

DIGITAL PATHWAYS IDENTIFICATION PROJECT

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on behalf of Digital Skills Organisation



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Submitted on 23rd November 2021.

Through its consultancy arm, NCVER provides professional research and evaluation services to Australian and international clients. NCVER consults in areas ranging from the training needs of diverse groups, analysis of industry skill requirements, program evaluations and research into a range of national training policy and practice issues.

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Executive Summary

The technology sector is one of the largest sectors in the Australian economy, contributing \$167b per annum to GDP and in addition employing 861,000 people, mainly in small to medium size enterprises (Accenture, 2021). However, according to AlphaBeta (2019), the sector is not reaching its full potential and should be even bigger than it is, with there being shortages of people with STEM skills, while Accenture (2021) note that Australia is behind other OECD countries when it comes to technology innovation and creation reflected in the proportion of businesses employing ICT specialists.

AlphaBeta (2019) and Accenture (2021) both suggest themes to improve Australia's position. Among these at least one relates to improving and expanding pathways into digital jobs. Identification of these pathways is the main purpose of this report.

The Digital Skills Organisation (DSO) has been undertaking work to define the optimal mix of digital career pathways as an initial step in describing and 'codifying' the digital skills sector in Australia. The clear definition of pathways enables national skills priorities to be identified and recognised and specific pathway actions to be developed and progressed.

The current report has examined digital pathways identified from overseas to assess their currency and relevance to the Australian environment with a view to developing a pathways model suitable for Australia. The focus has been on pathways into 'specialist' roles in the digital sector. When we talk about pathways models (sometime also referred to as frameworks) we are referring to identifying the digital skills competence associated with different occupations or skillsets and levels of proficiency for a nation and its citizens to benefit, participate and contribute to the digital world economy.

Why have a digital pathways model? It is a pointer, a roadmap if you will, on how to develop the pipeline of digital workers in all the different facets of digital work that are in demand in the economy. It is a navigation tool through this vast and complex network of required skills to meet the needs of a rapidly changing landscape. A model is of benefit to individuals, employers, training providers and government agencies alike.

To inform the thinking of the development of an effective model for Australia, the structures of existing international pathways models need to be considered for their salient aspects and for their appearance across multiple international frameworks. In addition to this, there are currently many government digital skills initiatives in place in Australia that provide valuable insights as to what may be required in a pathways model.

For this report, six international digital pathways models were examined. These were the:

1. Skills Framework for InfoComm Technology (SFw for ICT) - Singapore
2. Skills Framework for Media (SFw for Media) - Singapore
3. National Standards for Essential Digital Skills for the UK
4. European Commission Digital Skills Framework for Citizens (DigComp 2.1)
5. Skills for the Information Age (SFIA) - Global Skills Framework
6. Digital Intelligence Framework (DQ) with Global Standards for Digital Literacy, Digital Skills and Digital Readiness.

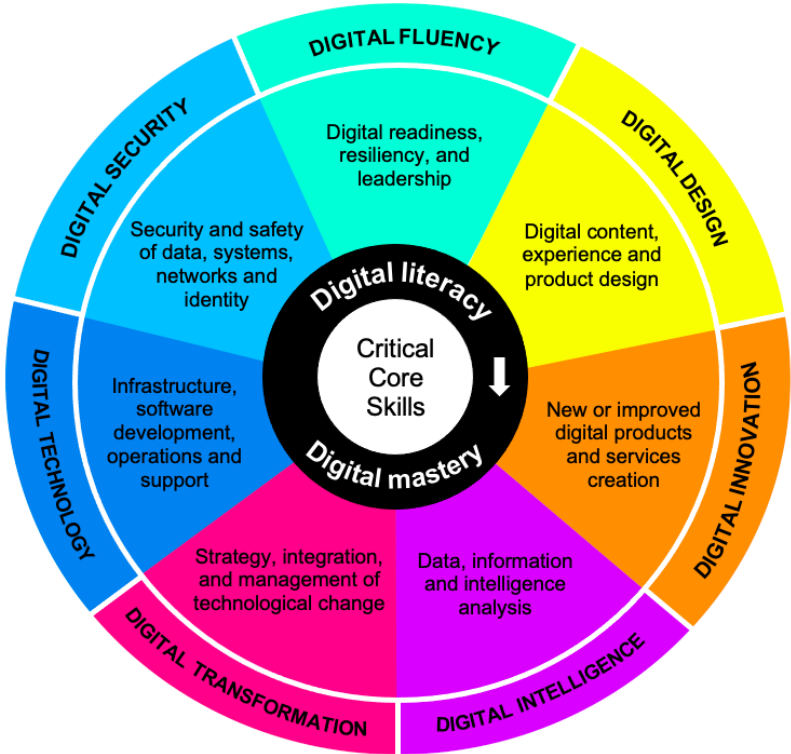
An analysis of these models or frameworks shows that there are several commonalities and differences among the pathways. Commonalities include that all mention data and information literacy, safety and security, communication and problem-solving skills and proficiency levels typically based on task complexity and level of autonomy. Workforce models do not include digital literacy, and all frameworks do not adequately include emerging technologies and technological innovations and related skillsets.

Major differences related to the purpose of the model or framework which ranged from essential digital skills for citizens through to skills for a specialised digital workforce. Further variations indicate a focus on job roles, minimal skillsets or pre-employment and foundation levels outcomes (noting any model for Australia would need to go beyond this). The exception to this is the DQ framework which mentions digital literacy, skills and readiness being developed across three levels, these being digital citizenship, digital competitiveness, and digital creativity.

The analysis of digital skills initiatives occurring across Australia found limited integration of activities or an overarching skills framework in Australia. The initiatives seem to be largely developed independently across the various governments in Australia. A DISER (unpublished) report on federal government digital skills initiatives found no compelling overall narrative uniting the initiatives. There was found to be overall, duplication, and a lack of common language to discuss these skills.

Given the context of what was found in the review of international frameworks and models, and the overview of government initiatives in Australia, it is suggested that the following features need to be considered in a digital skills pathways model for Australia.

The suggested DSO Pathways Model is shown figuratively below.



The development of the Pathways Model is based on five guiding principles. That it be stable over time; flexible, practical, and easily understood and implemented; independent of digital tools, occupation titles or the environment; dynamic with the ability to capture emerging technologies and innovation skill clusters and well defined and easy to adopt. Furthermore, its structure unifies the digital skills

ecosystem, is flexible to accommodate multiple pathways and adaptable to support a fit-for-purpose functionality.

The DSO Pathways model consists of four elements - Core Purpose, Digital Domains, Proficiency Levels and Critical Core Skills.

Core Purpose -The DSO Pathways Model aims to define and support the organisation of digital skills into a manageable framework. To achieve this, the structure, focus and stability of the model is derived from the core functions required to innovate, design, build, transform, analyse, and protect the data and technology that power the digital world, along with the necessity to adapt to the changing digital environment. Together these form the core purpose of digital skills training in this model, and each defines the foundation of a digital domain.

Digital Domains - There are 7 digital domains, including digital fluency providing an overarching support across all domains. Each domain is aligned to a purpose and associated with a core skill cluster.

1. Digital Design - Content, experience, and product design.
2. Digital Fluency - Digital readiness, resiliency and leadership.
3. Digital Intelligence - Data, information, and intelligence analysis.
4. Digital Innovation - New and improved products, processes, and services creation.
5. Digital Security - Safety and security of data, systems, networks, and identity.
6. Digital Technology - Infrastructure, software development and, operations and support
7. Digital Transformation - Strategy, integration, and management of technological change

Digital Proficiency Levels - There are seven proficiency levels that support foundation to advanced digital professional skills. They are defined by complexity of task and degree of autonomy. The proficiency levels are progressive, markedly distinct and aligned to three proficiency groupings - Digital Literacy, Digital Fluency and Digital Mastery. The flexible structure of the proficiency levels enables three approaches to skill development. They are based on proficiency groupings (level range), cumulative skill progression (levels on a continuum) and utilising proficiency levels as discrete independent units to meet skill requirements at varied proficiency levels (independent levels).

Critical Core Skills - The pathway model includes critical (non-technical) core skills across critical thinking, connecting with others and adaptability. There are 7 critical core skills that apply across all domains to build digital capability and assessed with performance criteria aligned to the proficiency levels. These include problem solving, analytical thinking, creative thinking, communication, collaboration, leadership, and adaptability.

In summary, the suggested DSO Pathways Model presents an opportunity to implement a transformational model of digital skills using a common language for describing these skills. The model brings together a number of important digital domains that are missing from other models such as digital design, digital transformation and digital innovation. Digital fluency provides an overarching support in this model across all digital domains. The inclusive framework embeds skill proficiency levels from digital literacy to advanced digital professional skills with critical core skills as the centrepiece of performance.

The model is flexible and adaptable so that digital skills obtained from across domains and at varying proficiency levels can be blended together in a fit-for-purpose manner. As the model does not have fixed tools and occupational labels, it can readily adapt to changes in technology.

Introduction

The Digital Skills Organisation (DSO) has been undertaking work to define what are the optimal mix of digital career pathways as an initial step in describing and ‘codifying’ the digital skills sector in Australia. The clear definition of pathways enables national skills priorities to be identified and recognised and specific pathway actions to be developed and progressed.

This report seeks to understand the variety of approaches that are in use today in similar digital skills contexts. It examines digital skills pathways that have been identified from overseas and their applicability to the Australian context, with a view to developing a pathway model suitable for trialling in Australia. A high-level review of international digital skills frameworks and Australian and State and Territory Government initiatives provides a useful and insightful foundation upon which to inform the development of a fit-for-purpose Digital Skills Pathway Model.

Occupations in the context of digital skills include both the specialised occupational classes (vertical) and the broader occupations that spans across multiple specialisations and activities (horizontal). The focus of this report is on the vertical occupational specialisations and pathways and what they might look like.

Background

Accenture (2021) found that the technology sector in Australia contributed \$167b per annum to GDP, about 8.5% of all GDP. It employed 861,000 people with most employers being SMEs (98%). AlphaBeta (2019) report that the tech sector is one of Australia’s largest sectors employing about 580,000 people and contributing 6.6% to Australia’s GDP (\$122b) with over 90% of tech businesses being SMEs. While the figures differ slightly due to differing definitions of the tech sector, they point to the size and significance of this sector.

However, AlphaBeta (2019) point out that the tech sector is not reaching its full potential and is about a half the size in terms of proportion of GDP of overseas peer countries. They found that while Australia does well in terms of adoption of technology and the prevalence of ICT skills in the workplace, there are shortages of employees with STEM skills. Accenture (2021) point out that Australia is behind other OECD countries in terms of measures of technology innovation and creation. This includes, for example, the proportion of businesses employing ICT specialists.

AlphaBeta (2019) identified six key themes to improve the technology sector policy framework. Among these is skilling the workforce of the future, with the others being (public-private relationships, boosting investment, incentivising innovation, pragmatic regulation, and improving access to talent). Accenture (2021) similarly note barriers to innovation and development have constrained growth and have similar themes to grow the workforce and economic contribution of the sector under three broad headings - growth, talent, and regulation. Importantly, the objective of talent includes ‘grow the pipeline of skilled workers and pathways into tech sector jobs’.

Digital Skills Pathways

In this report, pathway models (frameworks), refer to identifying digital skills competence associated with different occupations/skillsets and levels of proficiency for a nation and its citizens to benefit, participate and contribute to the digital world economy. The identification of these pathways is the main purpose of this report.

Why have a digital pathways model?

It is a pointer, a roadmap if you will, on how to develop a pipeline of digital workers in all different facets of digital work that are in demand in the economy. It is a navigation tool through the vast and complex network of required skills to meet the needs of a rapidly changing landscape.

Digital skill frameworks also provide a means to categorise and organise the complexity and range of digital skillsets. And in doing so, create a well-defined common language and clearly defined pathways.

Effective digital skills pathways provide a way to understand what is relevant in the digital space and the in-demand skills available. It enables informed decisions to be made to choose the best option to prepare for employment, acquire digital skills within the workforce or design a training strategy.

Digital skills pathways are also a guide for non-technology professionals to acquire in-demand skills and for those already in the technology sector to upgrade their digital skills to stay competitive.

More importantly without well-defined pathways that are easily navigable, there is no consistent framework in place to support digital skills acquisition and development. Therefore, a pathways model has a unifying role to play.

Digital pathways are a model of benefit to individuals, employers, training providers and government agencies alike, from advancing digital skills development and building digital capacity to promoting lifelong learning. Specifically, they guide:

Individuals to:

- seek digital skills identification and development and promote awareness of in-demand skillsets
- assess and identify relevant digital skills training programs
- prepare for job roles or upgrade digital skills

Employers to:

- develop digital skill maps and articulate job requirements to attract fresh or mid-career professionals
- reskill existing employees to build digital capacity
- recognise skills and invest in training employees for career development and skills upgrades

Training providers to:

- develop a road map for relevant digital skills training programs
- gain insight on sector trends and existing and emerging skills that are in demand
- design up-to-date and relevant programs to address industry needs

Government, regulatory and peak bodies to:

- navigate the profusion of government digital skills initiatives and unify actions to be developed and progressed
- align a common digital skills language across different departments and agencies
- measure progress consistently and effectively identify skills priorities

Effective Digital Skills Pathways present many benefits for individuals, employers, training providers and government agencies. To develop an effective digital skills pathways model, this report firstly considers the structures of existing international digital skills frameworks and secondly insights from a high-level review of Australian government digital skills initiatives to inform the development of a model for the Australian context.

International Digital Skills Frameworks

Digital skills frameworks

A digital skills framework identifies the digital skills competence aligned to different occupations or skillsets and levels of proficiency for a nation and its citizens to benefit, participate and contribute to the digital world economy.

Most commonly, digital frameworks are designed to support and guide providers, organisations and employers who offer training on essential digital skills needed for their citizens or workforce to operate in a digital world.

Digital skills frameworks also create a shared vision of what is needed in terms of competences at the national level to provide digital skills education and training.

This section presents a high-level review of international digital skills frameworks and compares their underlying structure and components to provide insight to the development of a digital skills pathway model for Australia.

International digital skills frameworks

There are a limited number of Digital Skills Frameworks in the marketplace at the macro-level. However, there are 6 models that have been uncovered that are more predominant in the digital skills landscape. They are the:

1. Skills Framework for InfoComm Technology (SFw for ICT) - Singapore
2. Skills Framework for Media (SFw for Media) - Singapore
3. National Standards for Essential Digital Skills for the UK
4. European Commission Digital Skills Framework for Citizens (DigComp 2.1)
5. Skills for the Information Age (SFIA) - Global Skills Framework
6. Digital Intelligence Framework (DQ) with Global Standards for Digital Literacy, Digital Skills and Digital Readiness.

The key structure and components of each Framework is outlined in Table 1. It shows diversified structures and underlying components that build the model. More information is shown in Appendix 1, Table A1.

Table 1 International digital skills frameworks

Digital Skills Framework	Structure	Components
<p>The European Digital Competence Framework for Citizens (DigComp 2.1) Developed by the JRC of the European Commission. First published in 2013.</p>	5 Competence Areas with 21 Competences across 8 Proficiency Levels	<p>Competence Areas</p> <ol style="list-style-type: none"> 1. Information/data literacy 2. Communication and Collaboration 3. Digital Content Creation 4. Safety 5. Problem Solving
<p>Skills Framework for InfoComm Technology (SFw for ICT) Developed by SkillsFuture Singapore (SSG), Workforce Singapore (WSG), Infocomm Media Development Authority (IMDA) and Cyber Security Agency of Singapore (CSA) with employers, industry, education and training providers.</p>	7 Tracks, 32 Sub-Tracks and 104 job roles across 6 Levels of Proficiency. Provides career pathways, responsibilities, skills and competencies. 12 technical skills and competences with job specific knowledge, skills and abilities. Includes 16 non-technical Critical Core Skills (CSS) within 3 skill clusters Thinking Critically, Interacting with Others, and Staying Relevant. Basic, Intermediate and Advanced Levels.	<p>7 Tracks</p> <ol style="list-style-type: none"> 1. Data/Artificial Intelligence 2. Infrastructure 3. Software and Applications 4. Strategy and Governance 5. Operations and Support 6. Cyber Security 7. Sales and Marketing
<p>Skills for the Information Age (SFIA) is a skills framework that describes the skills and competencies in ICT, Digital transformation, software engineering. SFIA is a global not for profit organisation in the UK.</p>	6 Categories, 17 Sub-Categories and 102 professional skills with 7 levels of responsibility. Includes SFIA views of DevOps, Digital Transformation, Big Data, Info/Cyber Security, Agile Skills, Enterprise IT and Software Engineering.	<p>6 Categories</p> <ol style="list-style-type: none"> 1. Strategy and Architecture 2. Change/Transformation 3. Development and Implementation 4. Delivery and Operation 5. Skills and Quality 6. Relationship/Engagement
<p>Skills Framework for Media (SFw for Media) Developed by SkillsFuture Singapore (SSG), Workforce Singapore (WSG) and Enterprise Singapore.</p>	SFw for Media consists of 10 tracks across 112 job roles with 18 Technical Skills and Competencies with occupation/specific knowledge, skills and abilities. 16 Critical Core Skills (CSS) within Thinking Critically, Interacting with Others and Keeping Relevant categories.	<p>10 Tracks:</p> <ol style="list-style-type: none"> 1. Game Production, 2. Game Design 3. Game Technical Development 4. Quality Assurance 5. Content Production & Management 6. Visual Graphics 7. Production Technical Services 8. Content Post-Production, 9. Media Technology & Operations 10. Media Business Management
<p>National Standards for Essential Digital Skills Defines the UK essential digital skills adults need for work and life in a digital world. Supporting providers, organisations and employers who offer digital skills training for adults.</p>	The standards set out skill statements across two levels - Entry Level for adults with no or little prior experience of digital devices/internet and Level 1 for those with some experience but lacking secure basic digital skills.	<p>5 Essential Digital Skills</p> <ol style="list-style-type: none"> 1. Using devices/handling information 2. Creating and editing 3. Communicating 4. Transacting 5. Be safe & responsible online
<p>Digital Intelligence Framework (DQ) Endorsed by the Coalition for Digital Intelligence (CDI) formed in 2018 by OECD, IEEE SA and DQ Institute in association with the WEF. In 2020 the IEEE approved the Global Standards on Digital Literacy, Digital Skills & Digital Readiness</p>	8 Critical Areas of Digital Life, developed at 3 levels (Digital Citizenship, Digital Creativity & Digital Competitiveness) across 24 digital competencies (DQ24) and 12 Future Readiness Skills at Basic, Intermediate, Advanced Levels.	<p>8 Digital Life Critical Areas</p> <ol style="list-style-type: none"> 1. Digital Identify 2. Digital Rights 3. Digital Literacy 4. Digital Communication 5. Digital Emotional Intelligence 6. Digital Security 7. Digital Safety 8. Digital Use

Skills Framework for InfoComm Technology

Skills Framework for InfoComm Technology (SFw for ICT) provides a comprehensive workforce digital skills model based on 7 tracks aligned to 32 sub-tracks and 104 job roles. The tracks consist of Data and Artificial Intelligence, Infrastructure, Software and Applications, Strategy and Governance, Operations and Support, Cyber Security and Sales and Marketing. It is a structured framework based on job roles. It does not include Digital Design in its structure. SkillsFuture Singapore has developed a separate Skills Framework for Media- SFw for Media.

Skills Framework for Media

Skills Framework for Media (SFw for Media) consists of 10 tracks across 112 job roles. It identifies the Media Digital Skills tracks which cover Game Production, Design and Technical Development, Quality Assurance, Content Production, Management and Postproduction, Visual Graphics, Production Technical Services, Media Technology and Operations and Media Business Management. It is comprehensive and specific to the design/media industry.

UK Essentials Digital Skills Framework

UK Essential Digital Skills Framework is focussed on Digital Citizenship and Literacy with 5 essential skills and the adoption of national standards. The digital skills focus on using devices and handling information, creating, and editing, communicating, transacting and how to be safe and responsible online. The national standards set out skill statements across two levels - Entry Level for adults with no or little prior experience of digital devices or the internet and Level 1 for those with some experience but looking to secure basic digital skills. It is easy to adopt but limited to Entry/Level 1 pre-employment and foundation training.

European Commission Digital Skills Framework for Citizens

The European Commission Digital Skills Framework for Citizens (DigComp 2.1) is updated every 3 years. It features 5 Competence areas with 21 competencies across 8 proficiency levels. The European Digital Competence areas cover information and data literacy, communication and collaboration, digital content creation, safety and problem solving. Proficiency levels extend from Foundation to Highly Specialised Levels. The framework is practical and easy to adopt. However, it does not capture emerging technologies or adequately encompass datafication at the level of the workforce.

Skills for the information Age

Skills for the information Age (SFIA) is business and industry led. It describes the skills and competencies in ICT, digital transformation, and software engineering across 7 levels of responsibility and includes 102 professional skills. SFIA also provides views of specific ICT roles including Digital Transformation, DevOps, Information and Cyber Security, Agile Skills, Enterprise IT and Software Engineering. SFIA is a resource to build digital skillsets and pathways.

Digital Intelligence Framework

Digital Intelligence Framework (DQ) encompasses global standards for digital literacy, skills, and readiness. It consists of 8 Critical Areas of digital life which comprises digital identity, digital rights, digital literacy, digital communication, digital emotional intelligence, digital security, digital safety and digital use. These can be developed at 3 levels - Digital Citizenship, Digital Creativity and Digital Competitiveness - and applied across 24 competencies (DQ24) and 12 Future Readiness Skills. It is focussed on foundation, pre-employment, and school education sectors with scope for the workforce at entry levels and up.

Level of information on proficiency levels and non-technical skills

The proficiency levels in the international digital skills frameworks are shown in Table 2. The data indicates a diversity of approaches to proficiency in terms of levels, stages/groups/tiers and cognitive challenge. However, it shows that autonomy and complexity are the most common basis to differentiate proficiency levels.

Table 2 Proficiency levels of international digital skills frameworks

DigComp 2.1	Digital Intelligence DQ	Essential Digital Skills	SFIA
8 Levels Based on Autonomy, Complexity, Cognitive Domain Level 1-2 Foundation Level 3-4 Intermediate Level 5-6 Advanced Level 7-8 Highly Specialised Remembering, Understanding, Applying, Evaluating, Creating	3 Levels Based on Attitude/Values Knowledge, Skills Basic: Foundational Skills and Knowledge Intermediate: Applying and enhancing this knowledge and skills Advanced: Applying skills to a broader level (organisation professional)	2 Levels Entry Level: No or little prior experience of digital devices or internet. Level 1: Some experience but lacking secure basic digital skills. SFw for ICT/Media 6 Levels Based on Autonomy, Complexity, Responsibility, Knowledge & Abilities	7 Levels Based on Autonomy, Complexity, Influence, Knowledge, Business Skills Level 1: Follow Level 2: Assist Level 3: Apply Level 4: Enable Level 5: Ensure, Advice Level 6: Initiate, influence Level 7: Set strategy, inspire, mobilise

A review of the non-technical skills in the international digital skill frameworks are summarised in Table 3. This indicates that the most common non-technical skills across all frameworks are problem solving and communication skills. Four models include collaboration, leadership and creativity and decision making/analytical thinking while adaptability is represented in three cases (Skills Framework for InfoComm Technology, Skills Framework for Media and Digital Intelligence Framework (DQ)).

Table 3 Non-technical skills of international digital skill frameworks

Digital Intelligence (DQ)	SFw for ICT/Media	SFIA
Future Readiness Skills Adaptability Analytical Thinking Communication Creativity Critical Thinking Initiative Leadership Organisational Skills Problem Solving Resilience Social and emotional Technological Skills	Critical Core Skills Adaptability Creative Thinking Building Inclusivity Collaboration Communication Customer Orientation Decision Making Developing People Digital Fluency Global Perspective Influence Learning Agility Problem Solving Self-Management Sense Making Transdisciplinary Thinking	Behavioural Factors Collaboration Communication Creativity Decision Making Delegation Influence Leadership Learning & Development Planning Problem Solving DigComp 2.1 Competence Area Collaboration Communication Problem Solving

Comparison of digital skills frameworks

A comparison of the digital skills frameworks indicates that there are some common features and major differences. In summary these are listed in Table 4.

Table 4 Comparison of international digital skills frameworks

Digital Skills Frameworks Common features	Digital Skills Frameworks Different features
<ul style="list-style-type: none"> • Data security, safety and data literacy are included in all frameworks • Focus on Digital Citizenship and/or Digital Literacy in 3 models • Proficiency levels are commonly based on autonomy, complexity of task and level of responsibility (Appendix 1, Table A3) • Non-technical skills – problem solving and communication, are centred in all models with creativity, collaboration, and leadership in most. SFIA produced the behavioural skills underlying the proficiency levels. (Appendix 1, Table A4)) • Non-technical skills are assessed at Basic, Intermediate and Advanced Proficiency. • Approved Standards for Digital Citizenship for the UK and DQ Global Standards in Digital Citizenship, Skills and Readiness. • The pathways lead to pre-employment, foundation or short courses or job roles. Limited higher certification. • Do not adequately include emerging technologies and new digital markets. 	<ul style="list-style-type: none"> • Range from simple (Essential Skills UK) to comprehensive underlying structures and components (SFw ICT). • Difference in language and definitions. For example, pathway, competence or tracks are similar concepts with different terminology; categories are not well defined. Artificial Intelligence, digital literacy, digital fluency what do these mean in context? • There are a number of digital domains ranging from 5 Competences (DigComp/Essential Skills) to 10 Tracks (Singapore - SFw Media) • Proficiency Levels vary from 2 levels to 8 levels for advanced digital skills (Highly Specialised DigComp 2.1) • Proficiency categories vary in terminology. For example, Intermediate or Level 3: Apply; or Advanced and Highly Specialised may be at the same level. • The focus on the stage of digital proficiency varies from Digital Citizenship (UK), Digital Literacy (DQ) or Advanced Level digital skills that are limited in these models.

A comparison across the Skills Framework model indicates that:

Most commonly, all of these digital skills frameworks include digital skills related to data and information literacy, safety and security. There is also an even number of models that focus on digital citizenship or digital literacy compared to advanced digital skills and workforce models. The majority of workforce models that exist relate to job roles rather than skillsets and do not feature digital literacy in its structure. Further variations indicate minimal skillsets or pre-employment and foundation level outcomes.

Proficiency levels are typically based on complexity of task, autonomy, and level of responsibility. Non-technical skills are paramount in the models particularly problem solving and communication which feature in all frameworks, while collaboration, leadership and creativity are included in workforce skill models. However, all digital skill frameworks do not adequately include emerging technologies and technological innovations and related skillsets.

The major differences between the digital skills frameworks relates to their underlying purpose. They range from focusing on essential skills for citizens to a specialised digital workforce. The exception to this is the DQ framework which is associated with 3 key global standard areas - digital literacy, skills and readiness developed across 3 levels - digital citizenship, digital competitiveness, and digital creativity. Other features of the models also vary. The number of digital skill domains range from 5 to 10 categories, proficiency levels range from 2 to 8 along with variation in the proficiency descriptors and groups.

It is also notable that all digital skill frameworks do not adequately include emerging technologies and technological innovations with related skillsets.

Digital skills development model features

A comparison across the Digital Skills Framework model suggests a Workforce Based Digital Skills Development Framework include a number of features.

Suggestions towards an effective digital skills pathway model include standard definitions specific to the framework and a common language to understand reference to digital skills. The number of domains range from 6 to 7 and include a digital design domain and an innovation domain to capture emerging technologies and related skills clusters. The digital skills model encompasses digital citizenship, digital literacy and advanced/professional digital skill levels into the one framework. In addition, there be digital skills proficiency levels that extend from foundation to advanced professional levels. Most importantly ensuring critical non-technical skills are included and sit at the centrepiece of digital skills performance.

Australian Government Digital Skills Initiatives

Federal government initiatives

A high-level exploration of the Australian context for digital skill initiatives indicates that Australia is facing a challenge to developing, training, and sustaining a digitally skilled workforce. This section considers the digital skill initiatives in Australia and the key findings that can inform the development of a sustainable and relevant digital skill pathways model for the Australian context.

The DISER (unpublished) identified more than 50 digital skills programs, policies and activities pursued by the Federal Government. Table 5 reports the government focus areas with a list of digital skill initiatives.

Table 5 Government focus areas regarding digital skills initiatives

<p>CYBER SECURITY Cyber Security National Workforce Growth Program, Cyber Skills Partnership Innovation Fund, Cyber Workforce Professionalisation Stream, Questacon Cyber Education, ASD Cyber Skills Framework, Australian Defence Force Cyber Gap Program, AusCyber AI & BLOCKCHAIN AI Action Plan, Blockchain Roadmap</p>	<p>STEM Advancing Women in STEM Strategy & 2020 Action Plan, Women in STEM Ambassador Indigenous Girls STEM Academy Women in STEM and Entrepreneurship Program, Girls in STEM Toolkit, Women in STEM Cadetships & Advanced Apprenticeships Programs</p>	<p>MEASUREMENT Digital Skills Measurement Framework, Longitudinal Data Collection, Startup Data Project RESOURCES Jobs Outlook Portal Digital Skills Finder APS Career Pathfinder Jobs Outlook Portal Labour Market Info Portal, JEDI, APS Digital Careers Framework</p>
<p>SCHOOL Digital Careers, Bebras, Young ICT Explorers, FarmBeats for Students, CyberTaipan. Pathways in Technology, Collaboration Pilot - Industry 4.0 OTHER Be connected initiative Foundations Skills for Your Future Skillings Australia Fund Job Trainer Fund</p>	<p>SME Empowering Business to Go Digital Business Advisory Services Entrepreneurs Program Small Business Digital Champions DSO Pilots, Business Investment and Innovation Program TALENT DTA Emerging Talent Program, Home Affairs Global Talent Visa Program, Skilled Migration Program</p>	<p>INDUSTRY Digital Directors Program Digital Foundations for Agriculture Strategy, National Digital Health Workforce & Education Roadmap/Capability Action Plan, National Nursing and Midwifery DHCF, National DHCF for Medicine, Mining Equipment Tech/Services Growth Centre, Adv Manufacturing Growth Centre</p>

The digital skills initiatives target different outcomes and industries.

An analysis of the data indicates the focus of digital initiatives often overlap. The figures show that 80% of these initiatives focus on reskilling and upskilling, 60% developing job-ready graduates, 40% building business capability and digital skills measurement tools and 20% of initiatives relate to talent identification.

The major focus areas include cybersecurity and STEM, digital skills for small and medium sized enterprises, industry growth, school education, resources for digital careers and measuring digital skills. Over 22% of these digital initiatives are frameworks, actions plans or roadmaps.

The key findings from the report of mapping the digital skills initiatives indicate that there is no clear or compelling narrative that unifies these initiatives and aligns key stakeholders. The efforts are overlapping, and duplicating industry led digital skill initiatives. Furthermore, there is a lack of a common language to discuss digital skills. There is also a perceived mismatch between government digital skills initiatives and industry needs with no standard definition of digital skills to measure effectively.

The government also recently announced the Next Generation Artificial Intelligence and Emerging Technologies Graduate Programs to train job-ready specialists. The latter program proposes to include robotics, cybersecurity, quantum computing, blockchain and data through national scholarships. Also of interest is the emerging occupations identified by the National Skills Commission (NSC) which includes occupations under the broad category of digital deepening and data analytics (NSC,2020). The former category relates to the increasing role of technology in business with digital marketing, social media and user experience specialists.

The review of the Australian Qualifications Framework (AQF) is also proposing more clearly defined and concise knowledge and skill bands that can be applied flexibly to qualifications (Expert Panel for the Review of the AQF, 2019). The recognition of micro-credentials in Australia through credit and alignment to an AQF band of shorter form credentials marks opportunities to meet the demand for digital upskilling and better response to employment and training needs.

A further national initiative conducted by NCVET (unpublished) involved a feasibility study to assess the potential of aggregating skills data and information sources in Australia. The outcomes of this research may propose options to develop data-driven intelligence to enable a better understanding of the supply and demand of digital skills in Australia.

State government initiatives

At the State and Territory Government level, the focus on emerging technologies is growing with increased committed investment to prepare the workforce with digital skills to meet the demands of technological innovation. Examples of state government digital skills initiatives include:

- Queensland's Digital Professional Workforce Action Plan 2020-2024 aims to develop an online digital industry directory, professional digital education pathway with digital traineeships/apprenticeships, accelerate online nationally accredited ICT and micro-credentialing and short courses and support mature-age digital career pathways
- The South Australian High-Tech Sector Plan 2030 for new jobs and career pathways strategy includes the Diploma of Applied Technologies, 42 Australia coding school and FIXE Scholarships. Focus areas include Applied Industry 4.0, cybersecurity, quantum computing, Internet of Things (IoT), Computer Vision/VR, Blockchain, AI/Machine Learning & Advanced Data Analytics, Optics and Photonics
- The Digital Skills and Jobs Program 2021 is aimed at training mid-career Victorians to transition to high growth career pathways with up-to-date digital skills for business roles in specialised digital areas including web or software development, digital marketing, data analytics or cybersecurity.
- TAFE NSW Schools Launchpad commences in 2022 with teacher-led virtual classrooms including programs in Big Data, Cloud Computing, Cyber Security, Game Design, Robotics and Web Development
- University of South Australia's (UniSA) new partnership in 2021 with Accenture has seen a co-creation of the Innovation Academy in Digital Business offering a bachelor's degree in digital

business along with short Professional Development courses which will be developed to also upskill Accenture's global clients and its own workforce.

- The University of Technology Sydney (UTS) partnership with Telstra (Telstra+UTS) are developing microcredentials to target skill gaps at Telstra. UTS has developed processes for Telstra employees to “stack” their microcredentials for credit towards a Master of Professional Practice. These microcredentials have shown the highest retention and completion rates across all of Telstra's previous Professional Development activities.

In summary the digital skills initiatives are commonly developed independently across jurisdictions through action plans, programs, and partnerships. There is limited integration of activities or an overarching skills framework in Australia which reduces the capacity to adequately navigate the digital skills landscape and effectiveness of training. However, industry engagement and microcredentialing indicate a positive approach.

Digital skills development model features

The key issues arising from the government digital skill initiatives suggest a Workforce Based Digital Skills Development Framework include a number of key features.

Suggestions for an effective digital skills pathway model include the design of a structure that unifies the digital skills training eco-system. Additional features include standard definitions of digital skills terminology and a common language to discuss and measure skills. Most importantly, the model is flexible to enable multi-directional pathways and micro-credentials that can be blended. Finally, the digital skills framework includes security and data analysis domains to support cyber security, data analytics and AI/machine learning along with an innovation domain to accommodate emerging technologies and technological innovations with related skill clusters.

The DSO Pathways Model 1.0

A suggested DSO Pathways Model

Guiding principles

The DSO Pathways Model presented is informed by the analysis of a high-level review of international digital skills frameworks and Australian government digital skills initiatives.

The development of the model is based on five guiding principles that require a pathways model to be:

1. Stable over time
2. Flexible, practical, and easily understood and implemented
3. Independent of digital tools, occupation titles and the environment
4. Dynamic with the ability to capture emerging technologies and innovation skillsets
5. Well defined and easy to adopt.

Structure

The design criteria for the structure of the pathways model are established on the basis that it unifies the digital skills ecosystem, is flexible to accommodate multiple pathways and adaptable to support a fit-for-purpose functionality.

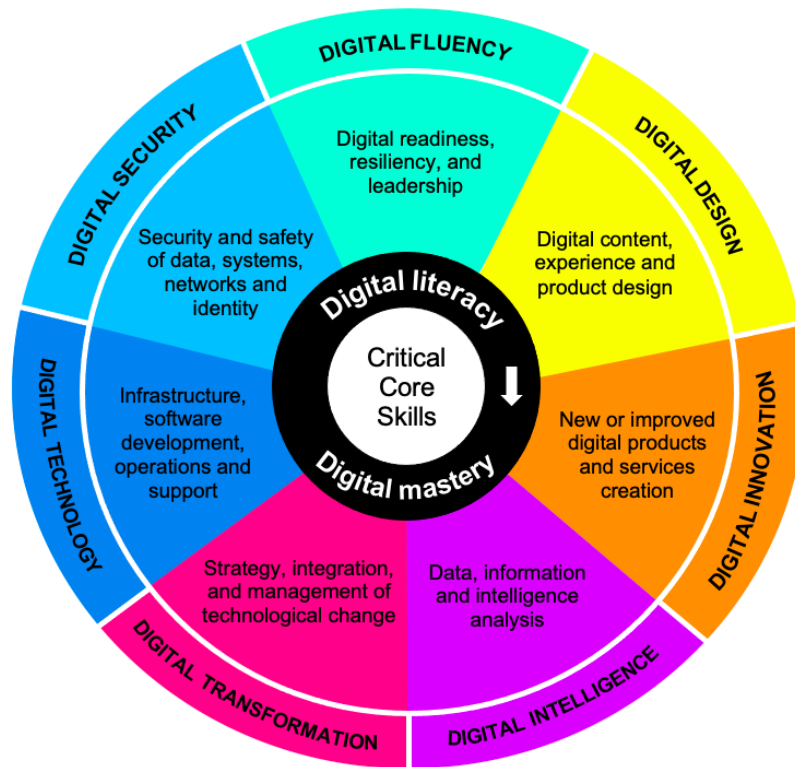
The Digital Pathways Model also takes an inclusive approach to capture both essential digital skills and advanced digital skills needed to develop new digital technologies, products and services within the same framework.

The suggested DSO Pathways Model consists of four elements:

- Core purpose
- Digital skill domains
- Digital proficiencies levels, and
- Critical core skills

A visual representation of the model for illustrative purposes only is presented in Figure 1.

Figure 1 Suggested DSO pathways model 1.0



Core purpose

The DSO Pathways Model aims to define and support the organisation and complexity of digital skills into a manageable framework. To achieve this, each digital domain has an underlying purpose to anchor the model around the building blocks of digital transformation, as well as the core need of the employer and the aspirations of the individual. Purpose gives core stability and structure to the model and is derived from the core functions required to innovate, design, build, transform, analyse and protect the data and technology that power the digital world, along with the necessity to adapt to the changing digital environment. This together forms the core purpose of digital skills training in this model, and when we define what to focus on in the digital context, as illustrated in Table 6, we bring together a unified model that clearly identifies digital skill domains.

Table 6 DSO Pathways purpose, descriptor and digital domains

Purpose	Descriptor	Digital Domain
Adapt	Readiness, Resilience and Leadership	Digital Fluency
Analyse	Data, information and intelligence analysis	Digital Intelligence
Build	Infrastructure, software development, operations, and support	Digital Technology
Design	Content creation, experience and product design	Digital Design
Innovate	Creation of new or improved products, processes and services	Digital Innovation
Protect	Security and safety of data, systems, networks and identity	Digital Security
Transform	Strategy, integration and management of technological change	Digital Transformation

Figure 1 presents a visual representation of the DSO pathways model to illustrate the digital domains as a unified digital skills ecosystem through which one may travel, creating a pathway from stacked skills.

Digital domains

There are seven digital skill domains. Each domain is aligned to a core purpose and related to specific core skills cluster. Each digital domain is presented with a digital domain descriptor and examples of associated digital skill clusters.

Digital Design

Digital Design Domain Descriptor: Digital content, user experience and product design.

The Digital Design domain covers a range of skill clusters associated with content creation, user experience design and digital products development. Digital Design includes user interface design, web design, data visualisation, animation, game design, visual effects and social media production.

Digital Fluency

Digital Fluency Domain Descriptor: Digital readiness, resilience, and leadership.

The Digital Fluency domain supports the skill clusters associated with the digital mindset and cognitive attributes related to successfully adapting within and across technological contexts. It includes digital citizenship to digital leadership, understanding risks and response, constructing knowledge, communicating ideas, and navigating digital spaces effectively. Digital fluency also includes the know-how to use the right tools, processes, and software. This is an overarching pathway across all other pathways as an essential skillset to operate effectively across the digital landscape and drive digital transformation.

Digital Innovation

Digital Innovation Domain Descriptor: New or improved digital products, processes, or services.

The Digital Innovation domain is designed to include digital skills clusters for emerging and disruptive technologies in their infancy and entrepreneurial start-ups. Over time these technologies/applications may diffuse into other domains after commercialisation. It also accommodates entrepreneurial skill clusters, business innovation, new and improved business processes/services and provides the ability to capture new skills evolving from emerging technologies. It also supports innovation thinking and innovative processes from within and across organisations.

Digital Intelligence

Digital Intelligence Domain Descriptor: Data, information, and intelligence analysis.

The Digital Intelligence domain encompasses a range of skill clusters from information and data literacy to data analytics and data modelling. It includes data and decision making, big data, data engineering, web analytics, data science and data modelling to machine learning and artificial intelligence.

Digital Security

Digital Security Domain Descriptor: Security and safety of data, systems, networks, and identity.

The Digital Security domain covers a broad range of skill clusters including cybersecurity to data protection, online privacy, risk and control, threat intelligence and detection, forensic skills, risk management, security administration, information security, vulnerability research and cyber-ethics.

Digital Technology

Digital Technology Domain Descriptor: Infrastructure, software development, operations, and support.

The Digital Technology domain focuses on skill clusters related to the development, operation, maintenance, and support services for digital infrastructure including hardware, operating systems, networks, and software design and development. It includes cloud computing, programming, and coding, software engineering, app development, telecommunications, database support and maintenance.

Digital Transformation

Digital Transformation Domain Descriptor: Strategy, integration, and management of technological change

The Digital Transformation domain supports the skill clusters that underpin the organisational strategy, application, and management of technological change including change management, quality management, strategy and governance and planning and adoption of new products, processes, services, systems applications and integration.

Table A2 in Appendix 1 looks at how these digital domains sit within the international frameworks discussed.

Digital proficiency levels

The Pathways Model has 7 levels of proficiency from Level 1, the lowest, to Level 7, the highest. The proficiency levels cover foundation to advanced level professional skills. Each level represents a step up in digital skill development according to complexity of task and degree of autonomy.

The elements that represent the levels of proficiency are defined in a way that makes the different levels progressive and markedly distinct while also aligning to a 3-tier proficiency grouping. Table 7 maps the proficiency groups to a range of proficiency levels with an indicative description of task complexity and degree of autonomy in completing the task or resolving the problem to achieve the learning outcome.

The structure of the proficiency levels presents a flexible framework to support three approaches to skill development. These are based on proficiency groupings (specified range of levels), cumulative skill progression (levels on a continuum) and utilising proficiency levels independently as distinct units to meet skill requirements at varied levels.

Firstly, the proficiency levels can be applied using 3 proficiency groups that cover Digital Literacy, Digital Fluency and Digital Mastery.

Digital Literacy Level 1-2 covers the foundation skills and relates to the fundamental knowledge and understanding and use of digital tools, methods, processes or applications. It aims to provide a basic understanding across the digital domains. These proficiency levels focus on simple or well-defined tasks with guidance. They apply to digital literacy and foundational learning and relate to the “know-what” dimension.

Table 7 Proposed DSO Pathways proficiency levels

Proficiency Group	Proficiency Group Descriptor	Level	Description
Digital Literacy: (know-what)	Foundation knowledge and understanding (and use)	Level 1	Understands and uses tools, methods/processes, and applications with basic information. Learns new skills. Able to perform simple tasks with guidance.
		Level 2	Understands and uses tools, processes and applications in structured context. Able to perform well-defined/routine tasks with guidance.
Digital Fluency: (know-how and why)	Application of knowledge and understanding	Level 3	Applies knowledge and understanding of tools, processes and applications to "well-defined or routine tasks done independently.
		Level 4	Applies knowledge and understanding of tools, processes and applications to a variety of different tasks and problems independently and guiding others.
		Level 5	Applies knowledge and understanding to evaluate and apply appropriate tools, processes or applications to varied tasks, adapting to others in complex context.
Digital Mastery:	Advance knowledge to a broader context	Level 6	Advances knowledge of tools, methods and applications to initiate, improve and integrate. Resolves complex problems with limited solutions. Leading others.
		Level 7	Advances knowledge of tools, processes and applications to create and propose new ideas and processes. Resolves complex problems with many factors. Inspiring others.

Digital Fluency Level 3-5 relate to the application of knowledge and understanding to demonstrate the proficiency to apply the tools, methods, processes or applications to well-defined or varied tasks independently. The professional at this level focuses on the “know what and why” dimension with increasing levels of autonomy and complexity of task. There is a focus on implementation, evaluation and the ability to implement something new with the tools and know-how.

Digital Mastery Level 6-7 advances the knowledge and understanding into a broader context with more complex problems and higher levels of autonomy and influence to build digital skills capacity. There is a focus on the ability to initiate, improve, integrate and transform with the tools, processes and applications at a professional level, and at the highest proficiency Level 7 to create, innovate, propose new ideas, processes or applications at a highly specialised level. This is digital mastery.

Alternatively, the proficiency levels can be utilised as a digital skill development progression on a continuum from entry Level 1 to digital mastery/advanced Level 7. With this approach the proficiency levels are applied on a proficiency continuum and the skill development is cumulative.

Thirdly, the proficiency levels are designed as distinct units and can be applied independently to meet skill development needs. This approach provides the agility and option to build digital pathways with skill clusters of varied proficiency levels travelling through the digital domains.

Table A3 in Appendix 1 provides further information on proficiency maps for the international digital skills frameworks discussed in this report.

Critical core skills

At the core of the DSO Pathways Model are critical skills that apply to all pathways to build digital capability and are assessed with performance criteria. For this model these non-technical skills are referred to as Critical Core Skills. Table 8 summarises these skills.

Table 8 DSO Pathways non-technical critical core skills

Category	Critical Core Skills
Critical Thinking	Problem Solving, Analytical Thinking, Creative Thinking
Connecting to Others	Communication, Collaboration, Leadership
Adapting	Adaptability skills associated with ability to learn, grow and change in dynamic environments

Critical Core Skills are transferable skills. In this model there are seven critical skills across three categories.

Critical thinking skills of Problem Solving, Analytical Thinking/Decision Making and Creative Thinking; Connecting to others through Communication (emotional intelligence), Collaboration (building teams) and Leadership (developing people), and Adaptability skills associated with the ability to adapt and apply skills to learn, grow and change in dynamic environments.

A performance criterion for Critical Core Skills is aligned to the 7 levels of Proficiency.

Table A4 in Appendix 1 provides information on critical skills maps for the international digital skills frameworks discussed in this report.

Digital skills pathways example

This section presents practical applications of the digital pathways model.

Figure 2 illustrates examples of Cybersecurity and Machine Learning core skill clusters and their journey through digital domains to build digital skill pathways. The diagram indicates the digital core skill clusters, descriptors and digital skill domains. The domains also feature colour coding for easy visual reference and alignment with the DSO pathways model in Figure 1. All digital core skill clusters indicated in this figure are for illustrative purposes only for this report.

Cybersecurity digital skills pathway

The first example in Figure 2, illustrates 7 digital core skill clusters related to Cybersecurity. They map to the digital domains in this way:

- Analytics core skill clusters are related to data analysis and maps to the Digital Intelligence domain.
- Information assurance, security administration, threat intelligence and vulnerability research core skill clusters specifically relate to the protection of data, information and potential threats and risk and align to the Digital Security domain.
- Information Governance and Information Management core skill clusters focus on organisational strategy and management plan and map to Digital Transformation

These seven Cybersecurity core skill clusters travel through three digital domains - Digital Intelligence, Digital Security and Digital Transformation - to create a Cybersecurity digital skills pathway.

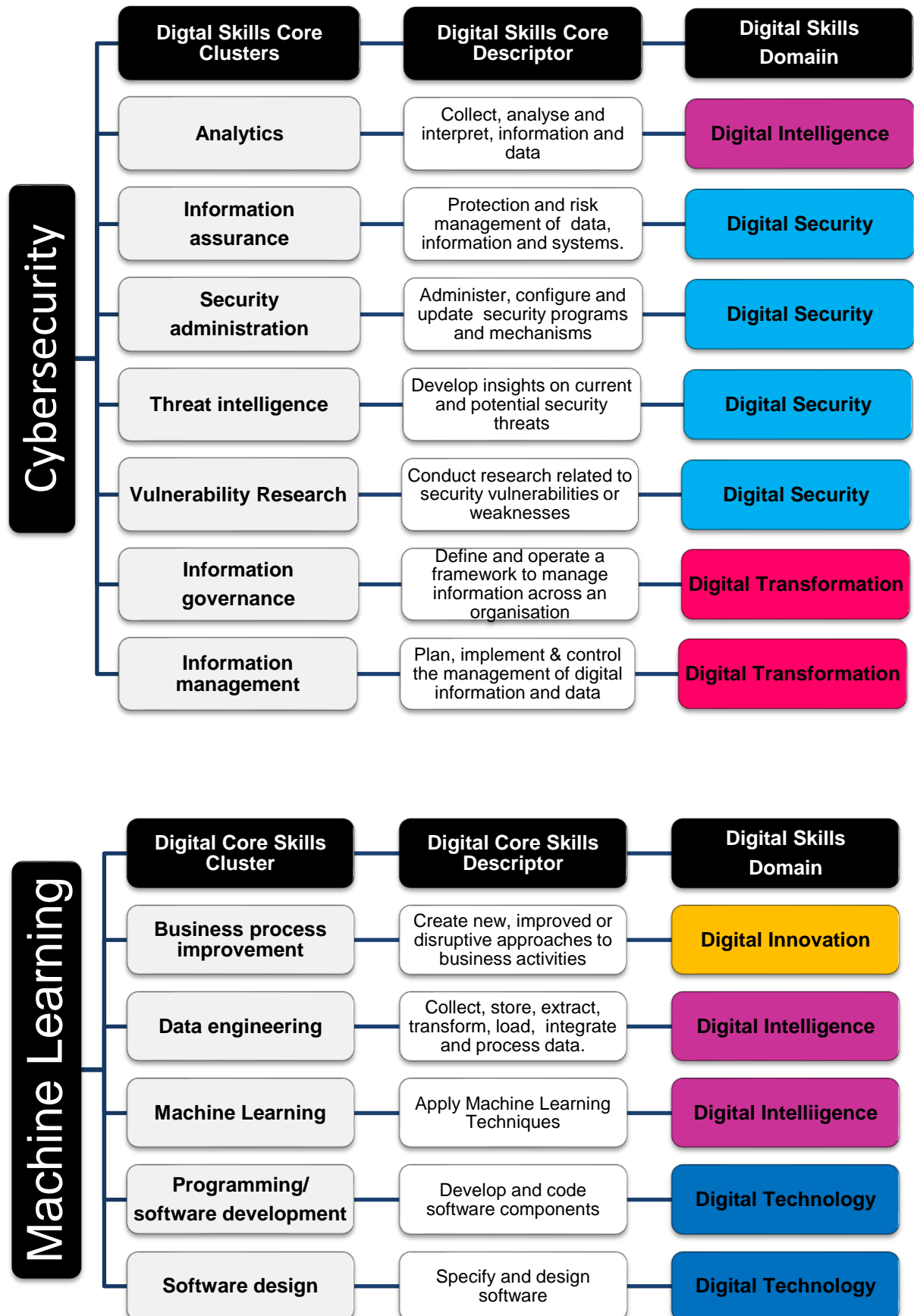
Machine learning digital skills pathway

The second example in Figure 2, Machine Learning, illustrates 5 digital core skill clusters. They map to the digital domains in this way:

- Business process improvement core skill clusters relate to the creation of new/improved approaches and maps to the Digital Innovation domain.
- Data engineering and machine learning applications core skill clusters encompass data, analytics and intelligence and align with the Digital Intelligence domain.
- Programming/software development and software design core skill clusters relate to the building of software and map to the Digital Technology domain.

In this example, the Machine Learning core skill clusters travel through three digital domains. One skill cluster journeys through the Digital Innovation domain and two skill clusters travel through the Digital Intelligence and Digital Technology domain, to create a Machine Learning digital skills pathway.

Figure 2 Digital skills pathway example



Transformational digital skills model

The suggested DSO Pathways model is a transformational design for several reasons. It combines and unites a number of digital skills domains that are missing in other frameworks. These include digital design, digital innovation, digital transformation, and digital fluency. The digital design domain encompasses content, experience, and product design skill clusters. The digital innovation domain accommodates entrepreneurial and business innovation skill clusters and provides the ability to capture new skills evolving from emerging technologies. The digital transformation domain supports the skill clusters that underpin technological change. Digital fluency brings essential mindset and cognitive attributes to successfully adapt across technological contexts which are generally excluded from skill frameworks but in this model presents an overarching support across all digital domains. The inclusive model also encompasses digital literacy to advanced digital skill levels with the flexibility to integrate multi-directional pathways with professional workforce skill proficiencies.

Next Steps

This report provides the first stage to unify the digital skills eco-system and provide a foundation framework upon which to build. It now needs a bold, progressive, and practical approach to add the elements that will define, describe, and direct a pathway to meet digital skills development and employment needs.

The following steps are a suggested guide to achieve this outcome:

1. Define all terminology used within the pathways model and align with DSO Skills model standard definitions to develop a common digital skills language
2. Build on the 7 Digital Skill Domains and define digital skill clusters and descriptors
3. Develop the 7 Digital Skills Proficiency Levels and establish the descriptors
4. Develop the Critical Core Skills and determine the performance proficiency criteria
5. Develop a more refined fluid visual representation and logic flow of pathways and their components
6. Prioritise initial focus to Cybersecurity, Data Analytics and AI/Machine Learning/Cloud Digital Skills Pathways

In conclusion, the DSO pathways model provides three overarching strengths. It is holistic and encompasses the digital skills eco-system in one model. It is an adaptable and flexible framework with digital domains and skill clusters that can be blended together at varying proficiency levels for a fit-for-purpose training strategy. In addition, it is agile as it can evolve with technically up-to-date and new digital skills related to emerging technologies.

The application of the Pathways Model provides a roadmap for individuals, employers, training providers, and government agencies to navigate the vast digital skills landscape. And in doing so, advance digital skills development, build digital capacity and promote lifelong learning within a unified digital skills framework in Australia.

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- UTS+Telstra: Rapidly reskill 1,000+ Telstra employees in data capability across six countries? Challenge Accepted, available at: <<https://open.uts.edu.au/insights/success-stories/telstra-plus-uts/>>

Appendix 1 Framework Comparisons

Table A1 International digital skills frameworks

Digital Skills Framework	Structure	Components	Proficiency Levels
<p>The European Digital Competence Framework for Citizens (DigComp) Developed by the JRC of the European Commission. First published in 2013.</p>	<p>DigComp 2.1 consists of 5 Competence Areas with 21 Competences across 8 Proficiency Levels</p>	<p>Competence Areas 1. Information & data literacy 2. Communication and Collaboration 3. Digital Content Creation 4. Safety 5. Problem Solving</p>	<p>8 Proficiency Levels based on Complexity of tasks, Autonomy and Cognitive Domain. Foundation Level 1-2, Intermediate Level 3 - 4, Advanced Level 5-6 and Highly Specialised Level 7-8</p>
<p>Skills Framework for InfoComm Technology (SFw for ICT) Developed by SkillsFuture Singapore (SSG), Workforce Singapore (WSG), Infocomm Media Development Authority (IMDA) and Cyber Security Agency of Singapore (CSA) with employers, industry, education and training providers.</p>	<p>SFw for ICT consists of 7 Tracks, 32 Sub-Tracks and 104 job roles. Provides career pathways, responsibilities, skills and competencies with 12 non-technical and 16 Critical Core Skills.</p>	<p>7 Tracks 1. Data and Artificial Intelligence 2. Infrastructure 3. Software and Applications 4. Strategy and Governance 5. Operations and Support 6. Cyber Security 7. Sales and Marketing</p>	<p>Each track has 6 Levels of Proficiency based on Autonomy, Responsibility, Complexity, Knowledge and Abilities. There are also 16 Critical Core Skills (CSS) under Thinking Critically, Interacting with Others & Keeping Relevant with Basic, Intermediate and Advanced Proficiency Levels.</p>
<p>Skills for the Information Age (SFIA) SFIA is a skills framework that describes the skills and competencies in ICT, digital transformation and software engineering. SFIA is a global not for profit organisation in the UK.</p>	<p>SFIA consists of 6 categories with 17 sub-categories and 102 professional skills. Includes selected SFIA views of DevOps, Big Data, Digital Transformation, Information and Cyber Security, Agile Skills, Enterprise IT, Software Engineering</p>	<p>6 Categories 1. Strategy and Architecture 2. Change/Transformation 3. Development and Implementation 4. Delivery and Operation 5. Skills and Quality 6. Relationship/Engagement</p>	<p>Consists of 7 Levels of Responsibility based on Autonomy, Influence, Complexity, Knowledge and Business Skills. Follow, Assist, Apply, Enable, Ensure/Advice, Initiate and Set strategy, Inspire, Mobilise.</p>

Digital Skills Framework	Structure	Components	Proficiency Levels
<p>Skills Framework for Media (SFw for Media) Developed by SkillsFuture Singapore (SSG), Workforce Singapore (WSG) and Enterprise Singapore.</p>	<p>SFw for Media consists of 10 tracks across 112 job roles with 16 Critical Core Skills and 18 Technical skills and competences with occupation specific knowledge, skills and abilities.</p>	<p>10 Tracks:</p> <ol style="list-style-type: none"> 1. Game Production, 2. Game Design 3. Game Technical Development 4. Quality Assurance 5. Content Production & Management 6. Visual Graphics 7. Production Technical Services 8. Content Post-Production, 9. Media Technology & Operations 10. Media Business Management 	<p>Each track has 6 Levels of Proficiency based on Autonomy, Responsibility, Complexity, Knowledge and Abilities. There are also 16 Critical Core Skills (CSS) under Thinking Critically, Interacting with Others & Keeping Relevant with Basic, Intermediate and Advanced Proficiency Levels.</p>
<p>National Standards for Essential Digital Skills Defines the UK essential digital skills adults need for work and life in a digital world.</p>	<p>Supporting providers, organisations & employers across the UK who offer training for adults to secure their essential digital skills needed for life and work at Entry Level and Level 1.</p>	<p>5 Essential Digital Skills</p> <ol style="list-style-type: none"> 1. Using devices and handling information 2. Creating and editing 3. Communicating 4. Transacting 5. Be safe and responsible online 	<p>The standards set out skill statements across two levels - Entry Level for adults with no or little prior experience of digital devices/internet and Level 1 for those with some experience but lacking secure basic digital skills.</p>
<p>Digital Intelligence Framework (DQ) Endorsed by the Coalition for Digital Intelligence (CDI) formed in 2018 by OECD, IEEE SA and DQ Institute in association with the World Economic Forum. In 2020 the IEEE approved the Global Standards on Digital Literacy, Digital Skills and Digital Readiness (IEEE 3527.1)</p>	<p>The DQ Framework consists of 8 Critical Areas of Digital Life. These can be developed at 3 levels (Digital Citizenship, Digital Creativity and Digital Competitiveness) across 24 digital competencies (DQ24) and 12 Future Readiness Skills</p>	<p>8 Critical Areas of Digital Life</p> <ol style="list-style-type: none"> 1. Digital Identify 2. Digital Rights 3. Digital Literacy 4. Digital Communication 5. Digital Emotional Intelligence 6. Digital Security 7. Digital Safety 8. Digital Use 	<p>The Critical Areas developed at 3 Levels Citizenship, Creativity & Competitiveness with 12 Future Readiness Skills (Basic, Intermediate and Advanced) Analytical & Critical Thinking, Organisational & Technological Skills, Problem Solving, Creativity, Initiative, Communication, Adaptability, Resilience, Social & Emotional Skills, Leadership</p>

Table A2 Digital domain and skill clusters within digital skills frameworks

Purpose	Digital Skills Domain	DigComp 2.1	Digital Intelligence Digital Literacy Skills, Readiness	Essential Digital Skills Literacy	SFw for ICT Workforce, Jobs	SFw for Media Workforce, Jobs	SFIA Views
ANALYSE	Digital Intelligence: Data and decision making	Information and data literacy	Data and AI Literacy Computational Literacy	Handling information	Data and Artificial Intelligence	Quality Assurance	Big Data/Data Science (View)
BUILD	Digital Technology: IT Infrastructure, hardware, software and support	Programming (3.4) Using digital technologies (5.3)	Digital Use Network Management	Using devices Transacting	Infrastructure, Software and Applications, Operations and Support,	Game Technical Development Production Technical Services Media Technology & Operations	DevOps (View) Software Engineering (View) Agile Skills (View) Enterprise IT (View) Development & Implementation Delivery & operation
DESIGN	Digital Design: Content, Experience and user design	Digital Design: Content	Content Creation	Creating and editing	User Interface Design User Experience Design (T) Design Thinking Practice (T)	Game Design Content Production, Visual Graphics, Content Post- Production	User interface design User experience (SC)
INNOVATE	Digital Innovation: Emerging Technologies and Value Creation	None	Digital Creativity (Level)	None	None	Game Design	Digital Strategy, Innovation and Investments
TRANSFORM	Digital Transformation	None	Digital Competitiveness (Level)	None	Strategy and Governance	None	Digital Transformation (View) Change & Transformation
PROTECT	Digital Security	Safety	Digital Security and Safety Cyber Risk Management Security Management Digital Identity	Be safe and responsible online	Cyber Security	None	Information and Cyber Security (View)

Table A3 Proficiency maps within the digital skills frameworks

PROFICIENCY MAP	Define	Level	DigComp 2.1 Complexity, Autonomy, Cognitive Domain	DQ Future Readiness Skills	Essential Digital Skills	SFw for ICT/Media Responsibility, Autonomy, Complexity	SFIA Complexity, Autonomy, Knowledge, Business Skills
Digital Literacy	Knowledge - Understanding and use of digital tools [know-what]	Level 1: Process	Level 1: Foundation - Remembering	Basic: Foundational skills and knowledge	Entry Level and Level 1	None	None
		Level 2: Use	Level 2: Foundation - Remembering		None	Level 1	Level 1: Follow
Digital Fluency	Application - Ability to create something new with the tools and knowledge [How and Why]	Level 3: Apply	Level 3: Intermediate - Understanding	Intermediate: Applying and enhancing the knowledge and skills	None	Level 2	Level 2: Assist
		Level 4: Implement	Level 4 : Intermediate - Understanding		None	Level 3	Level 3: Apply Level 4: Enable
		Level 5: Evaluate	Level 5: Advanced - Evaluating		None	Level 4	Level 5: Ensure/Advice
Digital Mastery	Advance: Knowledge and capability to drive digital transformation, innovation	Level 6: Initiate Integrate, influence	Level 5: Advanced Applying Level 6: Advanced Evaluating	Advanced: Applying skills to a broader level – organisation, profession.	None	Level 5	Level 6: Initiate, Influence
		Level 7: Create Innovate, Lead, Inspire	Level 7: Highly Specialised - Creating Level 8: Highly Specialised - Creating		None	Level 6	Level 7: Set strategy, inspire, mobilise

Table A4 Critical skills maps within the digital skills frameworks

CRITICAL SKILLS MAP	DigComp 2.1	Digital Intelligence (DQ)	Essential Digital Skills	SFw for ICT/Media	SFIA
Critical Skills	<i>Competence Areas</i>	<i>12 Future Readiness Skills</i>	<i>Digital Skills</i>	<i>Critical Core Skills (CSS)</i>	<i>Behavioural Factors with levels of responsibility</i>
Proficiency Levels	Level 1 to 8 Based on Task Complexity, Autonomy Level and Cognitive Domain. Foundation, Intermediate, Advanced and Highly Specialised Levels.	3 levels Basic: Foundation Knowledge. and Skills Intermediate: Application of Knowledge and Skills Advanced: Broad Application of Knowledge and Skills (organisation)	Entry Level Level 1 Competence	Level of Proficiency Ruler by Level of Responsibility, Autonomy and Complexity for 3 proficiency levels (Basic, Intermediate and Advanced)	Level 1 to 7 Based on Autonomy Influence, Complexity, Knowledge and Business Skills
Critical Thinking	Competence Area 5: Problem Solving	Analytical Thinking Creativity Critical Thinking Problem Solving	Problem solving: Identifying and solving technical problems	Thinking critically: Creative Thinking Decision making Problem Solving Sense making Transdisciplinary thinking	Creativity Decision making Delegation Problem Solving
Connecting with Others	Competence Area 2: Communication & Collaboration	Communication Leadership Social and Emotional Skills	National Standards 3: Communicating and Sharing	Interacting with Others: Building inclusivity Collaboration, Influence Communication Customer orientation Developing people	Collaboration Communication Skills Influence Leadership
Adapability	None	Adaptability Initiative Organisational Skills Resilience Technological Skills	None	Staying Relevant: Adaptability Digital Fluency Global Perspective Learning Agility Self-Management	Learning and development Planning



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