to facilitate digital change by:

- strengthening digital education and training;
- generating knowledge and innovations from data;
- ensuring technological sovereignty and scientific leadership;
- creating security and trust; and
- facilitating better and more sustainable living and working.

The different strategies described here all seem to point to Germany’s strong focus on embedding digital skills at all levels of the education and training system. They also suggest a strong inclination towards a lifelong learning approach whereby the relevance of skills is continually upgraded to avoid any skills gaps emerging. In the following sections, we examine the ways in which the broad policy objectives for skills development are operationalised.

**4.3 Lifelong Learning**

Lifelong learning is a key feature of Germany’s strategy for digital transformation.\(^92\) \(^93\) To ensure lifelong learning, Germany’s government has identified that the central employment policy challenge is how to shape transitional periods between education and work, work re-entry, career switchovers, and help individuals to future proof their skills sets,\(^94\) which points to a strong emphasis on lifelong learning. The government recognises that, ‘A future Digital Strategy by the Federal Government must establish political goals such as digital participation, cyber-security, or the building-up of people’s digital competences, reinforcing this with specific measures’.\(^95\)

Germany treats lifelong learning as a major education and training approach to ensure that people have the skills and capacity to continuously adapt to new technologies and that industry has an adequate supply of appropriate skills. This is clearly articulated in the Digital Policy for Business, Work and Consumers, which

\(^91\) https://www.bildung-forschung.digital/files/BMBF_Digitalstrategie.pdf
\(^92\) Lima, L.C., Guimarães, P. and Touma, N. (2016), Adult learning and education policies in Germany, Portugal and Sweden: An analysis of national reports to CONFITEA VI. In R. Egetenmeyer (Ed.), Adult Education and Lifelong Learning in Europe and Beyond (pp. 29–65), Peter Lang, Frankfurt am Main.
\(^93\) https://repositorium.sdum.uminho.pt/handle/1822/39507
\(^95\) Ibid.
is an important operational document for the digital competency priority of the Digital Agenda. It states that:

digital education and education for digitalisation need to be imparted throughout each phase of life and of education. The key term is ‘lifelong learning’. This begins with education for young children, includes school, higher education, initial and further vocational training, and encompasses work with senior citizens. Its basis is a functioning—and also digital—infrastructure at all places of learning, primarily in (vocational) schools, yet also in companies, and not least at home (BMWi, BMAS and BMJV (2017, 38).

Two key initiatives illustrate Germany’s approach to lifelong learning, namely the Dual Vocational Training System and the Inter-company Vocational Training Centres.

4.3.1 Dual Vocational Training System

An important feature in the training system, designed to facilitate continuous lifelong learning is the Dual Vocational Training System. This is a system whereby vocational schools, vocational training institutes and companies work together to give learners a clear pathway to fully fledged vocational qualifications and industry placement. Its aim is to combine theory and vocational training embedded in a real-life work environment as well as to provide workers with opportunities for continuous skills update.

Because technologies are rapidly changing and thereby impacting on the world of work and skills, the model is seen as of particular importance to the success of the country’s digital transformation. To strengthen this approach, the Alliance for Initial and Continuing Training was established in 2015. It is comprised of various key stakeholders including the federal government represented by the BMWi, the BMAS and the BMBF, the Federal Employment Agency (BA), business and industry representatives, unions and state (Länder) government bodies.

The alliance’s core objective is to help strengthen the ‘dual vocational training and make it more attractive to young people and to companies offering training. (87)96 It appears that the alliance operates on three-year terms with regular evaluation and redefining of its goal, which in 2019 was stated as being to strengthen the attractiveness and quality of dual training to enable as many young people as possible to upskill.

The alliance’s work is premised on the view that the development and supply of relevant skills is not possible without the coordinated effort of government, businesses, unions and the vocational training establishment. Collaborations

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between businesses and the vocational training establishment are considered key, as this is where effective dual training takes place, with employers providing practical training placement opportunities. Evaluation of the alliance has shown that around 70% of young people moved into regular apprenticeships within six months after completing this program.97

4.3.2 The Digitalisation in Inter-company Vocational Training Centres Initiative

Digital skills development represents an initiative by the Federal Institute for Vocational Education and Training through the Digitalisation in Inter-company Vocational Training Centres (ÜBS) and Competence Centres launched by the BMBF.98 This special program ran between 2016 and 2019 with the main objective of helping accelerate the digitalisation of processes in the training of specialist staff in the context of the Vocational Training 4.0 initiative, through high-level training on digitalisation and as an interface between research and practices.99

The Inter-company Vocational Training Centres were initially created to facilitate the centralised instruction of apprentices in the skilled trades and offer courses in other fields, such as agriculture. These have since evolved into multifunctional centres of further vocational training. For instance, they are increasingly active in the field of advanced training and continuing education, including master craft programs. They also offer occupational guidance and/or vocational preparation as well as supporting other activities.100 They thus form an important component of the country’s lifelong learning strategy.

Between €30 million and €37 million was made available annually to fund the program.101 While details of the outcomes are not available, the funding was used to purchase digital technology in the centres, such as industrial robots and 3D printers, and digital teaching and learning media such as tablets and touchscreens.102

4.4 Funding for Digital Skills Development

In Germany, funding for digital transformation initiatives is a combination of public money (federal government and the EU) and private investment, including in-

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100 https://www.bibb.de/en/12303.php
BMBF (2019), op. cit.
102 Ibid.
kind contributions from companies (EC, 2017). The BMBF and the BMWi have contributed €200 million to Industrie 4.0 (EC, 2017, p. 2).

Funding for digital skills development comes largely from the federal and Länder governments. This is mostly for establishing, equipping and maintaining the national education and training system. It is worth noting that, in the German system, digital skills are not given separate and special consideration; rather they are considered and developed as underpinning employability skills with which everyone must be equipped. Thus, apart from specific ICT training cases and initiatives, which are mostly funded by industry, training for digital skills is part of the general funding for education and training.

As part of its ‘education offensive for the digital knowledge-based society’, the DigitalPakt Schule (‘digital pact for schools’) initiative of the BMBF will equip all schools with appropriate tools for imparting the skills appropriate for the emerging digitally driven and knowledge-based society.103 The government is investing €5.5 billion over five years to provide 40,000 schools with all necessary digital equipment. In return, Länder governments will provide the teachers with the necessary training.104 A further €550 million is being contributed by the school authorities in the federal states. This appears to be the main funding dedicated to providing education in the digital world for the teaching workforce. Note, the official language is ‘skills for a digital society’ as opposed to ‘digital skills’.

4.5 Digital Skills Assessment and Recognition

As indicated above, Germany’s view of digital skills is that:

- they are essential competencies to be provided to all Germans to effectively participate in an increasingly digital society;
- they should facilitate one’s employability but also their capacity to adapt to changing workplace competency requirements; and
- their development should be systematic, continuous and progressive throughout one’s schooling and vocational training.

The approach has therefore been to embed digital skills into the education and training curricula right from primary school, through secondary school, to higher education and VET, broadly following the DigiComp framework. The DigiComp framework105 was developed to support the development of digital competence of individuals in Europe. It articulates five levels of competency: (i) information

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103 https://www.digitalpaktschule.de/de/was-ist-der-digitalpakt-schule-1701.html
and data literacy; (ii) communication and collaboration; (iii) digital content creation; (iv) safety; and (v) problem solving (discussed in detail in the EU case study, Section 7).

In Germany, digital skills are assessed as a core component of the attainment of traditional mainstream qualifications. What is happening though is the continuous modernisation of the training curriculum, with the introduction of new courses inclined more towards digital skills development. For example, the 2019 Report on Vocational Education and Training Germany\textsuperscript{106} specifically describes the modernisation of the VET system through the inclusion of new courses, for example, ‘data protection and information security [which] have now become an integral element of training’ (91). These do not necessary lead to new and separate qualifications.

Although businesses are encouraged and expected to provide continuous training as part of professional development, it is expected that major training programs that shape and influence employability, are developed and credentialed within the formal education and training system’s qualification framework. Businesses are, instead, encouraged to work collaboratively with the education and training system to ensure that the skills being developed, including digital skills, are appropriate for industry generally.

It is for this reason that DigitalPakt Schule addresses all types of school in higher education and vocational education, regardless of the sponsorship of the respective school. It is also the core view informing Vocational Training 4.0 that skills are developed in a system where the interface is seamless between vocational schools, vocational training institutes and companies that provide practice placement.

These two initiatives ensure that not only are schools provided with appropriate equipment, follow appropriate curricula and have well-trained teachers, but also that industry is an integral part of the process of co-creating workforce and society skills. The end objective is that all students and trainees at any exit point have the desired skills, including digital skills.

4.6 Notable Initiatives for Digital Skills Development

**Apprentice for Industry 4.0:** This is a new initiative launched in 2019 by the Chambers of Commerce and Industry. It involves an interdisciplinary training program that is offered nationwide, intended for apprentices from the second and third year of apprenticeship in the industrial–technical area. Apprentices have the option to select from a range of modules on IoT, business benefits of digital technology, intelligent tools and related soft skills, with the aim of creating

\textsuperscript{106} BMBF (2019), op. cit.
acceptance of digital technologies at an early stage, as well as providing young people with crucial specialist and media skills to meet the needs of Industry 4.0.\footnote{https://www.cedefop.europa.eu/en/news-and-press/news/germany-new-nationwide-training-concept-industry-40}

**Berufsbildung 4.0 (‘VET 4.0’):** The Berufsbildung 4.0 initiative is the scheme under which Germany’s government seeks to respond to evolving skills needs as a result of digital transformation by adapting what is taught in the VET system (Hutfilter et al., 2018, p. 30). To achieve this, the scheme has established inter-company vocational training centres and utilises funding made available through the scheme to invest in digital technologies for VET students to learn to use. This means they can complete their VET qualification with additional skills in using the most up-to-date digital equipment. Berufsbildung 4.0 also incorporates training for VET teachers in digital skills (Hutfilter et al., 2018, p. 30). Germany has taken the stance that improving the workforce’s general employability skills level (cognitive skills) can have positive impacts for digital upskilling in the long term. The rationale is that better skilled employees (literacy and numeracy) are generally in a better position to take advantage of opportunities provided to upskill or reskill in the digital arena (Hutfilter et al., 2018, p. 35).

**Strategy to embed digital competence in the school curriculum:** Informed by the Digital Competence Framework for Citizens (DigComp) framework, in 2016, the Standing Conference of the Ministers of Education and Cultural Affairs presented the Education in the Digital World strategy across schools and vocational education, and institutions of higher education. It is focused on six areas to change digital skills training in schools, from changes in teaching and curricula developments, and the training of educators and teachers, to changes in the legal framework.\footnote{https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2017/KMK-Strategie_Bildung_in_der_digitalen_Welt_Zusammenfassung_en.pdf} A key area identified is the integration of digital skills into the curriculum rather than the introduction of a separate subject dedicated to digital skills. This represents a recurring theme in the German education and VET sectors.

**Alliance for Initial and Continuing Training:** This alliance of key industry stakeholders aims to enhance opportunities for acquiring training and skills that are relevant and appropriate to the contemporary and emerging world of work. It was established by the federal government in 2015 and comprises various key stakeholders including the BMWi, BMAS, BMBF, BA, business and industry representatives, and unions. Other stakeholders include Länder government bodies such as the Conference of Ministers and Senators for Labour and Social Affairs, Conference of Ministers of Education and Cultural Affairs, and Conference of Ministers of Economics. The alliance’s core objective is to help strengthen the ‘dual vocational training and make it more attractive to young...
people and to companies offering training’. The initiatives include a lift in BA registered company-based training places and the running of information events for young people and companies, such as BA’s Training Week.

**Mittelstand 4.0 (‘SMEs 4.0’)—digital production and work processes:** SMEs are a significant component of the German economy, accounting for 99% of businesses and 48% of GDP. The Mittelstand 4.0 initiative was set up to support German SMEs to become digitised, to network and to start using Industry 4.0 applications to maintain their competitiveness. The specific aims of Mittelstand 4.0 include ensuring SMEs have appropriate information about the economic and technological aspects of digital transformation relevant to their business, and enabling them to implement safe digital transformation geared particularly towards the opportunities that digitalisation presents for SMEs within German industry more broadly. With specific regard to digital skills transformation, Mittelstand 4.0 is comprised of 11 competence centres whose role is to provide information and training for SMEs (Probst et al., 2018, pp. 88–89). The information and training is provided through workshops, demonstration plants—simulated production processes—and networks with representatives of the complete value chain.

### 4.7 Concluding Observations

This analysis shows that Germany has highly advanced and comprehensive education and continuing vocational training systems. Its reliance on heavy manufacturing, and thus its need for large numbers of technically qualified workers, necessitates this and explains the degree of policy emphasis evident in the analysis. There are a few key observations:

- One of the strengths of Germany’s approach is that it has used its Industry 4.0 strategy to engender **extensive, dynamic networks of different partners** including industry, as well as social partners and government to make digital transformation of the economy initiatives work—both practically and in terms of funding. Industry is also at the heart of training initiatives via the VET system.

- The above is also because, similar to Sweden, Germany follows the social partnership administration model through which the government is able to coordinate digital transformation efforts with the support of, and engagement between, industry bodies and trade unions. This includes **funding for digital skills training specifically** and support of the dual technical vocational initiative with work placements for students and trainees.

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109 BMBF (2019), op. cit.

The close involvement of industry as co-creators of training, as above, also means that graduates of the education and training system possess **work-ready skills**, since the system of apprenticeship provides the opportunity for gaining work practice.

Similar to Sweden and Singapore, Germany’s approach to **digital skills training is through embedding** specific digital skills and knowledge into the school, higher education and vocational training curricula. In this way all citizens have the opportunity to develop all necessary skills, including digital, that will enable them to take advantage of changing and emerging occupations.

In the same context, lifelong learning is a key and important feature of the German education and training system, with a view that people should be able to flexibly move through new work and employment situations. This is achieved through, for example, the dual technical vocational training system, which enables **effective interfacing between schools, universities and VET, and the Alliance for Initial and Continuing Training**.
5. United Kingdom

5.1 Overview

The UK has been at the forefront of digital innovation and recognises both the challenges and opportunities of digital revolution for workforce skills development. This is informed by a clear understanding of the potential impact on the economy of digital skills shortages. For instance, in 2016, the House of Commons Science and Technology Committee estimated the economic cost of the digital skills gap at £63 billion per year in lost additional GDP. Since then, the UK government has taken proactive measures to keep abreast of the fast pace of innovation in ICTs and to ensure that the supply of digital skills in the workforce meets rapidly evolving employer demands.

The UK government understands that it has an important role to play in facilitating a strong relationship and communication between employers and training organisations to ensure that the curriculum of digital skills qualifications remains up to date. However, there is little evidence of significant and active contribution, particularly from employers, to education and training activities, which leaves the sole responsibility to government. Outside compulsory education, the approach for upskilling people is mostly through government-sponsored employer training. This means that most of those who are outside the labour market—including the long-term unemployed and the displaced—are unlikely to access such sponsorship. One area of significant concern, in this respect, is the lack of digital skills among older citizens, including those in the workforce. To this end, the government has rolled out fully funded digital qualifications for adults following the UK’s current approach based on the vision that no adult that needs basic digital skills will pay for access to training. To support this, it has constituted several mechanisms including a Digital Skills Innovation Fund. To date it has provided £1.1 million for four regional programs aimed at increasing the participation of women, disabled people and people from lower socio-economic areas in tech sector occupations such as data analyst, programmer, cyber security specialist and software developer.

Where the UK has moved ahead of the rest of the countries profiled in this Scan is in its formal legislation of digital skills entitlement through the Digital Economy Act of 2017. This is a much stronger step, which makes digital skills the legal right of all citizens. This is meant to ensure that all citizens have the necessary basic skills to benefit from the digital economy. Whether and how this will be implemented is yet to be fully tested.

At a Glance

<table>
<thead>
<tr>
<th>Total population 2019</th>
<th>66.65 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total workforce 2019</td>
<td>32.8 m</td>
</tr>
<tr>
<td>Unemployment rate 2019</td>
<td>3.8%</td>
</tr>
</tbody>
</table>

Key industries
- Finance and banking
- Information technology
- Construction, oil and gas
- Metals, chemicals, coal, pharmaceuticals
- Aerospace, shipbuilding, electronics and communications equipment, food processing, tourism.
Over the past decade, the UK has commissioned several reviews to assess its position and challenges for lifelong learning as a pathway for economic growth, productivity improvement and innovation. Guided by both the UK’s Industrial Strategy and Digital Strategy, one of the reforms is to develop a lifelong learning strategy that brings together education, health, justice, employment and other services in a coordinated effort.

5.2 Key Policies and Strategies

The UK has formally legislated for digital skills entitlement in the Digital Economy Act of 2017. This involves giving adults with no or low digital skills access to fully funded education and training in digital literacy and related skills. This legal entitlement is similar to the UK’s approach to numeracy and literacy (English language), which are considered foundational skills. It is widely agreed that foundational digital skills facilitate entry into various pathways, including further study, employment and, ultimately, improvement in everyday life outcomes.

The enactment of the digital skills entitlement legislation forms part of the broader UK Digital Strategy, which has seven pillars: 1) world-class digital infrastructure; 2) broadening access to digital skills; 3) facilitating growth in digital start-ups; 4) fostering the ability for British businesses to adopt and tap the potential of digital technologies; 5) safeguarding the use of the internet from cyber risks; 6) expanding the government’s scope to deliver more of its services online; and 7) ensuring that people’s privacy and personal data are adequately protected to engender confidence in the use and application of digital technologies.

Unlike in the Singapore and Sweden cases, the UK has a decentralised setting for the development of digital skills, with different aspects and responsibilities spread across various government departments and agencies; each with some involvement in ensuring that the supply of digital skills meets the evolving demands for digital skills from employers. However, the Department for Digital, Culture, Media and Sport has overarching responsibility for the digital economy in terms of setting policy, while the Department for Education oversees the provision of education to children and adults, and regulates training organisations in the vocational education sector. The Education and Skills Funding Agency (ESFA) is tasked with funding education and skills for children, young people and adults. The Department for Business, Energy and Industrial Strategy contributes to policy settings for the digital economy on an industry-by-industry basis. The Office of Qualifications and Examinations Regulation regulates

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111 https://www.gov.uk/government/topical-events/the-/uks-industrial-strategy
qualifications, examinations and assessments in England, including vocational and technical qualifications.

The Digital Skills Partnership (DSP) has been set up to facilitate collaboration among key stakeholders, including government, business, unions and other not-for-profit organisations. It has three key aims: 1) delivering digital skills programs to disadvantaged and under-represented groups; 2) helping small businesses and not-for-profits to upskill their staff and increase their digital capabilities; and 3) supporting schools to ensure that they have teachers who have the knowledge to teach digital skills. The DSP stakeholders include the following:

- Departments for (a) Business, Energy and Industrial Strategy (b) Digital, Culture, Media and Sport (c) Education (d) Work and Pensions and (e) Ministry of Housing, Communities and Local Government;
- private companies such as Google, Microsoft, Lloyds and Barclays;
- community organisations such as the Federation of Small Business and the Good Things Foundation; and
- academia, for example, the Oxford Internet Institute.

The policy focus remains on establishing an industry standard for foundational digital literacy and ensuring that those studying advanced and specialist digital qualifications are better equipped with up-to-date technical skills as well as soft skills such as commercial acumen and communication skills.

5.3 Lifelong Learning

In comparison with the other cases examined here, the UK is the weakest with regard to lifelong learning. Perhaps as a result, the 2019 Consumer Digital Index found that 11.9 million people (22% of the population) lack the digital skills needed for day-to-day life, and more than half of UK employees (53%) do not have the digital skills needed for work.\textsuperscript{113} This has driven a concerted push by the UK government to prioritise the importance of foundational digital skills alongside literacy and numeracy as fundamental knowledge that all citizens should have.\textsuperscript{114}

According to the OECD, 50% of people with no ICT experience in the UK are unemployed.\textsuperscript{115} One of the challenges identified in upskilling the workforce for

digitisation is the existing lack of a culture of learning. Consequently, larger numbers of workers will need to undertake significant upskilling and reskilling during their careers to ensure that their skills keep abreast of employer demand. To address this barrier, some experts have called for a new right or entitlement for employees to have paid time off for training, and that shorter and more flexible qualifications be available for existing workers. This is broadly consistent with the recommendation of the Aagar Review for a lifelong learning loan allowance, which would be made available for tuition loans at qualification Levels 4, 5 and 6, to adults over the age of 18 years, without a publicly funded degree. It would be designed to facilitate part-time study, retraining, modular and ‘second chance’ learning.

The Government Office for Science (GOS) has drawn attention to the fact that barriers to lifelong learning reflect and contribute to inequalities in society; literacy and numeracy in the UK is either around or slightly below the average of international standards, and lifelong learning is skewed towards wealthier and younger groups. Against this backdrop, the GOS draws attention to the importance of promoting a culture of lifelong learning as a pathway for economic growth, productivity improvement and innovation. Guided by the government’s Industrial Strategy and Digital Strategy, one of the reforms the UK is considering is to develop a lifelong learning strategy that brings together education, health, justice, employment and other services in a coordinated effort.

It is estimated that the aggregate qualification level of the workforce has improved significantly in recent years. The percentage of adults qualified to Level 4 and above has nearly doubled since 2002 and the share of adults not qualified to Level 2 halved over the same period. Despite this, around 13% of the adult population still is not qualified to Level 2.

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5.4 Funding for Digital Skills Development

As in the other case countries studied, including Singapore, Germany and Sweden, the government of the UK remains the major underwriter of education and training. For example, the ESFA is tasked with funding education and skills for children, young people and adults. It oversees the distribution of £58 billion in funding for the education and training sector. In addition, the Department for Education and NESTA—an innovation foundation based in the UK—announced the Career Tech Challenge, which is a £5.75 million program designed to fund innovative projects that offer digital solutions to future proofing the jobs and occupations likely to be most susceptible to technological upheaval.121

5.4.1 Review of Publicly Funded Digital Skills Qualifications

In its review, the then Skills Funding Agency (SFA) sought to address the question of how public funding of digital skills qualifications could ensure that training was relevant and able to equip the workforce with digital skills that employers need (SFA, 2016).

A key finding of the report is that there needs to be greater clarity and understanding around the definition of digital skills to clearly identify training needs and allocate appropriate funding. To that end, the SFA (2016) grouped digital skills into three categories:

- Basic or foundational skills that everyone should have access to at no cost. These are designed to give learners basic, fundamental skills for digital literacy.
- General skills that most of the workforce will need to have. The SFA does not offer a description of these skills but Burning Glass Technologies (2019) suggests that a working knowledge of productivity office software is necessary for most white-collar roles across all industry sectors (see Section 5.5).
- Advanced or specialist skills that ICT professionals require.

Each of these categories would be associated with a set of qualifications and/or accreditations, with achievement in the foundational category necessary to progress to training for a qualification or accreditation in the general skills category.

The proposed definition of digital skills is as follows:

The very broad set of skills that individuals need in order to understand, use or create the software and services we all access through devices such as computers, tablets and ‘smart’ phones.

One of the recommendations of the review was to emphasise the crucial importance of digital literacy alongside literacy and numeracy. The SFA was replaced in 2018 by the ESFA.

121 https://www.nesta.org.uk/project/careertech-challenge/
5.4.2 Adult Learning Technology Fund

NESTA and the UK Department for Education have co-launched the Adult Learning Technology Fund. This represents a £5.75 million partnership designed to improve the accuracy and efficacy of, and access to, careers guidance. The fund will also be used to improve the accuracy of forecasting skills demand, drawing on the skills taxonomy for the UK developed by NESTA based on data mining millions of online job ads.¹²²

What is interesting as a point of difference from the Singapore, Germany and Sweden cases, is the lack of notable private sector financial contribution towards skills development generally. Unlike in the command economy in Singapore where the state obligates private companies to actively contribute towards skills development both financially and in-kind—and in Sweden and Germany where companies are obligated, under the social partnership contracts, to support education and training in the same way—the UK, like Australia has no such arrangements or obligations for private sector contribution. Education and training therefore remains the sole responsibility of government.

5.5 Digital Skills Assessment and Recognition

It is estimated that digital skills—that is, a good working knowledge of productivity office software such as word processing and spreadsheet programs—are almost universal requirements; they are necessary for around two-thirds of UK Standard Occupation Classification groupings and account for over 80% of online job ads.¹²³

The importance of technical knowledge around the use of digital technologies should not be underestimated, but there is a growing body of research pointing to the importance of skills complementary to digital skills, such as problem solving and communication skills, as well as critical foundational skills such as literacy and numeracy.¹²⁴

The digital training qualification will be made up of two components: essential Digital Skills Qualifications (ESDQs) and Functional Skills qualifications (FSQs). The ESDQs have been created around five core skills or competencies: using devices and handling information; creating and editing; communicating; transacting; and being safe and responsible online. The FSQs are designed to ensure that the

skills learnt are relevant to the workplace and everyday life. New digital FSQs are being developed for teaching in 2021.

### 5.5.1 Entitlement to Basic Digital Skills

Flowing from the establishment of [digital skills entitlement](https://www.gov.uk/government/publications/essential-digital-skills-framework), the UK government will roll out fully funded digital training and qualifications for adults aged 19+ years with little or no digital skills, from August 2020. Based on a new essential digital skills framework and associated standards for essential digital skills, training will serve as a foundational pathway to future work opportunities.125

As part of the approach, the government is reforming basic digital qualifications by introducing new essential digital skills qualifications and new Digital FSQs. The five core digital foundation skills are using devices and handling information; creating and editing; communicating; transacting; and being safe and responsible online.

### 5.5.2 Shadbolt Review of Computer Sciences Degree Accreditation and Graduate Employability

The 2016 Shadbolt Report argues that the development of computer science specialists is necessary to facilitate the UK’s participation in the digital revolution.126 Specifically, the report examines accreditation and how it contributes to employment outcomes. The review underlying the report sought to investigate the high rates of unemployment among newly graduated computer scientists with anecdotal feedback from employers of a digital skills shortage.

The report is frank about its assessment of a digital skills gap based on an appraisal of employers’ responses to surveys. It suggests that employers are divided on how to improve the job readiness and relevant skill sets of computer science graduates. According to the report, some employers believe that graduates’ technical skills are sound but that they lack soft skills such as communication and commercial acumen, while other employers consider that more work experience is necessary.

There is little consensus on the technical skills that graduates should have. Some employers believe that foundational principles are important and that more applied skills and new technologies can be learnt on the job, while other employers consider it more important for graduates to be abreast of the latest technological trends. The report highlights that the ability to evaluate and

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measure a digital skills gap among computer science graduates is challenging against the backdrop of a rich diversity of opinions around what skills matter.

The report recommends that computer science students be taught core foundational knowledge listed in the Association of Computing Machinery model curricula and that this be combined with relevant work experience to best facilitate the learning of necessary skills and positive employment outcomes.

5.5.3 United Kingdom Report of the Independent Panel on Technical Education

The Independent Panel on Technical Education was established in November 2015 by the Minister for Skills on behalf of the Secretaries of State for Education and for Business, Innovation and Skills. The UK government has implemented all 34 recommendations of what is generally referred to as the Sainsbury Report.

Some of the recommendations relate to the development of a more coherent and consistent model of technical education that facilitates the learning of technical knowledge and skills necessary to gain skilled employment. It is recommended that employer-designed standards are crucial to an effective system of technical education.

The UK has eight qualification levels, which, like the Australian Qualifications Framework, represents a hierarchy of qualifications and accreditations. The report recommends a more centralised approach to the provision of qualifications for Levels 2 and 3. The report proposes a new system of technical education around 15 routes be developed in conjunction with the qualification levels, including a digital route, where typical occupations are IT business analyst/systems designer; programmer; software developer; IT technician; web designer; and network administrator.

Like with private sector and community contribution to education and training, assessment and recognition of digital skills is an area where the UK’s approach to digital skills development differs from those of Singapore, Germany and Sweden. The latter countries have sought to embed digital skills as an integral part of existing training for essential employability skills, instead of seeking to develop and credential digital skills separately.

5.6 Notable Initiatives for Digital Skills Development

5.6.1 Building a Digital-ready Workforce—National Health Service

The Topol Review estimated that within two decades, 90% of all jobs in the UK National Health Service (NHS) will require an understanding of digital technologies (NHS, 2019).127 The NHS remains focused on improving the digital

skills of healthcare workers in England through the Building a Digital Ready Workforce Program (DRWP), including offering foundational digital literacy to workers who have limited understanding and knowledge of digital technologies. The Topol Review encourages NHS organisations to invest in adequate training for their employees to develop specialist skills. The DRWP includes the development of the NHS Digital Academy:

designed to provide specialist IT training and development support to 300 senior clinicians and health managers, with the aim of building the next generation of chief information officers (CIOs) and chief clinical information officers who can help drive through the digital transformation the NHS requires.\textsuperscript{128}

### 5.6.2 Shaping Tomorrow’s City Today—Digital Skills Strategy 2018–2023

The City of London has a comprehensive digital strategy, the Digital Skills Strategy 2018–2023. The strategy sets out a vision, approach and commitment to digital skills from 2018 to 2023, and guides digital skills work within the organisation as well as the community, industry and education sectors. The strategy is in part informed by the community and in part by the Corporation’s children’s services, education, and economic development teams.

This strategy prioritises the three pillars of digital skills activities:\textsuperscript{129}

- Digital competitiveness: focused on working with businesses to explore ways to support digital innovation and enterprise; fill digital skills gaps and shortages identified by businesses; and prevent and safeguard against cyber-attack and cyber terrorism.
- Digital creativity: focused on working with businesses, educators and civil society to raise educational aspirations and attainment in terms of digital skills; and prepare learners for the jobs of the future in terms of the necessary digital skills, behaviours, attitudes and competencies.
- Digital citizenship: focused on working with individuals and communities to address barriers and gaps to improve access and participation; build digital skills to connect capital, enable positive transitions and provide advice and support; and improve cyber, digital and financial inclusion and safety.

### 5.6.3 Private Sector Initiatives

Unlike the other country cases analysed, the UK seems to have few notable private sector initiatives for digital skills development and lacks a systematic approach to their inclusion as part of addressing the digital skills challenge.

\textsuperscript{128} Ibid.

The few available examples of private organisations being involved are often where upskilling may also confer an indirect or long-term benefit to the business: for example, financial digital literacy may encourage potential bank customers or essential digital skills may grow numbers of ICT users. Such initiatives, where there may be mutual benefit, have been encouraged through the government’s DSP approach and include:

- **Lloyds Bank** has 23,000 Digital Champions currently working with digital skills charities to deliver digital skills training across the community where it is most needed.
- **Barclays** runs the Digital Eagles program to help people develop their digital skills and confidence, so they are able to take full advantage of all things digital, including digital banking.
- **Google** offered five hours of free digital skills training to every person and every small business in the UK seeking to develop their digital skills.
- **Microsoft** announced plans to make available free online digital literacy training to everyone in the UK.
- **Google** pledged to launch its Summer of Skills program in coastal towns across the UK. It will develop bespoke training programs and take Google experts to coach communities, tourist centres and hospitality businesses across the British coastline to accelerate digitisation and help boost tourism and growth in UK seaside towns.
- **Accenture** digital skills program offers free online courses to improve and build digital literacy and skills, including Grow Your Career; Social Media; Web Analytics; Digital Marketing; User Experience; Retail; and Mobile.
- **Microsoft** Apprenticeship Program gives young people a vital first step in their digital technology careers, combining hands-on learning with qualification-led training. Students who complete the apprenticeship receive a recognised apprenticeship qualification.
- **Cisco** Networking Academy has supported some 240,000 people in the UK and helped sponsor seven million people around the world to improve their skills. It has further committed to support a quarter of a million more people in the UK to acquire the necessary digital skills by 2020.

### 5.7 Concluding Observations

As is evident from the above analysis, the UK case differs somewhat from the other three cases analysed, as follows:

- The UK has **legislated for digital skills entitlement** in its Digital Economy Act. It has created a departmental portfolio for digital. As an extension of its Industrial Strategy, it has implemented a national Digital Strategy. One of the pillars of the

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strategy is the recognition that digital skills are essential for prosperity, wages and opportunities for young.

- To counterbalance anxiety around technological unemployment\(^{131}\) and address the digital divide in the community, the UK has rolled out **fully funded digital qualifications for adults with low or no digital skills**. Indeed, having specific digital skills is considered one way in which workers can reduce the personal impact of automation. The two points above in part address calls for a 'reskilling revolution'\(^ {132}\) and the need to draw on the UK workforce’s transferable skills,\(^ {133}\) with recent reports revealing that 53% of UK workers currently do not have the digital skills needed for work and that by 2030, 8% of UK adults will remain 'digitally disengaged'\(^ {134}\) and two-thirds of the workforce could be lacking in the required digital skills.\(^ {135}\)

- A key challenge that the UK faces in developing a digitally savvy and dynamic workforce is that **the VET system is decentralised** compared with countries such as Singapore and Sweden. To bring coherence to provision of digital skills training at national level, the UK has established a DSP. This partnership, which extends from the UK’s **Digital Strategy**, is a coalition of public, private and community sector organisations that work on the ground to improve the digital capability of people and organisations.

- The UK has a new **essential digital skills framework** and associated **standards for essential digital skills** that set out the minimum digital skills and knowledge requirements for a foundational pathway to future study and work opportunities.

- Over the past decade, the UK has commissioned several reviews to assess its position and challenges for lifelong learning as a pathway for economic growth, productivity improvement and innovation. Guided by the **Industrial Strategy** and **Digital Strategy**, one of the reforms the UK is considering is developing a **lifelong learning strategy** that brings together education, health, justice, employment and other services in a coordinated effort.

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\(^{132}\) https://www.techuk.org/insights/opinions/item/16939-looking-ahead-to-the-budget-digital-skills

\(^{133}\) Deloitte (2018), op. cit.


6 CANADA

6.1 Overview

Canada ranks strongly on various global measures of digital readiness and the preparedness of a country’s VET system to help navigate its workforce through a period of technological upheaval. According to the OECD, its workforce is among the five highest ranked countries for generic digital skills. Further, it attains a ranking of 11 in the IMD Digital Competitiveness Ranking for 2019, from a pool of 63 countries. It is noteworthy that Canada’s digital knowledge and readiness is high by global standards against the backdrop of what already has been a period of rapid innovation over two decades and in the absence of an overarching digital policy framework.

Nonetheless, the Advisory Council on Economic Growth (ACEG) asserts that Canada’s skills development infrastructure is not currently equipped to meet the challenge of an acceleration in automation risk and technological upheaval going forward.\(^\text{136}\) To help workers adapt to the prospect of accelerating skills obsolescence, the Canadian government is seeking to achieve three goals: collect up to date and detailed information on how the world of work and skills demand is changing; develop adult training systems that are dynamic, adaptive and resilient; and find ways to support and fund these systems.\(^\text{13}\)

Since the release of an ACEG report in 2017, the government has adopted several of the recommendations in its centrepiece Innovation and Skills Plan (ISP) to strengthen VET. It has developed a platform for lifelong learning that mirrors Singapore’s SkillsFuture Credit through the introduction of the Canada Training Benefit (CTB), which encourages existing workers to upskill or reskill at a college, university or accredited training organisation.

The government’s Skills and Competencies Taxonomy (SCT) is arguably international best practice in its breadth and scope in matching skills and competencies to occupations. It has committed to further improving the quality of labour market intelligence through the launch of Future Skills, which includes integrating digital skills more rigorously into the SCT.

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6.2 Key Policies and Strategies

A key policy instrument in the Canadian government approach to address skills shortages is the ACEG’s Learning Nation: Equipping Canada’s Workforce with Skills for the Future report. In 2017, the Canadian government adopted some of the ACEG and Forum of Labour Market Ministers (FLMM) key recommendations addressing a skills plan for working Canadians. The ACEG is an arm of government established by the finance minister in 2016 to advise on policies promoting strong and sustainable long-term economic growth. The FLMM is made up of federal, provincial and territorial ministers responsible for labour market policies and programs and is co-chaired by the federal government (Employment and Social Development Canada [ESDC]).

6.2.1 Innovation and Skills Plan

The centrepiece of the government’s policy approach to address workplace skill acquisition is the ISP, designed to ensure that the workforce in Canada has the skills and opportunity to develop their skills to meet the evolving demands of employers across the digital and other economic sectors.\(^\text{137}\)

In its ISP, the government makes a number of commitments around skills including making more training opportunities available to more Canadians; lifting the number of people participating in work-integrated learning; encouraging business investment in training; and growing the number of Canadians with Science, Technology, Engineering and Mathematics (STEM), digital and computer coding skills—particularly among disadvantaged groups.

As part of the ISP, the government also announced measures to increase the amount and quality of labour market intelligence around the evolving demand for skills and occupations through the launch of Future Skills,\(^\text{138}\) and increase funding to make it easier for working adults to retrain, including through the provision of the CTB.

6.2.2 Future Skills

The ACEG recommends the creation of a Future Skills organisation (originally conceived of as the Future Skills Lab) to standardise and systematise the collection of labour market data and information relevant to evaluating the supply and demand for skills.\(^\text{139}\) Future Skills is made up of the Future Skills Council and Future Skills Centre, with the following roles:

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\(^{139}\) https://www.voced.edu.au/content/ngv%A76097
• The council is designed to give advice on skills demand and other workforce developments to the relevant minister and complement the work of the Labour Market Information Council (LMIC). The ACEG envisaged that the Future Skills Council would work closely and collaborate with the LMIC.

• The centre is an independent research agency that undertakes research on skills assessment and development. It is co-managed by three partner organisations: Ryerson University, the Conference Board of Canada and the non-profit organisation Blueprint ADE. The centre is currently undertaking research on bridging the skills gap in Canada.140

6.3 Lifelong Learning

Canada has several instruments that encourage participation in lifelong learning.

6.3.1 Lifelong Learning Plan

Canada has instituted a Lifelong Learning Plan (LLP).141 The LLP allows Canadians with registered retirement savings plan to withdraw up to CA$20,000 to finance full-time training or education for themselves, or their spouse or common-law partner. Participants in LLP have up to 10 years to make repayments, which are at a rate of 1/10 of the total amount withdrawn per year until the full amount is repaid.

6.3.2 Canada Training Benefit

In 2019, Canada also created the CTB, designed to facilitate existing workers to upskill and reskill.142 In this respect, it has the hallmarks of Singapore’s SkillsFuture Credit. The CTB has three dimensions: a tax credit to give workers money to help pay for training; income support during training; and job protection so that they can take the time they need to keep their skills relevant and in demand:

• Training credit: Eligible workers between the ages of 25 and 64 years would accumulate a CA$250 annual credit balance, up to a lifetime limit of CA$5,000, to be used to refund up to half the costs of taking a course or enrolling in a training program.

• Employment insurance training support benefit: This will provide workers with up to four weeks of income support through the Employment Insurance (EI) system. This benefit will help workers on training leave and not earning their regular income to cover their living expenses.

• Leave provisions: This ensures that workers have a job to return to at the end of their training.

140 https://www.conferenceboard.ca/research/bridging-canada's-skills-gap?AspxAutoDetectCookieSupport=1
141 https://www.canada.ca/en/revenue-agency/services/tax/individuals/topics/rsps-related-plans/lifelong-learning-plan.html
Participants have the flexibility to engage in occupational skills training with colleges, universities and approved eligible institutions. Although the program is not confined to digital skills development, it is likely that many participants will avail themselves of courses that either focus on, or have a component of, digital skills learning in light of growing demand for digital competencies.

6.3.3 Canada Job Grant

The Canada Job Grant, introduced in 2013, offers employers a training subsidy for their workers. It covers two-thirds of the cost of training with a registered training organisation, with the employer needing to fund the other third. The maximum amount is CA$10,000 per grant.

6.3.4 Labour Market Transfer Agreements

A key pillar in Canada’s adult skills development system are Labour Market Transfer Agreements, which have historically offered training opportunities to those who have become unemployed and qualify for unemployment insurance. The training programs have been designed to offer participants opportunities to reskill and/or upskill to facilitate their re-entry into the workforce. The skills training programs offered include employment counselling and services; training to improve levels of literacy; essential and work-related skills; upskilling for those precariously employed and underemployed; and needs-based services to strengthen the impact of skills training. They are funded by the federal government and administered by the provinces.

6.4 Funding for Digital Skills Development

Aligned with the ISP, Canada has earmarked funding for development or training specifically for digital skills, as well as for VET more broadly.

6.4.1. Funding for Digital Skills

Through its Digital Literacy Exchange program, the government is investing CA$29.5 million from 2018–19 to 2021–22 to support the development of fundamental digital literacy skills for Canadians, particularly under-represented groups, so that they have the necessary digital tools, access and skills development opportunities to participate in the digital economy.

Under the Digital Skills for Youth program, the government offers wage subsidies and funds to cover training and administrative costs to employers that create digital/IT-related jobs for youth; that is, recent post-secondary graduates aged

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143 http://www.ic.gc.ca/eic/site/102.nsf/eng/home
<30 years. The program helps to develop digital and soft skills through work and training.

Further, because of Canada’s cultural roots and history, a social partnership model between employers and trade unions has not emerged. The absence of such a partnership contributes to the fact that collaboration between employers and VET organisations in Canada is limited compared with other nations included in our international scan, notably Germany and Sweden. Consequently, funding for the VET system in Canada is largely sourced from government, with limited funding for training coming from employers or industry bodies. It is estimated that an additional CA$15 billion of annual investments in adult skills development will be necessary to navigate the rapidly changing climate for skills demand from employers (ACEG, 2017).

6.4.2 Funding for Individual Programs

Historically, Labour Market Development Agreements (LMDAs) have provide EI-funded skills training and employment assistance for those out of work. In the ISP, launched in 2017, the government announced that the criteria for participation in LMDAs would be broadened beyond the unemployed to give more members of the workforce the ability to retrain, build and expand their range of skills, and become job ready. Government spending on these LMDAs is approximately CA$2.5 billion per annum (ACEG, 2017).

The government announced the investment of CA$1.7 billion over five years, and CA$586.5 million per year ongoing to fund the CTB. In 2018, the government committed an investment of CA$225 million over 4 years, and CA$75 million per year thereafter in Future Skills to better understand current and future skills demand, and develop, test and evaluate new approaches to skills development (see Section 6.5.3).

6.5 Digital Skills Assessment and Recognition

As early as 2012, the Information and Communication Technology Council (ICTC) called for the development of national standards for digital literacy.¹⁴⁵ They envisioned that this would be comprised of three key dimensions. The first is the creation of a reference scale to evaluate people’s varying levels of digital literacy, ranging from level 1 (basic) to level 5 (advanced). Second, benchmarks for digital literacy would need to be developed across occupations; for instance, a software engineer would need to have an advanced level of digital knowledge. Third, education and training programs would be developed to

cater to the different benchmark requirements of digital literacy across occupations.

There still appears to be little agreement on the actual skills and competencies that contribute to the digital skills gap in Canada and therefore little consensus on how to address the gap, particularly given that the digital skills required for many occupations remain poorly understood (Shortt et al., 2020). According to Shortt et al. (2020), the available frameworks on digital skills remain too heterogeneous. Further, the authors of a study from Ryerson University note that ‘there is limited interrogation of the claims about skill gaps or an empirical investigation of perceptions about required skills, available skills and future skill requirements’. Against this backdrop, the Office of Literacy and Essential Skills (OLE) has developed an important skills framework to guide policy makers, employers and workers.

6.5.1 Office of Literacy and Essential Skills

The OLES aims to help adult Canadians improve their literacy and essential skills to better prepare for, and get and keep a job; and adapt and succeed at work. It developed a list of nine essential skills that are required for life, learning and work and has integrated them into employment and training programs, and mapped these essential skills and competencies across more than 350 occupations (essential skills profiles). These essential skills are digital skills/computer use; reading; writing; document use; numeracy; thinking; oral communication; working with others; and continuous learning.

6.5.2 Digital Skills Framework

A study undertaken by WDM-Consultants emphasises the importance of digital skills frameworks to guide policy development and digital skills development. Based on an international review of the relevant literature, the study identified four key clusters of workplace digital skills: foundational skills, transversal skills, technical knowledge, and digital information processing skills. Foundational skills include literacy and numeracy; transversal skills are associated with thinking, problem solving and working with others; technical knowledge includes the ability to use, understand and create with computer software and hardware;

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while digital information processing skills refer to high-level cognitive skills, and include the capacity to use digital tools to identify, access, use and integrate information. The framework developed contains a detailed taxonomy of attributes that fall into each of the clusters. The Digital Skills Framework was validated by a small group of stakeholders representing various economic sectors. This framework is similar to that suggested by the Brookfield Institute.\footnote{Hadziristic, T. (2018), The State of Digital Literacy: A Literature Review, Brookfield Institute, https://brookfieldinstitute.ca/report/the-state-of-digital-literacy-a-literature-review/}

6.5.3 Digital Skills Shortages

The ICTC asserts that Canada suffers from a digital skills shortage based on a range of employer surveys in which respondents communicated difficulties in hiring workers with relevant or adequate digital skills.\footnote{Hadziristic, T. (2018), The State of Digital Literacy: A Literature Review, Brookfield Institute, https://brookfieldinstitute.ca/report/the-state-of-digital-literacy-a-literature-review/} One such survey is the Global Talent Index Report, undertaken by the ICTC, the Hays Global Skills Index and the Canadian Council of CEOs. One problem with this approach to identifying skills shortages is that it is not clear whether the employers surveyed represent a random sample, which is important for drawing statistical inferences. Further, this meta-survey approach does not stipulate the types of digital skills (and other complementary skills) that are experiencing a shortage.

Separately, the ICTC estimated that as at 2016, there were around 880,000 ICT specialists employed in Canada, with 55% of those working in non-ICT industry sectors.\footnote{Hadziristic, T. (2018), The State of Digital Literacy: A Literature Review, Brookfield Institute, https://brookfieldinstitute.ca/report/the-state-of-digital-literacy-a-literature-review/} The ICTC projected that by 2020, 84,000 new jobs for ICT professionals would be created. Given estimates of retirements and exits, the ICTC asserted that 182,000 new positions would need to be filled and could not be entirely met by the supply of ICT graduates. However, it did not stipulate how many of those roles it would expect to be filled from the skilled immigration program.

6.5.4 Skills and Competencies Taxonomy

The LMIC was launched by the government in 2017 as a not-for-profit with the aim of improving the quality and timeliness of information about Canada’s labour markets to facilitate better decision making by policy makers, employers and workers. Part of the LMIC’s mandate is to identify any existing and/or prospective skills shortages.

ESDC designed the SCT to facilitate a detailed understanding of the skill requirements of different occupations, thus obtaining a systematic but bottom-up view of aggregate skills demand. It does so by assessing the necessary skills and competencies across occupations and the importance of those skills and competencies within each occupation.
To better understand the changing nature of jobs, and the skills and competencies required across occupations, the LMIC has partnered with Statistics Canada and ESDC to further develop the SCT.

The SCT distinguishes between 47 skills organised into five categories: foundational, analytical, technical, resource management, and interpersonal. It also sets out the competencies—including digital literacy—required across various occupations. Digital literacy refers to ‘the skills needed to understand and use digital systems, tools and applications, and to process digital information’.

This definition is currently organised within the skills category and foundational skills subcategory. The focus of the ongoing work is to develop a definition and framework around digital skills based on nationally and internationally recognised standards, practices and concepts. The ESDC is also undertaking further work with the OLES to better define and integrate the concept of digital skills into the SCT. Based on this international scan of five countries, the SCT could be considered international best practice in terms of its breadth and scope for matching skills and competencies to occupations.

6.5.5 Tapping into Big Data to Identify Skills Shortages in Real Time

Microsoft Research combined with researchers from the Bank of Canada to analyse job search queries using the Bing search engine during 2015–16.

It found that job searches relating to the technology sector—including for occupations such as programmer, data scientist and systems engineer—accounted for 4% of all job searches and were concentrated in geographical areas characterised by higher-than-average household incomes and education (Bank of Canada, 2019).

The process of data mining online job advertisements to obtain valuable information about the evolving demand for occupations and skills (including digital skills) has also been used by NESTA for the UK (see Section 5.4.2). The collaboration between Microsoft Research and the Bank of Canada was for the purposes of a one-off study. Nonetheless, the study and NESTA’s analysis for the UK demonstrates the ability of big data analytics to provide an ongoing assessment of the evolving demand for digital skills.

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153 The Australian and New Zealand Standard Classification of Occupations only matches occupations to levels of accreditation consistent with Australian Qualification Framework levels.

6.6 Notable Initiatives in Digital Skills Development

6.6.1 Workplace Digital Essential Skills in Rural Small Businesses

Many employees with low literacy in small and medium-sized organisations in rural areas are known to lack digital skills and have little access to basic digital skills training that would allow them to fully participate in an increasingly technological economy.

The Workplace Digital Essential Skills in Rural Small Businesses is a national pilot project that was administered by the Restigouche Canada Business Development Corporation from January 2012 to March 2016. The original concept was to develop a flexible training model that would increase access to basic workplace digital skills training in small rural businesses that would be suitable for low literacy workers.\(^{155}\)

6.6.1 Advanced Digital and Professional Training Work-integrated Learning Program

The Advanced Digital and Professional Training (ADaPT) program is an employer-driven, work-integrated learning (WIL) skills development and work placement program for recent graduates, run by Ryerson University.\(^{156}\) The program offers graduates from non-ICT-specialist programs the ability to grow their competence around digital literacy, communications and business financials. It is conducted in collaboration with employers and industry partners in the form of a paid work term.

Short work placements with industry partners are an integral part of the program, which has similarities to the dual VET system in Germany and emphasises both theoretical knowledge as taught by vocational schools and practical work skills as taught by companies.

6.6.2 Companies That Outsource Their Workforce’s Digital Skill Development

In the private sector, companies are investing in their employees’ human capital by paying for digital skills training with registered training organisations. For example, Google, Royal Bank of Canada, Uber and Deloitte use the digital learning company BrainStation\(^ {157}\) to offer courses to their staff in design, data and development. Other companies use Udacity\(^ {158}\) for instance, to upskill or reskill

\(^{156}\) https://www.ryerson.ca/adapt/
\(^{157}\) https://brainstation.io/
\(^{158}\) https://www.udacity.com/nanodegree?utm_source=gsem_brand&utm_medium=ads_r&utm_campaign=1708167721_c&utm_term=66580286077_sa&utm_keyword=udacity_e&gclid=EAIaIQobChMIv4mv07Hp6A1VEJiYCh1OawXfEAYASAAEgKcPD_BwE
their employees in the areas of data science, machine learning and AI, business and marketing, and web development.

6.6.3 Student Work Placement Program

The Student Work Placement Program gives post-secondary students paid work experience related to their field of study.\textsuperscript{159} ESDC delivers the program through Employment Delivery Partners, who are industry and employer bodies and associations. The partners work with businesses and post-secondary educational institutions to provide wage subsidies to businesses that offer student work placements, and foster relationships and collaborate with educational institutions to recruit students for placement. There are various programs available. The digital program offers wage subsidies for occupations in STEM and business.

6.6.4 Digital Literacy Framework for Canadian Schools

Media Smarts is a Canadian not-for-profit charitable organisation that develops digital and media literacy programs for schools.\textsuperscript{160} It has developed a digital literacy framework for schools based on three key skills: understand, use and create. The framework provided teachers with supporting lessons and interactive resources linked to curriculum outcomes.

6.7 Concluding Observations

Canada and Australia have some important similarities: they have a similar culture and population density; both are resource rich and dependent economies; they have experienced appreciating home currencies during commodity booms, which has hampered the competitiveness and growth of their export-dependent manufacturing sectors; and, up until the coronavirus pandemic, both economies were operating at close to full employment.

Canada, the UK and Australia all rank highly on several global index measures of the quality of their human capital—largely reflecting their strong commitment to education. Their governments are also cognisant of the need to ensure that their VET systems are resilient and flexible enough to equip their workforces with the skills to navigate the growing shadow of automation risk and ongoing technological upheaval.

The Canada scan reveals four key recurring themes associated with the supply and demand for training, in the approaches that can best help existing workers

\textsuperscript{159} \url{https://www.cewilcanada.ca/cgi/page.cgi/Studentworkplacementprogram.html}
\textsuperscript{160} \url{https://mediasmarts.ca/teacher-resources/digital-literacy-framework/use-understand-create-digital-literacy-framework-canadian-schools-overview?gclid=EAIaIQobChMI8Ivy1aDo6AIvJdUrCh2cxwMAEAAYASAAEgJr-fD_BwE}
navigate the rapidly dynamic nature of work and skills demand in an era of digital transformation:

- **Up to date courses with employer input:** They ensure that training courses offered by accredited training organisations are updated to reflect changing industry conditions and the competency and skills requirements of occupations. This requires close collaboration between training organisations and industry bodies. This occurs in all the countries in our international scan but collaboration is stronger in countries with a social partnership model such as Sweden and Germany.

- **WIL:** This approach represents an invaluable bridge between formal learning and work experience, best demonstrated by Germany’s dual track VET system. As above, the social partnership model helps to facilitate WIL. Countries with a more decentralised approach to VET, such as Canada, Australia and the UK, cannot hope to emulate this model outside the existing apprenticeship model. Nonetheless, governments can seek to encourage WIL through financial incentives to employers and industry bodies.

- **Empower workers with information:** Empowering existing workers with up to date and accurate information about the evolving demand for occupations and skills is essential to help them navigate the changing nature of work, particularly if they wish to upskill or reskill. Singapore appears to offer best practice in terms of its Skills Future program. Separately, Canada is investing in organisations and agencies, such as the LMIC and Future Skills Council to undertake detailed and granular analyses of skills demands across occupations and identify skills shortages.

- **Worker incentives to upskill or reskill:** It is important for workers to have cost-effective access to retraining opportunities, which involves two dimensions: the affordability of the course or qualification and the employment earnings forgone either by opting out of the workforce completely for the duration of the retraining or reducing hours worked. CTB and Singapore’s SkillsFuture Credit are designed to provide workers with financial incentives to retrain. In the case of the CTB, workers can do so in the knowledge that they will be able to return to their job once the training is complete. Shared investment could mark the way for other governments to bear some of the financial burden of ensuring that their workforce is digital ready and able to grow to meet dynamic demand requirements from employers.
7 European Union

7.1 Overview

The EU has prioritised digital skills in a range of initiatives and programs. These are manifested in the country-level scans; for example, for Germany, the UK and Sweden. The Digital Single Market offers an umbrella strategy for all things digital. Although this might not directly apply to the Australian case, being a single nation, there are nonetheless several key highlights that provide lessons for Australia. For this reason, we only summarise several relevant strategies.

The EC has adopted the concept of ‘a digital society’ to guide digital transformation across its member states. Unlike a ‘digital economy’, a digital society implies a more holistic view of the necessary measures and changes to ensure that all of society is prepared for the future of society, life and work. The EC’s Creating a Digital Society policy website states:

The EC aims for an inclusive digital society which benefits from the digital single market. Building smarter cities, improving access to eGovernment, eHealth services and digital skills will enable a truly digital European society.

Regarding skills, the EC has determined that around 44% of European citizens do not have basic digital skills and 37% of the general workforce, excluding those in ICT roles, lack sufficient digital skills. Even in the ICT sectors, there is a shortage of people with specialised ICT skills. Although the number of ICT specialists in the EU grew by 500 thousand to reach over eight million, there are currently at least 350,000 vacancies for ICT specialists in Europe. To address this, the Skills Agenda for Europe initiative has been launched, under which the DSJC\textsuperscript{161} was created with the aim of coordinating digital skills development initiatives and programs. Over 43% of Europeans still do not have basic digital skills and cannot fully take part in the digital society.

To facilitate a uniform transition to a digital society in the whole of the EU, the EC has developed, and uses, the Digital Economy and Society Index (DESI) as the main instrument for benchmarking digital transformation across countries to obtain an understanding of digital leaders and digital laggards.


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At a Glance

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<th>Total population 2019</th>
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<td>Total workforce 2019</td>
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<td>Unemployment rate 2019</td>
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<td>No. of member states</td>
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<td>Key industries</td>
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The EC has further developed the **DigComp framework** for digital skills, which is the most comprehensive digital skills frameworks that exists. It underpins many of the activities around digital skills at the levels of (i) education and training; (ii) lifelong learning and inclusion; and (iii) employment.

### 7.2 Policies and Strategies

The overarching strategy for Europe's digital transformation is contained in the ECs **Shaping Europe’s Digital Future Policy**. It adopts a ‘digital society’ approach with the aim that the processes and benefits of the digital transformation include and empower every European citizen. Primarily, there is recognition that the transformation will not happen without an adequately skilled workforce. Central to the transformation is solid workforce digital skills base, as is evident from the focus given to this in the **New Skills Agenda for Europe** initiative, which is discussed next.

#### 7.2.1 New Skills Agenda for Europe

The **New Skills Agenda for Europe** is the overarching skills policy for the region, adopted by the EC in 2016. Under this banner, initiatives are currently being implemented to respond to upskilling and reskilling needs throughout EU member states:

- upskilling pathways: new opportunities for adults;
- **European Qualifications Framework (EQF)**;
- the DSJC (see Section 7.2.2);
- blueprint for sectoral cooperation on skills;
- EU skills profile tool for third-country nationals;
- VET;
- key competencies;
- Europass;
- graduate tracking; and
- analysing and sharing of best practice on brain flows.

Although not solely focused on digital skills, the agenda underscores their importance as essential employability skills, alongside literacy and numeracy. The right to inclusive education, training and lifelong learning are also enshrined in the agenda (EC, 2019c).

#### 7.2.2 Digital Skills and Jobs Coalitions

As a core initiative of the **New Skills Agenda**, the DSJC was created to spearhead digital skills development across the EU. Its stated aim is to, ‘bring together

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163 [https://ec.europa.eu/social/main.jsp?catId=1223&langId=en#upskilling]
Member States, companies, social partners, non-profit organisations and education providers, [to] take action to tackle the lack of digital skills in Europe'.

Its role is to bring together EU member state governments, industry partners and education/training providers (Moueddene et al., 2019, p. 13) to implement actions to upskill and reskill non-ICT workforces in Europe for digital transformation. Its work is guided by four established guiding priorities:

- **digital skills for all**—developing digital skills to enable all citizens to be active in our digital society;
- **digital skills for the labour force**—developing digital skills for the digital economy; for example, upskilling and reskilling workers and jobseekers, and undertaking actions on career advice and guidance;
- **digital skills for ICT professionals**—developing high-level digital skills for ICT professionals in all industry sectors; and
- **digital skills in education**—transforming teaching and learning of digital skills in a lifelong learning perspective, including the training of teachers.

The parties involved have responsibility for training (both online and face to face), accreditation of digital skills, work experience placements/internships and general promotion of the importance of addressing the digital skills gap.

The Action Plan of the DSJC, adopted in September 2018, includes objectives to:

- contribute to the success of the Digital Opportunity Traineeship initiative (as part of the Erasmus+ and Horizon Europe schemes);
- expand EU Code Week to reach 50% of all EU schools by 2020;
- strengthen and initiate connections between pan-European stakeholders;
- lobby to cement funding for digital skills in the EU budget;
- expand membership of the coalitions to include all relevant sectors and stakeholders;
- promote the need for digital upskilling among workforces;
- assist national coalitions;
- enable SMEs to improve acquisition and maintenance of digital skills; and
- raise awareness of existing tools in place to support digital upskilling and reskilling as well as assessment and accreditation of digital skills training.

As part of the DSJC, EU member states were encouraged and supported to each establish their own digital skills strategies by the middle of 2017. These would include setting up their own DSJC nationally, which would be comprised of the relevant stakeholders in each country. In addition, individual member states were encouraged to bring in their own digital skills policies and initiatives under the leadership of the EU DSJC and to utilise New Skills Agenda objectives (EC, 2019c). A Digital Skills Awards program was introduced as a way for the EC to both acknowledge innovative projects taking place under this initiative, and profile
successful activities to enable other member states to learn and exchange ideas.\textsuperscript{164}

7.3 The European Union’s Lifelong Learning Strategy

The EU clearly recognises education and training as essential to an individual’s personal development and building a skilled, trained and flexible workforce. It is considered critical to Europe’s economy and society’s competitiveness and innovation capacity, and is crucial for social equality, cohesion and inclusion. Since 2006, digital competence has been conceptualised as a key competency for lifelong learning.\textsuperscript{165} In 2018, the EC launched the new Digital Education Action Plan 2018–20. Its goal is to (i) scale up the digital readiness of both general and vocational schools; (ii) develop relevant digital competencies and skills for the digital transformation; and (iii) improve education through better data analysis and foresight.\textsuperscript{166}

The EU set itself a target of 15\% adult participation in adult learning by 2020.\textsuperscript{167} In particular, the EU focuses on programs that impart initial education and update skills, so that low-skilled adults gain and maintain employment. Interestingly, participation in adult learning is higher for 25–54-year-olds than for 55–74-year-olds.\textsuperscript{168} The 2019 \textit{Index of Readiness for Digital Lifelong Learning} (IRDLL) for Europe found that Estonia, the Netherlands, Finland, Luxembourg, Malta and Cyprus are leading in terms of using digital technology to support lifelong learning; whereas Germany, Greece and Italy are among the laggards.\textsuperscript{169}

A report on continuous VET offered by enterprises shows that 88\% of firms in the EU employing over 250 employees offer continuous VET to the benefit of 48\% of the employees. However, this decreases with the size of the firm—66\% of firms with 50–249 employees and 48\% of firms with 10–49 employees offer continuous VET, which creates benefit for 37\% and 30\% of employees respectively.\textsuperscript{170}

As a diverse collection of member states, different countries organise training to help adults with low qualifications to improve their level of education. In some instances, a course leads to a specific level such as primary and secondary. In

\textsuperscript{166} https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en
\textsuperscript{167} https://www.europarl.europa.eu/thinktank/infographics/lifelonglearning/index.html
\textsuperscript{168} Ibid.
\textsuperscript{170} https://www.europarl.europa.eu/thinktank/infographics/lifelonglearning/index.html
others, it follows the single structure of the schooling system in that country. For instance, in France, learning for adults is comprehensive and public and there are dedicated national level programs and frameworks; whereas in Greece, initiatives are independent, local and run by private providers—there are no national-level dedicated programs and frameworks.\textsuperscript{171}

The validation of non-formal and informal learning is increasing to certify skills and knowledge. The most common use is the award of partial or full qualifications, followed by credits, exemptions and access to formal programs. At the EU level, the YOUTHPASS certificate validates non-formal and informal learning following participation in an Erasmus+ mobility project.\textsuperscript{172}

Individual countries have adopted a variety of approaches to validation; these typically exist at the national level and take the form of a legal framework, strategy or policy that brings three sectors together: the educational system, the labour market and third sector organisations such as charities or non-government organisations. In some instances, countries have chosen to focus specifically on one or two of the sectors in their arrangements. For instance, Austria, Sweden, Poland and Germany provide full or partial qualifications, whereas Hungary, Croatia and Slovakia offer not qualifications, but credits.\textsuperscript{173}

A resolution adopted by the council on a renewed European Agenda for Adult Learning for the years 2015–2020 highlights the need to increase adult participation in formal, non-formal and informal learning—whether to acquire work skills, for active citizenship or for personal development and fulfilment. Several priority areas were set, including to ‘significantly increase the supply and demand for high-quality provision, especially in literacy, numeracy and digital skills’. It also aims to offer more flexible opportunities for adults to learn, and improved access through more learning at the workplace and through digital means.\textsuperscript{174}

Further to this, the council has adopted a recommendation on upskilling pathways aimed to help adults develop a minimum level of literacy, numeracy and digital skills or a specific upper secondary level qualification (Level 3 or 4 in the EQF).\textsuperscript{175} This pathway is particularly suitable for adults with low levels of skills and without upper secondary education. It works by offering (1) a skills assessment for individuals for upskilling; (2) relevant training to boost literacy, numeracy or digital skills or progress towards higher qualifications to meet labour market needs; and (3) formal validation and recognition of skills. These pathways

\textsuperscript{171} Ibid.
\textsuperscript{172} Ibid.
\textsuperscript{173} Ibid.
\textsuperscript{174} https://ec.europa.eu/education/policies/eu-policy-in-the-field-of-adult-learning_en
\textsuperscript{175} Ibid.
have been implemented particularly in member states with lower numbers of skilled adults, such as Bulgaria, Croatia, Greece, Italy, Poland, Romania and Spain.\footnote{https://ec.europa.eu/social/main.jsp?catId=1224}

### 7.4 European Funding for Digital Skills Development

In support of member states and their digital transformation efforts, the EC funds various schemes and initiatives. The focus is the whole of economy and society transformation, with workforce upskilling being a key focus. For example, under the Digital Europe program, €9.2 billion has been set aside for use in priority areas such as digital skills, cyber security, AI and supercomputing, culminating in broad-ranging implementation of digital technology throughout the economies and societies of the EU (EC, 2019a). Under this scheme, €700 million has been allocated to expand the digital talent pool by around 256,000 people who will be able to use the latest technologies throughout Europe. This will be done by:\footnote{https://ec.europa.eu/digital-single-market/en/policies/digital-skills}

- Offering 160 master degrees in novel digital technologies. These programs have been developed with stakeholders such as European centres of excellence in areas including high-performance computing, cyber security and AI. The aim is to train 80,000 digital specialists.
- Establishing training in advanced digital skills via specialist courses, to enable SMEs to adopt digital technologies. This will potentially assist approximately 150,000 individuals in the workforce and those seeking employment.
- Providing 35,000 employment assignments in workplaces and centres that are pioneering the use of digital technologies.

The EC also provides funding for research and development in regard to various ways of enhancing the region’s digital transformation. A scan of recent research funding opportunities, under the Shaping Europe’s Digital Future Strategy,\footnote{https://ec.europa.eu/digital-single-market/en/newsroom-agenda/funding-opportunity/digital-skills-and-jobs-coalition} reveals a strong focus on digital skills. Some of these include calls for proposals to:

- design, build, enrich and maintain the European Digital Skills and Jobs Core Service Platform (2019–2020);
- develop support services for the scaling up of the DSJC and the Digital Opportunity Traineeships (2018); and
- design training solutions to improve digital skills and employability of people working for small businesses (2017).

\footnotesize
\begin{enumerate}
  \item \footnote{https://ec.europa.eu/social/main.jsp?catId=1224}
  \item \footnote{https://ec.europa.eu/digital-single-market/en/policies/digital-skills}
  \item \footnote{https://ec.europa.eu/digital-single-market/en/newsroom-agenda/funding-opportunity/digital-skills-and-jobs-coalition}
\end{enumerate}
Apart from funding available directly from the EC there are initiatives involving the EC and industry to provide similar funding. An example is the Connecting Europe Facility, co-funded by the EU, ‘to support the design and delivery of Master programmes specialised in digital domains to be disseminated via the Digital Skills and Jobs Core Service Platform’.

The program has a total budget of €6.5 million with the applicant (which can include education and training centres, research institutions, SMEs and unions) required to contribute up to 75% of the total amount requested. Unlike the general workforce, this program targets advanced digital skills development to address the shortage of specialised digital skills in AI.

### 7.5 Digital Skills Assessment and Recognition

Unlike the other cases studies in the scan, the EU is neither an individual nor a single country, so there is not one single digital skills assessment and accreditation tool or system to discuss. However, it has adopted various frameworks that help member states to assess the strength of their national skills bases. The overarching framework, in this respect is the EQF, which is, ‘a common European reference framework whose purpose is to make qualifications more readable and understandable across different countries and systems’.

The eight levels of competence run from basic, Intermediate, to advanced, and finally to highly specialised, and contain detailed descriptions and examples of use for each (Carretero et al., 2017, pp. 19–20). The EQF is multi-layered and covers level of skills and complexity of the task, how the individual is able to work autonomously and the cognitive domain in which the individual can make sense of, and reflect on, their digital skills. Thus, with specific regard to digital skills, it captures different levels of maturity. This EU contribution to framing, understanding and building strategy around digital skills is perhaps the most widely applied globally. The 2017 and 2019 reports are well cited in both academic and practitioner reports (combined they have almost 1,000 citations).

#### 7.5.1 European Digital Competence Framework for Citizens

Complementing this overarching framework with specific regard to digital skills, the EU has also adopted the DigComp to underpin policy around digital education and training practices throughout the EU and access to lifelong learning; and respond to changing digital skills needs in the economy and wider

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179 [https://www.euro-access.eu/calls/european_platform_for_digital_skills_and_jobs_](https://www.euro-access.eu/calls/european_platform_for_digital_skills_and_jobs_)

society (Carretero et al., 2017; Ferrari, 2012). DigComp has been used for multiple purposes, particularly in the context of employment, education and training, and lifelong learning, and there is evidence of its application for (i) policy formulation and support (including at the EU level); (ii) informing education, training and employment; and (iii) assessment and certification. Despite this, research on the DigiComp framework suggests that its level of sophistication and underlining complexity make it a challenge for organisations to adopt and apply (Iordache et al., 2017).

In alignment with the EQF, the DigComp framework is structured along the lines of the eight levels of competence in the EQF but with specific focus on digital skills (Carretero et al., 2017). The most recent report on this framework outlines the breadth of its implementation and shows how it has informed activities in three domains: (i) education and training; (ii) lifelong learning and inclusion; and (iii) employment. Examples of initiatives in each of the domains are provided in Table 2 alongside five levels of implementation.

DigComp, in addition to informing EU and national initiatives, is a reference point for the Europass CV for (self) assessment, validation and recognition of digital skills (an approach to making education, work experience and skills transparent internationally). The DESI is another tool available to EU policymakers to inform policy decisions on digital transformation and is based on the DigComp framework.

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183 Kluzer and Priego (2018), op. cit.

Table 2: The DigComp Framework

<table>
<thead>
<tr>
<th>Domain</th>
<th>Education and training</th>
<th>Lifelong learning and inclusion</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence assessment</td>
<td>Student Competence Framework by the Slovakian Education Institute</td>
<td>Your journey to digital: the upskilling platform for unemployed people in France, Ireland, Romania and Italy</td>
<td>INCODE 2030: Enhancing digital competence in Portugal</td>
</tr>
<tr>
<td>Training trainers</td>
<td>Digital Competence Framework for Teachers in Norway</td>
<td>Professional digital competence profiles in Spain</td>
<td>Digital skills self-assessment tool for employees and managers in the Dach region Germany</td>
</tr>
<tr>
<td>End user learning</td>
<td>5 Days of Digital Literacy: online course at Anglia Ruskin University, UK</td>
<td>Curriculum for e-facilitators and unemployed youth in Spain, Germany, Hungry and Switzerland</td>
<td>Digital Innovations for Growth Academy: training enterprise trainers and educators</td>
</tr>
<tr>
<td>Adaptation and specification</td>
<td>Samsung Digi Pass for vocational students in Estonia</td>
<td>Pane E internet: curriculum and learning resources for basic digital literacy in Italy</td>
<td>Prodiego: learning platform for employment services staff in Italy</td>
</tr>
<tr>
<td>Recognition and certification</td>
<td>Digital Competence Portfolio for Teachers in Spain</td>
<td>New digital competence certification system in Spain</td>
<td>Elene4work: mapping soft digital skills of students and young workers across Europe</td>
</tr>
</tbody>
</table>

7.5.2 Digital Economy and Society Index

The DESI is a monitoring instrument that allows the EU to evaluate progress and performance among its members against the Digital Single Market policy, which relates to digital marketing, ecommerce and telecommunications. As well as showing the overall progress of the EU towards digital transformation goals, the index breaks information down to member state level so that countries can learn from each other’s policy successes and failures. Individual countries can also understand where they need to improve and compare their progress with others.

185 Ibid.
over time. The DESI focuses on several areas: connectivity; human capital; use of internet services; and integration of digital technology and digital public services.

Human capital is the dimension of the index that captures internet user skills and advanced skills and development (EC, 2019b). As such, it is possible to see where problems lie in relation to digital skills deficits; which countries in the EU are performing well and which not so well in digital inclusion; and where more funding needs to be directed. A valuable source of information, the DESI enables EU member states to learn from one another for the benefit of all. Indeed, many of the disparities between individual member states demonstrated by the index reflect historic disparities that are not confined to digital transformation and digital skills. However, given the significance of digital skills to the future economy of Europe, the DESI is a very useful initiative, especially in a multi-jurisdictional forum like the EU.

7.6 Notable Initiatives in Digital Skills Development

7.6.1 European Framework for Digital Literacy

Stemming from a project commencing in 2005, the European Framework for Digital Literac (DigEuLit) sought to arrive at a definition and framework for digital literacy to be used in Europe, to facilitate policy. Despite its age, the DigEuLit definition continues to be influential in informing definitions that are vital to the appropriate response to digital transformation in the EU and further afield, including in Australia.186

7.6.2 Women in Digital Strategy

The Women in Digital Strategy (WiD) was introduced to erode gender stereotypes that prevent women from pursuing an ICT career; to raise awareness of the need for digital skills and training among different cohorts of women; and lobby and support more women to become tech entrepreneurs.

The Declaration of Commitment to Women in Digital was signed on Digital Day, 9 April 2019. All EU member states plus Norway signed up to this statement of intent with the objective of addressing the under-representation of women in the tech industry by making it a political imperative cemented in four aims:

- Each EU member state must formulate a national WiD plan.
- Girls and Women in ICT Day will be marked across the EU on the same day.
- Stakeholders across multiple sectors of the economy (public, private and not-for-profit organisations) should pledge to implement a coherent strategy to respond

to the issue of gender inequities in digital access, digital literacy and lack of representation of women in the tech industry.

- Evaluation of progress made on addressing the gender divide in the digital economy and society should be instigated and improved in an ongoing manner with a view to establishing national targets for WiD. To facilitate this, the Women in Digital Scoreboard was introduced to monitor progress in getting women more involved in the digital economy and closing the gender gap that currently exists in relation to women’s participation in ICT. The WiD focuses on three key areas: internet use; internet user skills; specialist digital skills; and employment.187

### 7.6.3 Digital Single Market

The **Digital Single Market** is a directive that seeks to transform the existing EU single market model into one that is fit for the digital age and fully utilises the benefits of digital technologies, such as in the area of cross-border e-commerce.188 Many of the other policies and strategies that seek to address digital skills needs have at their core the primary objective of maximising the potential of the Digital Single Market ideal. The Digital Single Market has **three areas of focus**: (i) access to new technologies; (ii) allowing the environment for the potential of digital technologies to be fully realised; and (iii) an economy/society that enables all Europeans to thrive in a digital economy and promotes digitally inclusive societies.

As part of this, the EC has promoted initiatives focused on building digital skills for the workforce and consumers; modernising education across the EU using new digital technology for learning; recognising and validating skills; and anticipating and analysing skills needs. This includes the following initiatives:

- **European Social Fund Plus** focuses on providing a helping hand to youth and social inclusion by improving the quality, effectiveness and labour market relevance of national education and training systems, to support the acquisition of key competences, including digital skills and a focus on upskilling and reskilling.
- **The European Global Adjustment Fund** supports training, with a digital skills component, to help laid-off workers find another job or set up their own business.
- **Erasmus+**, like other Erasmus schemes, supports digital learning from early childhood to vocational education and university education, with a focus on digital skills through cross-border experiences.
- **Horizon Europe** is the flagship European PhD and post-graduate funding program that provides €100 billion research and innovation funding that covers all digital-related fields. As part of the Horizon Europe and Erasmus+ schemes,
students can strengthen their skills in fields like cyber security, big data, quantum technology and machine learning; or their digital skills for business in areas like web design, digital marketing and software development, through funded internships with businesses.

- **The EU Digital Assembly** is an annual event that bring together representatives from European governments and other important stakeholders in the EU digital space to discuss the EU’s digital policies and the likely ramifications of any changes to the digital economy and society since the previous year. The 2019 EU Digital Assembly included discussions under the themes Digital 4 Planet, Digital 4 Leadership, Digital 4 Jobs and Digital 4 Communities.¹⁹²

7.6.4 **European Digital Skills and Jobs Core Service Platform 2020**

There has been a proposal to design a platform that will become a one-stop shop for digital skills training in Europe. The idea is at the ‘tendering to design it’ stage.¹⁹³

7.7 **Concluding Observations**

- The EU takes a broad perspective on digital skills and considers the implications of digital transformation on its workforce, digital inclusion and resilience of its economy. This links to a core economic strategy of the EU around the Digital Single Market.

- As a collection of member states and an executive body (the EC) the EU is distinct from any of the individual country cases, such that funding to support initiatives is significant and larger than in any of the individual country cases. Initiatives benefit from economies of scale, cross-border learning, and collaboration and research schemes such as Horizon 2020.

- A core purpose of the EU is also to balance disparity between the more advanced and less advanced member states. This is an interesting dynamic as countries such as Sweden have strong foundations for digital skills and advanced ICT industry sectors, which fuels greater demand for citizens with digital skills; whereas countries such as Romania and Slovakia have lower levels of digital skills and lack national frameworks and policies to build digital skills.

- Because of the need to align and measure the progress of its various member states, the EU focuses on benchmarking. An important overarching tool for this is the DESI. Another useful, and more specific instrument is the IRDLL, which benchmarks readiness for digital lifelong learning for Europe. Such instruments could provide useful reference points for comparison with Australia. That is, they can be used to consider where Australia sits in relation to EU nations on digital skills development, and therefore which strategies to consider to move forward.

- The EU also draws heavily on the DigComp framework for digital skills. As noted, this is the most comprehensive digital skills frameworks that exists globally and

connects with other learning frameworks such as the EQF. DigComp underpins many of the activities around digital skills at the levels of (i) education and training; (ii) lifelong learning and inclusion; and (iii) employment. It provides an all-encompassing approach to digital skills training and informs initiatives at the national and EU level (see Section 7.3). Australia could benefit from using this framework, or adopting an Australian-specific framework when designing its digital skills initiatives. A further important consideration is that the DigComp framework is not static; rather it is live and continuously adapted to reflect skills and technology developments.
8 Multilateral fora

As illustrated by the EU case study, multilateral fora are taking a leadership role in helping members prepare for and optimise the potential of digital transformation. In some instances, the focus is on building the capability of a geographic trading block; in others, it is about ensuring ‘no person is left behind’.

The following section sets out a range of initiatives from the:

- **OECD**—comprised of 37 member countries that span the globe and come together with the common goal of shaping policies that foster prosperity, equality, opportunity and wellbeing for all.
- **G20**—comprised of 19 individual countries plus the EU, collectively accounting for 85% of the world economy and two-thirds of the world’s population. It is the premier international forum for global economic cooperation.
- **APEC**—a regional economic forum with 21 members. It works to build greater prosperity of the region by accelerating regional economic integration and building capability.
- **United Nations (UN)**—comprised of 193 member states and with a particularly broad charter that includes issues such as sustainable development, human rights and gender equality.

As high-level fora, these bodies tend not to operationalise skills development and capability building strategies per se. Rather, they facilitate the policy formation process, research and data gathering, while the member states work in-country to adopt and adapt in accordance with their own economy’s needs.

8.1 OECD/G20 Policies and Initiatives

G20 economies have recognised the significance of harnessing digital technologies to drive economic prosperity. They have also acknowledged the role of digital technologies in empowering women and bridging the digital gender divide. In its *Roadmap for Digitalisation Policies for a Digital Future*, the G20 identifies key priority areas and actions for development and cooperation in the digital economy, as well as addressing the gender divide. One of the areas is fostering digital skills in VET through accessibility by both genders.

Coordinated and effective policies can make positive contributions to alleviating the digital gender divide. The OECD’s *Bridging the Digital Gender Divide: Include, Upskill, Innovate* builds on the G20’s efforts and identifies the following action areas to bridge the digital gender divide:

- enhance access to and improve the affordability of digital technologies;
- facilitate labour market participation and on-the-job learning;

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• foster women’s entrepreneurship and engagement in innovation;
• overcome normative barriers, increase safety and foster evidence-based gender-related actions;
• collect gender-disaggregated data to inform digital policy; and
• boost skills.\textsuperscript{195}

The OECD’s report also provides a series of actions for the G20 to consider in bridging the digital divide:

• **Design and implement national digital strategies with targets (both numbers and dates) for closing the digital gender across the following four areas:**
  o extend networks and digital access (e.g. through satellite) to rural areas;
  o promote access to and affordability and use of connected digital devices (e.g. smart phones, tablets, laptops), especially for low-income individuals;
  o boost availability and promotion of e-banking and mobile money, especially to women and other disadvantaged categories; and
  o increase online safety.

• **Adapt national and G20 skills strategies to increase awareness of the digital gender divide.** G20 economies could consider making the following commitments:
  o agree to establish (time bound) targets for women in STEM;
  o create fund and grant schemes aimed at enhancing the enrolment of women in STEM education;
  o establish awards and prizes to enhance the visibility of women in STEM and high-technology sectors; and
  o implement awareness campaigns to tackle socio-cultural norms, bias and stereotypes.

• **Facilitate the labour market participation of women.**

• **Foster women’s entrepreneurship and engagement in innovation through the promotion of diversity in entrepreneurship.** G20 economies could take action across a number of dimensions, including:
  o promote a more gender-balanced composition of financing institutions;
  o design prizes and incentive schemes for companies and organisations actively implementing gender-neutral policies linked to measurable targets; and
  o foster networking and gender inclusion in entrepreneurial and innovative activities.

• **Foster evidence-based gender-related actions.**

• **Publish an annual digital gender equality report such as The Measurement Toolkit for the Digital Economy.**

Some notable examples of policy strategies or frameworks for digital skilling and initiatives to close the gender gap that flow from the OECD/G20 commitment include:

• #eSkills4Girls Initiative was launched under the German G20 presidency, with the aim of tackling the existing gender digital divide, particularly within low income

and developing countries. The platform aims to collect and disseminate information and knowledge on the issue, to showcase current initiatives as well as good practices and policy recommendations to different stakeholders that are playing an essential part in helping to get more women online and into IT professions.\textsuperscript{196}

- **Mind the Gap** is an EU-funded project undertaken by a consortium of partners from the UK, Spain and the Netherlands. The project brings together VET teachers and individuals working in gender, diversity and STEM-related subjects to address a clear problem: the widening skills gap in the sector and the clear division between men and women. A number of practices will be applied to recruit/retain girls in STEM and ensure that they are not lost during the transition to professional work. In addition, **Mind the Gap** will support VET teachers of STEM subjects to be more inclusive and gender aware in their teaching.\textsuperscript{197}

- The Netherlands’ **Dutch Technology Pact 2020** (Techniekpact) is a joint initiative between 60 public and private stakeholders including government, businesses, trade unions and the education community. The pact’s members have agreed on 22 national actions to create a sustainable workforce for the technology sector, with the aim of producing 30,000 additional technology graduates per year.\textsuperscript{198}

- Denmark’s **Disruption Council** is a partnership between trade unions, employer organisations, entrepreneurs, experts, youth and ministers that aims to prepare Danish civil society for the jobs of the future, and ensure that new policies and initiatives benefit all members of society, not just the highly educated. During 2017–19, members of the council visited workplaces that will potentially be transformed by digital technology, researched the impact of digitalisation and established a shared understanding of threats and opportunities.\textsuperscript{199}

- Sweden’s **DSJC** is a multi-stakeholder partnership focusing on skills uptake and lifelong learning, aiming to raise interest in IT among young people and women, and digitalise the Swedish school system. Established in 2018, members of the coalition include the government’s Digitalisation Council, Swedsoft, the Swedish National Agency for Education, the Swedish Association of Local Authorities and Regions, the Association of Swedish Engineering Industries, the Internet Foundation in Sweden and the Swedish IT and Telecom industries. The network is the Swedish branch of the wider EU initiative, the **DSJC**.\textsuperscript{200} For more information see Section 3.2.

- Sweden’s Digital Strategy establishes clear goals towards a more digitally inclusive society. The strategy involves aims such as increasing digital skills, modernising the education system and improving digital infrastructure, to harness the opportunities

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\textsuperscript{196} https://www.eskills4girls.org/
\textsuperscript{197} EC (2015), *Mind the Gap: European Research for Combatting Inequalities*
\textsuperscript{199} https://fho.dk/blog/2017/05/15/the-disruption-council/
of digital transformation, minimise the risks, and ensure that no citizens are left behind.\textsuperscript{201} For more information see Section 3.2.

- Korea’s \textit{Act of Promotion of Information and Communications Network Utilization and Information Protection} includes Article 14 (Proliferation of Internet), which states that

  the Government shall stimulate efficient private and public sector Internet use in order to encourage widespread Internet use, increase the Internet’s foundation, increase Internet education and publicity, and design and put into practice actions that end the Internet utilization gap by region, gender and age.\textsuperscript{202}

- France’s \textit{Plan sectoriel mixité et numérique} sets out a range of actions to promote equality between women and men in the digital sector. By federating the work of representatives of digital and public authorities, this plan aims to promote diversity by acting at every stage of a woman’s journey: in orientation and continuing education, and in access to employment and entrepreneurship. Examples of measures include:

  - fighting against stereotypes of sex, cybersex and cyber violence;
  - initial training, working on the representations associated with digital professions;
  - lifelong education, promoting the diversity of digital professions and the attractiveness of positions for women;
  - promoting the employment of women in the digital sector; and
  - communicating about the creation of businesses by women in the digital sector.

- Estonia’s \textit{Digital Agenda 2020}\textsuperscript{203} and the \textit{Lifelong Learning Strategy 2020}\textsuperscript{204} which is the Estonian education strategy, specify digital skills as their key policy priorities. The focus of the strategy is on creating an environment that facilitates the use of ICT and the development of smart solutions in Estonia in general. The ultimate goal is to increase the economic competitiveness, wellbeing of people and efficiency of public administration.

- Denmark’s \textit{Digital Growth Strategy} was set up in 2018 with 38 initiatives, all of which support Denmark’s digital growth in different ways. For example, \textit{Digital Hub Denmark} is a matchmaking platform aiming to improve companies’ access to talent within emerging digital technologies; and the Technology Pact is a national collaboration network that encourages more young people to engage in STEM subjects.\textsuperscript{205}

\textsuperscript{201} Ministry of Enterprise and Innovation (2017), op. cit.
\textsuperscript{202} Korean Legislation Research Institute (2016), \textit{Act on Promotion of Information and Communications Network Utilization and Information Protection, etc.}, https://elaw.klri.re.kr/eng_service/lawView.do?hseq=38422&lang=ENG
\textsuperscript{205} https://investindk.com/insights/the-danish-government-presents-digital-growth-strategy
- The Netherlands’ Digital Agenda for the Netherlands—Innovation, Trust, Acceleration sets out clear actions for the digitalisation of the country’s economy. The actions apply to the following areas: education, knowledge and innovation; open and high-speed infrastructure; security and trust; more scope for entrepreneurs; and digitisation of sectors.

- Portugal’s National Initiative on Digital Competences 2030 (INCoDe.2030) aims to broaden digital literacy, promote employability and professional training in digital technologies, and raise Portugal’s participation in the international research and development network, namely in the production of knowledge in all the areas associated with digital transformation. The initiative seeks to make use of the existing Portuguese training infrastructure to improve the overall level of competence in ICT, particularly in terms of human capital and Internet usage level. INCoDe.2030 includes a range of interventions alongside the promotion of digital competencies. It enables citizens to benchmark their level of digital skill in a dynamic framework based on the European initiative DigComp2.0, which can then be used to identify knowledge gaps. Specific programs have also been targeted towards disenfranchised groups, who are able to use a freely accessible online training platform. Further elements of the program include lifelong learning and active labour market programs to help disenfranchised workers adapt to a dynamic labour market.

The Going Digital Integrated Policy Framework is the latest output of the OECD Going Digital Project. This framework is designed to support better policy formation in the digital age and ensure that no one is left behind. It sets out the key steps for developing a digital transformation strategy that reflects a whole-of-government approach to policy making in the digital age. It also provides guidance on putting the framework into practice.

The framework serves as the basis for OECD national reviews of digital transformation and charts the road ahead by helping governments, people, firms and stakeholders shape policies for an inclusive and prosperous digital future. The framework includes seven interrelated policy dimensions, which are listed in Table 3.

Table 3: The OECD’s Going Digital Integrated Policy Framework

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Key policy domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Access</td>
<td>• Investment&lt;br&gt;• Communications infrastructure and services&lt;br&gt;• Competition&lt;br&gt;• Regional development</td>
</tr>
<tr>
<td>2. Use</td>
<td>• Digital government&lt;br&gt;• Investment&lt;br&gt;• Business dynamism&lt;br&gt;• SMEs&lt;br&gt;• Skills&lt;br&gt;• Digital security and privacy</td>
</tr>
<tr>
<td>3. Innovation</td>
<td>• Entrepreneurship&lt;br&gt;• SMEs&lt;br&gt;• Competition&lt;br&gt;• Science and technology&lt;br&gt;• Digital government&lt;br&gt;• Sectoral policies and regulations</td>
</tr>
<tr>
<td>4. Jobs</td>
<td>• Labour markets&lt;br&gt;• Skills&lt;br&gt;• Social protection&lt;br&gt;• Tax and benefits&lt;br&gt;• Regional development</td>
</tr>
<tr>
<td>5. Social prosperity</td>
<td>• Social policies&lt;br&gt;• Skills&lt;br&gt;• Tax and benefits&lt;br&gt;• Environment&lt;br&gt;• Healthcare&lt;br&gt;• Digital government</td>
</tr>
<tr>
<td>6. Trust</td>
<td>• Digital risk management&lt;br&gt;• SMEs&lt;br&gt;• Privacy&lt;br&gt;• Digital security&lt;br&gt;• Consumer protection</td>
</tr>
<tr>
<td>7. Market openness</td>
<td>• Trade&lt;br&gt;• Investment&lt;br&gt;• Financial markets&lt;br&gt;• Competition&lt;br&gt;• Taxation</td>
</tr>
</tbody>
</table>
8.2 Asia-Pacific Economic Cooperation

The Asia-Pacific region is becoming more digitalised and is developing numerous multilateral partnerships with other countries to achieve economic progress. The APEC economies have undertaken structural reforms in business and the public sector to foster inclusive growth and ensure that no one is left behind in the digital economy. The aim is to encourage more entrepreneurship, new business models and innovation.

To this end, the APEC Internet and Digital Economy Roadmap (AIDER) has been developed. It provides advice on key areas to facilitate the development and promotion of the internet and digital economy among APEC members to create sustainable growth. The AIDER also calls for taking action to bridge the gender divide in the APEC region and ensure digital strategies incorporate a gender perspective, with respect to women’s circumstances, needs and capabilities. The roadmap identifies 11 key focus areas:

1. development of digital infrastructure;
2. promotion of interoperability;
3. achievement of universal broadband access;
4. development of holistic government policy frameworks for the internet and digital economy;
5. promotion of coherence and cooperation of regulatory approaches affecting the internet and digital economy;
6. promotion of innovation and adoption of enabling technologies and services;
7. enhancement of trust and security in the use of ICTs;
8. facilitation of the free flow of information and data for the development of the internet and digital economy, while respecting applicable domestic laws and regulations;
9. improvement of baseline Internet and digital economy measurements;
10. enhancement of inclusiveness of the internet and digital economy; and
11. facilitation of e-commerce and advancement of cooperation on digital trade.209

Another significant report, the Guidebook on SME Embracing Digital Transformation, addresses the strategic challenges to digitalisation of SMEs and offers a detailed analysis of factors impacting SMEs' digital transformation through public–private collaboration. The report emphasises the role of digital governments in expediting SMEs’ journey towards digitalisation and advises governments to boost incentives for SMEs to adopt and implement digital technologies. The recommendations include:

- allocation of loans that SMEs require to introduce hardware and software of digital technologies;
- digitalisation of government sectors to serve as a role model for private sector/SMEs;

• encouragement of businesses to develop digital applications by procuring
digitalised product and services;
• building of digital transformation support systems through collaboration with the
industry and academia (including public associations, research institutions and
universities) to provide consulting and guidance on digital transformation;
• regular review and amendment to relevant regulations to provide a more flexible
environment for innovation and digitalisation; and
• enhancement of SMEs’ awareness to implement digital transformation.  

The most comprehensive report that builds on the AIDER and lays the foundation
for APEC’s digital economy is the APEC Economic Policy Report 2019: Structural
Reform and the Digital Economy. The report calls for a holistic approach to
structural reforms in the APEC region to boost the economic benefits of digital
transformation. The reforms fall under three broad themes:

• Core structural reforms in areas such as:
  o competition policy and law
  o regulatory reform
  o ease of doing business
  o public sector governance.

• Supplementing core structural reforms:
  o making core structural reforms pro-inclusive and/or undertaking structural
    reforms in areas such as human capital development, infrastructure and
    social security; and
  o ensuring that core structural reforms are aligned with other types of reforms
    and supporting policies to maximise the impact with respect to policy
    objectives such as inclusive growth.

• Optimising structural reforms:
  o enhancing labour market efficiency
  o tackling the rural-urban divide
  o improving micro, small and medium-sized enterprise (MSME) participation
  o empowering women economically.

The report places great emphasis on gender inclusion in the digital economy as
women are generally left behind in the region on account of their domestic roles,
their lower digital literacy compared with men and the absence of pro-inclusion
policies. It encourages governments to implement interventions and supporting
policies to bring about more inclusion and diversity in the digital economy. Policies
should address reforms in childcare and maternity leave to encourage greater
participation from women. Supporting policies can include awareness-raising
initiatives/programs and training and mentorship for women. The report
highlights examples such as the Science in Australia Gender Equity pilot and Girls
in STEM Toolkit to support women in STEM. Programs can also facilitate women’s

210 https://apec.org/Publications/2020/03/Guidebook-on-SME-Embracing-Digital-Transformation
211 APEC (2019a), APEC Economic Policy Report 2019, Economic Committee,
ease of doing business or create women-friendly working environments such as Canada’s Women Entrepreneurship Strategy, which provides business women with better access to financing, talent, networks and expertise.

APEC established its Policy Partnership on Women and the Economy (PPWE) in 2011 to promote the economic integration of women through its five key pillars:

1. access to capital
2. access to market
3. skills and capacity building
4. women’s leadership and agency
5. innovation and technology.

PPWE’s Strategic Plan 2019–2020 establishes the following three objectives to elevate gender perspective into APEC’s policies:

- create and promote new gender-focused policies and programs, and strengthen their integration across APEC fora;
- advance women’s economic participation through five priority pillars; and
- strengthen the foundation and operating structure of the PPWE and the Women and the Economy Forum.212

The PPWE has recently established the APEC Women and the Economy Sub-fund to promote APEC’s objective of increasing women’s economic participation. Some of the APEC initiatives include the APEC Women in STEM Initiative (increasing women’s participation in STEM education and careers); the Women’s Entrepreneurship in APEC Initiative (supporting capacity-building activities for women entrepreneurs); and the Women’s Micro-Enterprise Trade Network Project (connecting local women-owned MSMEs with the global market).

8.2.1. Major APEC Initiatives and Strategies on the Digital Economy

**Table 4: Examples of Strategies from APEC Countries**

<table>
<thead>
<tr>
<th>Country</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Digital Economy Strategy: a 7-year vision (2018–2025) on how businesses, governments and local communities can work together to maximise the benefits and opportunities enabled by digital technology.</td>
</tr>
<tr>
<td>Singapore</td>
<td>Digital Economy Framework for Action: a strategy to build Singapore’s competitive edge in the digital era by promoting collaboration and building a vibrant ecosystem (for more information see Section 2.3).</td>
</tr>
<tr>
<td>The Philippines</td>
<td>E-Commerce Roadmap 2016–2020: aims to increase the contribution of ecommerce to 40–50% of the country’s GDP by 2022.</td>
</tr>
</tbody>
</table>

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Thailand

**Digital Economy and Society Development Plan (2018–2037):** aims to drive the economy and build an equitable and inclusive society through digital technology.

Malaysia

**National e-Commerce Strategic Roadmap** and **National Policy on Industry 4.0 (Industry4WRD):** aim to enhance the e-commerce ecosystem and drive digital transformation in the manufacturing and services sectors, respectively.

The APEC Action Agenda for the Digital Economy commits economies to preparing a comprehensive work program on future implementation and further developing the digital economy-related work areas. It also aims to develop a program for future data and analytical support for APEC work under the roadmap. The action agenda also welcomes the establishment of the Digital Economy Steering Group, a new governance mechanism that monitors and reports progress made within focus areas identified in the AIDER.213

With regard to infrastructure, the APEC Connectivity Blueprint was developed to ensure a ‘seamless and comprehensively connected and integrated Asia-Pacific’. Digital connectivity falls under the area of ICT infrastructure.214

The APEC Framework on Human Resources Development in the Digital Age proposes a set of policy directions and measures to help economies ensure citizens are better prepared for the digital age. In addition, the APEC Education Strategy was established by the Human Resources Development Working Group to guide its projects and initiatives. One of the objectives of the strategy is to improve the use of education and technological capabilities in learning through better use of ICT.215

APEC’s Report on Regulations, Policies and Initiatives on E-commerce and Digital Economy for APEC MSMEs’ Participation in the Region outlines initiatives, policies and best practice related to digital economy and digital transformation in the APEC region. Prominent case studies covered in the report include:216

- **Canada’s Digital Charter**, which outlines 10 principles to assist the federal government’s work to leverage Canada’s unique talents and strengths to enhance the power of digital and data transformation. Some of the principles are universal access; safety and security; control and consent; transparency,

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214 APEC (2015), APEC Connectivity Blueprint, APEC Policy Support Unit, [https://apec.org/Publications/2015/01/APEC-Connectivity-Blueprint](https://apec.org/Publications/2015/01/APEC-Connectivity-Blueprint)


portability and interoperability; open and modern digital government; and data and digital for good. For more information on Canada, see Section 6.

The 13th Five-Year Plan for Economic and Social Development of the People’s Republic of China (2016–2020) cites as its objective, ‘pursuing innovation-driven development’ to ensure that business start-ups and innovations flourish, and that total productivity is improved. As part of the plan, the Internet Plus action plan promotes deeper and more extensive use of the internet to transform modes of production and methods of organisation, with the aim of bringing about a new pattern of industrial development that is internet based, intelligent, service oriented and coordinated.

Hong Kong’s 2017 Policy Address specifies eight major areas to increase government efforts in ICT development: 1) Increasing resources for research and development; 2) pooling technology talent; 3) providing investment funding; 4) providing technological research infrastructure, 5) reviewing legislation and regulation; 6) opening up government data; 7) improving procurement arrangements; and 8) popularising science education. Hong Kong’s government also published the Smart City Blueprint for Hong Kong, China with the view to building a world-famous Smart Hong Kong, China. The blueprint sets out more than 70 initiatives in six major areas—’Smart Mobility’, ‘Smart Living’, ‘Smart Environment’, ‘Smart People’, ‘Smart Government’ and ‘Smart Economy’—covering digital infrastructure to support online transactions and digital transformation in business.

The Smart Japan ICT Strategy sets out a strategy for Japan’s economic growth and contribution to international society through innovation in ICT. Three main visions comprise the strategy: 1) building ‘a knowledge- and information-based nation’ by 2020; 2) utilising ICT to create a total solution for complex social problems; and 3) speedy implementation of actions based on global trends. The Smart Japan ICT Strategy consists of two main parts: the ICT Growth Strategy (the domestic strategy) and the Initiative on Intensification of International Competitiveness and Global Outreach in the Field of ICT (the international strategy). A focus point is the development of a ‘super smart society’, or Society 5.0. To realise a super smart society, the Japanese government will promote the creation of a common platform or ‘super smart society service platform’ that allows coordination and collaboration between multiple ICT or IoT systems and for a wide variety of data to be collected, analysed and applied across all the coordinating systems to produce new value and services.

Korea’s Creative Economy initiative aims to generate new jobs and markets through creativity and innovation, by leveraging Korea’s science and technology capacity. The government’s Action Plan for the Creative Economy outlines six strategies: 1) creating an ecosystem in which creativity is rewarded fairly and it is easy to start a new company; 2) strengthening the competitiveness of ventures and SMEs as key players; 3) creating a new growth engine to develop new products and new markets; 4) training creative global talent; 5) strengthening the innovation competitiveness of science and technology and ICT as the basis of the creative economy; and 6) developing the creative economy culture in which people and government work together.
• Singapore’s *Action Community for Entrepreneurship* aims to help e-commerce SMEs expand their network and develop industry-specific skills. The community will seek to support Singaporean SMEs in three main areas: 1) an all-in access hub to connect Singapore SMEs with technology, funding and talent providers; 2) consultancy services, clinics and workshops that offer advice to Singapore SMEs on scaling and internationalisation; and 3) an environment that promotes and facilitates co-innovation between Singapore SMEs and other enterprises. For more information, see Section 2.

• Singapore’s *Digital Economy Framework for Action* aims to help businesses to transform into digital businesses, empower workers with technology, and create connected citizens. It encourages collaboration and partnership to strengthen digital capabilities across Singapore. The framework has three elements: 1) accelerate digitalising industries; 2) compete integrating ecosystems; and 3) transform industrialising digital. The four key enablers are 1) manpower development—continued upskilling and reskilling to train and groom information, communication and media professionals, and raise the digital literacy of the workforce to take on the challenges of the digital economy; 2) research and innovation—giving companies the competitive edge to keep abreast of the latest trends in technology through roadmaps that aim to inform and anticipate new developments; 3) physical and digital infrastructure—continued investment to boost Singapore’s infrastructure and enhance digital connectivity as technology evolves; and 4) governance, policies and standards—robust data privacy laws, cyber security and data protection, as well as continued efforts to calibrate governance of data policy and related activities like AI.

8.2.2 The Asia–Pacific Economic Cooperation Recommendations

Reviewing initiatives and best practices across the region, the APEC has made three recommendations to address the challenges of digital economy and digital transformation:

- update domestic legislations for the digital economy as a solution and raise consumer and business awareness;
- promote coherency and interoperability among different legislations; and
- build greater international collaboration.

8.3 United Nations

The UN *Sustainable Development Goals* are 17 goals for a better and sustainable future. Goal four underscores inclusive and equitable education and lifelong learning, gender equality and empowerment of girls and women. It establishes specific targets including:

- ensuring equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university;
- increasing the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship; and
• expanding the number of scholarships available to developing countries, in particular least developed countries, small island developing states and African countries, for enrolment in higher education, including vocational training and ICT, technical, engineering and scientific programs, in developed countries and other developing countries.\(^1\)

The **International Telecommunications Union** (ITU) affiliated with the UN has conducted several studies on the gender divide in access to technology, specifically telecommunication technology. The organisation is delivering global advocacy and programs to bring about gender equity in ICT careers. ITU has partnered with EQUALS, an organisation dedicated to gender equality in the digital age. They have created an interactive **Global Digital Gender Equality Action Map** that lays out hundreds of initiatives aimed at bringing about equality in digital access and skills across the globe.

One of the most comprehensive reports published by EQUALS, *Taking Stock: Data and Evidence on Gender Equality in Digital Access, Skills and Leadership*, presents a compilation of case studies about gender digital divide with recommendations from experts.\(^2\) The report reviews numerous policy frameworks and strategies from different countries and concludes that there is no one conclusive strategy for eliminating gender digital inequalities and implemented strategies either target the contributing factors to digital inequality e.g. affordability or recruiting or they aim to reshape stereotypical social norms and practices deemed to be the root cause of gender inequality. A summary of the reviewed policy frameworks is provided in Table 5.

Building on the researched frameworks, this report makes several recommendations to address digital gender divide in three categories: ICT access; ICT skills; and ICT leadership, as outlined in Table 6.

Another paper, *Closing Gender Divides in Digital Skills Through Education*, released by EQUALS focuses on addressing the digital gender divide through education.\(^3\) The report synthesises a large body of literature to offer recommendations for interventions. While all approaches must be tailored for specific contexts and no solution is considered a panacea, the report provides some advice to policy makers and others involved in the design and implementation of gender-responsive and gender-transformative digital skills programs. The recommendations include:

\(^1\) https://www.un.org/sustainabledevelopment/education/


\(^3\) EQUALS Global Partnership, (2019b), *I’d Blush if I Could: Closing Gender Divides in Digital Skills through Education*, https://2b37021f-0f4a-4640-8352-0a3c1b7c2aab.filesusr.com/ugd/04bfff_06ba0716e0604f51a40b4474d4829ba8.pdf
• adopt sustained, varied and life-wide approaches
• establish incentives, targets and quotas
• embed ICT in formal education
• support engaging experiences
• emphasise meaningful use and tangible benefits
• encourage collaborative and peer learning
• create safe spaces and meet women where they are
• examine exclusionary practices and language
• recruit and train gender-sensitive teachers
• promote role models and mentors
• bring parents on board
• leverage community connections and recruit allies
• support technology autonomy and women’s digital rights
• use universal service and access funds
• collect and use data, and set actionable indicators and targets.

The Broadband Commission has researched the digital gender divide and called for gender equality in access to broadband by 2020. A list of recommendations from the Broadband Commission’s Working Group on the Digital Gender Divide (2017)220 spells out a wide range of actions that stakeholders can take. The four recommendation areas are (1) support the collection, tracking and analysis of sex-disaggregated data on internet access and use; (2) integrate gender perspectives into relevant strategies, policies, plans and budgets; (3) address barriers related to affordability, skills and safety; and (4) support stakeholders to collaborate more effectively. A summary of the recommendations is provided in Table 7.

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<table>
<thead>
<tr>
<th>Barriers</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability or infrastructure</td>
<td>• Expand infrastructure to unserved/underserved communities</td>
</tr>
<tr>
<td></td>
<td>• Support original research and the collection, tracking, analysis and sharing of sex-disaggregated data</td>
</tr>
<tr>
<td>Financial constraints</td>
<td>• Improve affordability</td>
</tr>
<tr>
<td></td>
<td>• Remove gender-based barriers to acquiring business capital</td>
</tr>
<tr>
<td></td>
<td>• Support original research and the collection, tracking, analysis and sharing of sex-disaggregated data</td>
</tr>
<tr>
<td>Availability and aptitude (perceived and real; endogenous and exogenous)</td>
<td>• Invest in digital literacy capacity building</td>
</tr>
<tr>
<td></td>
<td>• Address gender stereotyping of STEM</td>
</tr>
<tr>
<td></td>
<td>• Invest in entrepreneurship capacity building</td>
</tr>
<tr>
<td></td>
<td>• Support original research and the collection, tracking, analysis and sharing of sex-disaggregated data</td>
</tr>
<tr>
<td>Interest and perceived relevance</td>
<td>• Provide relevant content and services</td>
</tr>
<tr>
<td></td>
<td>• Increase awareness/demonstrate potential and relevance of ICTs and ICT careers</td>
</tr>
<tr>
<td></td>
<td>• Address gender stereotyping of STEM</td>
</tr>
<tr>
<td></td>
<td>• Support original research and the collection, tracking, analysis and sharing of sex-disaggregated data</td>
</tr>
<tr>
<td>Safety and security</td>
<td>• Develop social, technical and regulatory measures to eliminate safety and security threats in public, educational and workplace settings</td>
</tr>
<tr>
<td></td>
<td>• Support original research and the collection, tracking, analysis and sharing of sex-disaggregated data</td>
</tr>
<tr>
<td>Socio-cultural and institutional contexts</td>
<td>• Combat stereotypes, biases and discriminatory norms at individual, institutional and societal levels (e.g. increase media awareness/sensitisation, establish and enforce legislation, promote gender-sensitive learning approaches and environments, spotlight role models, foster work-life balance, diversity policies and programs, gender lens investing)</td>
</tr>
<tr>
<td></td>
<td>• Collaborate with stakeholders (e.g. consult and involve women and men, share good practices and lessons)</td>
</tr>
<tr>
<td></td>
<td>• Support original research and the collection, tracking, analysis and sharing or sex-disaggregated data</td>
</tr>
</tbody>
</table>
### Table 6

<table>
<thead>
<tr>
<th>Category</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| **ICT access** | • Expand digital infrastructure  
                   • Improve affordability  
                   • Improve basic digital literacy  
                   • Promote education in general  
                   • Provide relevant content  
                   • Improve online safety and security  
                   • Improve offline safety and security  
                   • Combat social norms that disadvantage women  
                   • Collaborate with stakeholders  
                   • Collect and share sex-disaggregated data |
| **ICT skills** | • Provide equal opportunities to develop ability and aptitude  
                   • Train teachers in gender-responsive pedagogies  
                   • Promote interest and perceived relevance  
                   • Combat social and institutional norms that disadvantage women  
                   • Develop gender-responsive national policy on digital skills  
                   • Collaborate with stakeholders  
                   • Collect and share research and sex-disaggregated data |
| **ICT leadership** | • Address social norms, stereotypes, and socio-economic constraints that hold women back and discourage girls from considering STEM careers  
                   • Improve recruitment and advancement practices to remove conscious and unconscious bias  
                   • Promote change in organisational culture to be more inclusive and less discriminatory  
                   • Establish professional development initiatives targeting women and other marginalised groups  
                   • Foster greater work–life balance for all employees  
                   • Ensure accountability  
                   • Introduce regulatory measures to enforce diversity  
                   • Leverage the power of shareholders and investors to compel corporations to improve their gender diversity status  
                   • Foster women ICT entrepreneurs  
                   • Collect and share research and sex-disaggregated data |
<table>
<thead>
<tr>
<th>Area</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
<td>• Collect, analyse and track data</td>
</tr>
<tr>
<td></td>
<td>• Research women’s access to and use of the internet</td>
</tr>
<tr>
<td></td>
<td>• Publish and share data and research</td>
</tr>
<tr>
<td><strong>Strategies, policies, plans and budgets</strong></td>
<td>• Establish gender equality for internet and broadband access and use</td>
</tr>
<tr>
<td></td>
<td>• Assess strategies, policies and plans for budgets for gender equality</td>
</tr>
<tr>
<td></td>
<td>considerations</td>
</tr>
<tr>
<td></td>
<td>• Consult and involve women as well as relevant local communities and experts</td>
</tr>
<tr>
<td><strong>Address the barriers; affordable access</strong></td>
<td>• Improve understanding of affordability issues</td>
</tr>
<tr>
<td></td>
<td>• Innovate to reduce the cost of devices and services</td>
</tr>
<tr>
<td></td>
<td>• Improve network coverage, capacity and quality</td>
</tr>
<tr>
<td></td>
<td>• Provide public access facilities</td>
</tr>
<tr>
<td><strong>Address the barriers; threats that prevent</strong></td>
<td>• Research and understand the threats</td>
</tr>
<tr>
<td><strong>access and use</strong></td>
<td>• Increase awareness of threats and how they can be addressed or reduced</td>
</tr>
<tr>
<td></td>
<td>• Develop safety applications and services</td>
</tr>
<tr>
<td></td>
<td>• Strengthen protection measures and reporting procedures</td>
</tr>
<tr>
<td><strong>Address the barriers; digital literacy and</strong></td>
<td>• Understand women’s needs</td>
</tr>
<tr>
<td><strong>confidence</strong></td>
<td>• Invest in education and capacity-building initiatives</td>
</tr>
<tr>
<td></td>
<td>• Develop skills and confidence</td>
</tr>
<tr>
<td></td>
<td>• Support educators</td>
</tr>
<tr>
<td></td>
<td>• Support and promote female role models</td>
</tr>
<tr>
<td><strong>Address the barriers; relevant content,</strong></td>
<td>• Build awareness</td>
</tr>
<tr>
<td><strong>applications and services</strong></td>
<td>• Develop relevant content and services</td>
</tr>
<tr>
<td></td>
<td>• Consult and engage women</td>
</tr>
<tr>
<td><strong>Working together and sharing good</strong></td>
<td>• Develop and share tools, guidelines, case studies and other materials</td>
</tr>
<tr>
<td><strong>practice and lessons</strong></td>
<td>• Support and encourage multi-stakeholder cooperation</td>
</tr>
<tr>
<td><strong>Working together and sharing good</strong></td>
<td></td>
</tr>
<tr>
<td><strong>practice and lessons</strong></td>
<td></td>
</tr>
</tbody>
</table>

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