

# Developing appropriate workforce skills for Australia's emerging digital economy: working paper

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# Executive summary

## Project overview and objectives

This working paper is the first publication from a project looking at the role of vocational education and training (VET) in supporting the growing need for digital skills in the Australian workforce. It provides an opportunity for stakeholders to engage with the research mid-way through the project, enabling early results and findings to be used to inform decisions as needed.

The overarching aim of this project is to identify the digital skills requirements for the broader Australian workforce and examine the capacity of the vocational education and training (VET) system and industry training packages to effectively meet the growing need for digital skills. As part of the project's outputs, the study will develop a replicable methodology for reviewing the alignment between skills needs and training capacity, as well as propose a digital skills framework to guide the development of adequate and appropriate digital skills for the emerging digital economy.

The analysis is based on two sectors as case studies – transport and logistics, and public safety and correctional services – with the intention of the findings being broadly transferable across the economy. The study is based on the premise that digital skills are becoming increasingly important for enabling individuals to participate effectively in today's society.

Digital technologies are increasingly interwoven into all parts of our lives and impact on the social, economic and environmental wellbeing of individuals as private citizens and as workers. As growth in Australia's digital economy accelerates from 5% of GDP in 2014 to a projected 7% of GDP in 2020 (Deloitte, 2016, p.3), digital skills will become increasingly important across Australia's workforce.

For the purpose of this study, and the analysis involved, we define digital skills as a combination of a digital mindset (hardware, software, information, systems, security and innovation), knowledge (theoretical comprehension and understanding), competence (cognitive and practical knowhow) and attitude (value and beliefs).

## Study methods

The study employs a mixed method approach, combining both qualitative and quantitative analyses. It involves industry training package content analysis, content extraction and analysis from online job vacancy advertisements, and key industry interviews, as well as a quantitative employer survey. This paper primarily relies on data from the first two methods.

In the online job vacancy analysis, a total of 1708 job advertisements covering 74 occupations/job titles were analysed to explore digital skills requirements. These occupations were drawn from a list of occupations identified as 'in demand' in the 2015 environmental scans produced by the respective industry skills councils of the two sectors under consideration. In addition, a detailed content analysis was conducted of 11 training packages, with a specific focus on the qualifications for these occupations. In this analysis

758 units of competency were analysed to examine how and the extent to which digital skills provision is embedded into qualifications.

## Study findings

From the online job vacancy skills analysis a number of key observations are made:

- Of the 1708 jobs searched, only 204 job vacancies across all of the selected occupations specifically mentioned digital skills. This poses important questions regarding employers' articulation of digital skills and how well they are explicitly stated rather than perhaps assumed. This is important, considering that industry evidence suggests that occupations are changing as the economy enters a digital age, characterised by sophisticated efficiency and productivity-enhancing mechanical and digital technologies.
- Even in the job advertisements where digital skills were specifically mentioned, the level of expected application is largely vague and mostly basic. Employers used descriptions of expected performance like 'strong', 'good', 'sound', 'solid' and 'basic'. This suggests that employers are not clearly articulating their specific skills needs.
- Additionally, employers seem to require a very basic level of skills: mostly basic computer operations and digital literacy. However, we identified some trends in terms of skill levels and digital tools across industries and occupations, and across position levels (for example, managers/professions and technical/trades).
- It is also evident that employers tend to conceptualise and articulate digital skills from a tools perspective. Instead of listing the skills they require, they simply describe the tools they would like prospective employees to be able to use and operate.

The digital skills training content analysis of the 11 training packages reveals a number of important findings:

- The VET system clearly contains a significant amount of digital training content, spread across different units of competence.
- However, a large number of these units of competence are elective rather than core to the qualifications of the respective occupations. While this provides greater flexibility for training providers, trainees and employers, it suggests that perhaps the training system is not according digital skills the same 'essential skills status' as would be expected, considering their growing importance.
- Digital training content in the training packages is expressed broadly and generically, with little reference to specific tools and systems. This is done deliberately, with the aim of making the package flexible and adaptable to the wide variety of workplace tools and systems used by different industries across the sectors.
- It also shows that the training is more geared towards developing skills at the lower skills end; that is, for the basic use of computer hardware and software in processing data and information from organisational databases, as well as for online internet and web sources. This is counter to growing industry evidence of an increasing need for higher-level skills in data analytics, cyber-security, social media and mobile-related digital skills (see Deloitte 2016; Hajkovicz et al. 2016).
- The analysis also suggests that digital skills training content is available for all occupations across the sectors and at all levels. Interestingly, there appears to be more digital skills content in the lower-skills occupations; that is, in operational and non-

supervisory than in higher-skills occupations such as managers. This is an indication that, as digital skills become essential in all work settings, there is an assumption that people training for and entering higher-skill occupations already possess the necessary digital skills.

## Summary assessment

There seems to be a number of differences and similarities between what employers want (job advertisements) and the articulation of digital training content in the training packages. One key difference is that, while employers tend to define skills from a tools perspective, the training packages seem to provide a highly open-ended and broad layout of the training needed to equip people to work in a digital economy.

A key similarity is that both the employers and training package developers appear to have a basic and generic view of digital competency but frame these differently. This implies, therefore, that the way employers understand and articulate their skills needs (at least to potential employees) is different from the way training package developers understand and craft training guidelines. This is a problem that is attributable to the observation, from the literature, of lack of a uniform industry approach to conceptualising and articulating what constitutes digital skills and how they should be measured.

Since the development and updating of training packages is a tripartite exercise, with strong representation from industry employers through industry reference committee (IRC) and skills service organisation (SSO) arrangements, it is possible that employers are failing to clearly articulate the kinds and levels of digital skills they require in this area. This is leading training package developers to present a largely basic and open interpretation of technical content. Thus, while the findings from this stage of the research are important, they raise several critical questions and signal the need for further exploration to establish in-depth explanations for the observations here.

## Next steps

The next stage of this project – comprising key industry interviews and a survey of employers – will further explore what employers have specified as digital skills needs in job advertisements and how this compares with the content in the relevant training packages.

Considering the lack of uniform articulation of digital skills requirements and training package content, it is apparent that a ‘national digital skills framework’, akin to the National Literacy and Numeracy Framework, would be useful in supporting the needs of employers and training developers. The framework could guide the development of appropriate and adequate skills for the emerging economy. Such a framework is also needed to help define digital skills training content – to encompass the technological, informational and contextual aspects that are fundamental for the sustained productivity of the workforce in the continually transforming digital environment.

This effort would be informed by existing international practices such as the European digital competency framework, which defines key components of digital competence in the five areas of: information and data literacy; communication and collaboration; digital content creation; safety; and problem-solving.

# Introduction: project scope and objectives

The aim of this project is to identify digital skills requirements in the broader Australian workforce and examine the capacity of the VET system and industry training packages to effectively meet this growing need for digital skills. There are three broad categories of digital skills requirements (ECORYS 2016):

- Category 1: Basic computer literacy for everyday life
- Category 2: Digital skills for the general workforce, enabling them to effectively use information technology (IT) systems and general technology processes across all sectors
- Category 3: Digital skills for professionals specifically working in the information and communication technologies (ICT).

While there is an abundance of research on Category 1 (for example, Bowles 2013; Bynner et al. 2010) and Category 3 digital skills (for example, Deloitte 2016), little attention has been paid to Category 2 skills. The evidence suggests however that there is a growing lack of skills essential to effectively implement the new, highly digitised and mechanised systems of work, and, furthermore, that the Australian economy is struggling to meet Category 2 digital skills requirements (Deloitte 2016, Hajkovicz et al. 2016). The consistent message is that for the Australian economy to ‘take full advantage of the opportunities presented by new technologies ... the workforce must be equipped with digital skills’ (Deloitte 2016, p.5). Recent National Centre for Vocational Education Research (NCVER) studies show that the challenge lies not merely in adequately skilling new workers, but more importantly in how to upskill the existing workforce for ongoing productive employment (Snell, Gekara & Gatt 2016; Callan & Bowman 2015).

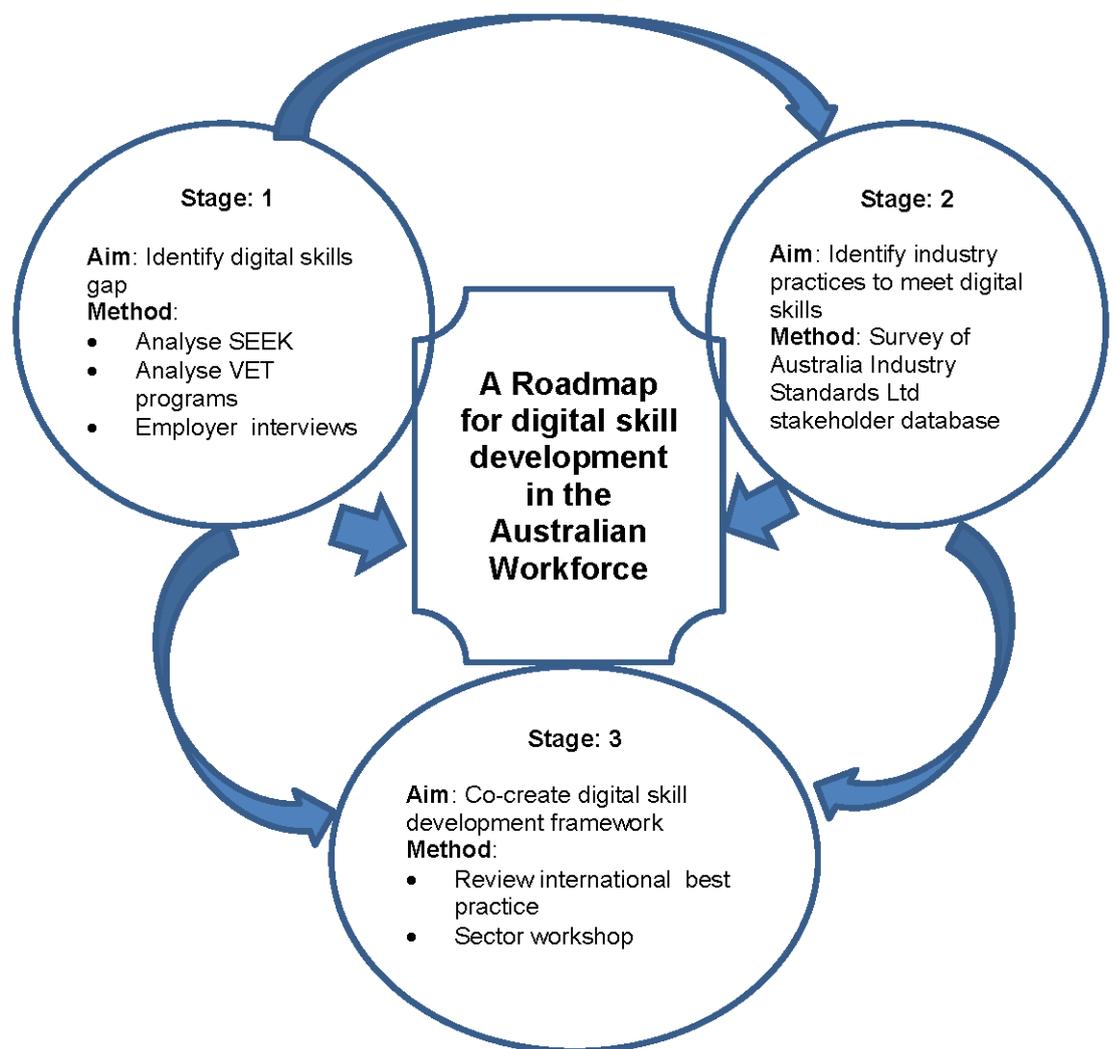
This study therefore focuses on a very important aspect of the workforce skills challenge facing Australia; that is, how to effectively equip the workforce with the appropriate digital skills for enhanced workplace participation and sustainable economic productivity. The research is guided by three key questions:

- What are the areas of digital skills-formation gaps (defined as the gap between the skills that industry employers want and what the training system is able to produce and supply) in the general workforce?
- What are the weaknesses and shortcomings in existing industry strategies, government policies and training programs, with specific regard to developing workforce digital skills?
- How can these shortcomings be addressed in order to eliminate the skills gap and effectively meet Australia’s growing demand for digital skills?

The project employs an embedded industry case study methodology, drawing on the combined strengths of stakeholder interviews, a structured employer survey, secondary data mining and industry research workshops. Similar methods have been utilised successfully in related studies, including a study of digital skills needs in the United Kingdom (ECORYS 2016); a study of the future of skills needs in Europe (CEDEFOP 2008); NCVET studies on skills transferability and employment mobility (Snell, Gekara & Gatt 2016); Australia’s future skills needs (Lowry, Molloy & McGlennon 2008); and numeracy skills for the future workplace (Marr & Hagston 2007).

The project is developed in three integrated stages, each guided by and responding to a key research question. The various methods are incremental and vertically integrated, as indicated in figure 1.

**Figure 1 Project research design**



The project results in three important outputs:

- a replicable methodology for identifying digital skills gaps, based on an analysis of industry cases
- a comprehensive framework for addressing the digital gap
- an industry dissemination webinar.

It is envisaged that these outcomes will contribute to shaping industry practices, as well as government policies. This will ensure that the capacity of the Australian VET system is enhanced to adequately equip workers across all sectors with the digital skills necessary to support the growing digital economy.

This working paper covers the digital skills job vacancy and training package content analysis part of the project. The next section introduces the concept of digital skills, including a discussion of the various ways by which digital skills are defined. This is followed by a description of the research methods and process, while the next section presents the results from the two analyses. This is followed by a brief discussion of the findings, with a short conclusion and discussion of the next steps.

# Conceptualising digital skills

Different terms exist to describe skills related to the use of digital technology (Ilomäki et al. 2016; Zhong 2011). The most often used term is digital literacy. Other common terms include digital skills, information and communication technology (ICT) skills, digital competence, media literacy, information literacy and internet skills. Within the last decade, however, the concept of social media skills has also become prominent. These terms imply that how we view and understand digital skills has grown over time, from an originally narrow focus to a much broader view, one that incorporates a wider range of non-technical ‘cognitive, attitudinal, social and emotional skills’ (ECORYS 2016, p.7). This reflects the rapid development of digital technologies in the social and work domains (Dore, Geraghty & O’Riordan 2015).

A narrow definition of digital skills would ordinarily refer to the acquisition and utilisation of computer skills or ICT skills (Dore, Geraghty & O’Riordan 2015). The focus is therefore mostly on the ‘technical, operational and procedural’ aspects of the hardware and software components of the new computer-based technologies (ECORYS 2016, p.17). Their precise scope means that terms such as ‘computer skills’ or ‘ICT skills’ are considered as the basic, as well as the narrowest, concepts of digital skills in the scholarly literature (Dore, Geraghty & O’Riordan 2015; ECORYS 2016).

The surge of the internet as a digital technology in the 1990s led to new considerations about the types of skills needed to function in networked online media environments (ECORYS 2016). Besides operational and technical skills, other non-technical skills, such as the ability to find, evaluate and manage increasing amounts of information on the internet, became a key emphasis. Terms such as ‘information literacy’ and ‘media literacy’ are key examples of such definitions in the literature. The development of Web 2.0 during the 2000s added another dimension to the internet. It shifted the internet from ‘a relatively passive content consumption medium to a medium that enables actively produced user-generated content’ (Van Dijk & Van Deursen 2014, p.7). This further expanded the range of digital skills descriptors to include attitudinal, social and emotional skills, deemed necessary for the internet.

In more recent years, with the growing usage of ‘Big Data analytics, social media platforms and mobile devices’ (Spitzer et al. 2013), other definitions have further broadened the scope of digital skills. These consider the range of competencies needed to function effectively in much more complex and demanding digital environments, including problem-solving and ethical issues, such as security, privacy and copyright.

A further and important development is that, while the initial driving view was that digital skills were predominantly meant for highly technical ICT professionals, it is becoming increasingly evident that the general workforce, including those engaged in low-skilled occupations, requires digital skills to navigate through workplaces that are becoming highly mechanised and digitised. This inevitably shapes the ways in which trainers, workers and employers come to perceive and define digital skills. It is this particular view that forms the core focus of this study. The above discussion suggests that it is difficult, or so far, there has been no attempt to conceptualise a single and encompassing definition of digital skills.

We therefore adopt a very broad definition of digital skills, based on the foregoing discussion. We define digital skills as a combination of a digital mindset (hardware,

software, information, systems, security and innovation), knowledge (theoretical comprehension and understanding), competence (cognitive and practical knowhow) and attitude (value and beliefs), all of which workers need to master and demonstrate. This definition encompasses the hard technical skills needed to operate digital devices, software and systems; cognitive skills to work in an increasingly data and information-intensive environment, covering a wide variety of information and data sources and types; ethical skills pertaining to security; and strategic skills to troubleshoot and resolve work-related problems in the digital environment. Our definition is anchored by the assertion that an analysis of skills must target identifiable skills.

# Research methods

The digital skills analysis is aimed at providing a replicable methodology for identifying differences in employer demand for digital skills and the training system's ability to meet these demands, the difference potentially amounting to a digital skills gap. To undertake this stage of the study we focused on two case sectors – transport and logistics, and public safety and correctional services. Recent workforce analyses indicate that an increasing proportion of the Australian workforce will be employed in these sectors. Furthermore, because of the growing technological innovation and mechanisation of work, the requirement for digital competency among the workers is on the increase and its possession will constitute critical employment criteria and performance enablers. We have deliberately chosen the transport and logistics, and public safety and correctional services sectors based on four important reasons:

- Industry research, specifically focusing on these sectors, has revealed the growing need for digital skills and highlighted the threat to performance and productivity if the workforce is not adequately skilled (Government Skills Australia 2015; Transport and Logistics Skills Council 2015). This is the result of the high rate of workplace technological uptake and operations mechanisation as a way of enhancing efficiency and productivity and mitigating operations costs (Government Skills Australia 2015; Transport and Logistics Skills Council 2015).
- These sectors hold great significance to the economy and society in terms of scale of national revenue and essential public service provision (Government Skills Australia 2015; Transport and Logistics Skills Council 2015). They are also identified as major current and future employers in the ongoing economic transformation (Snell, Gekara & Gatt 2016; Fairbrother et al. 2012).
- These sectors also experience persistent skills and workforce challenges, including recruitment and retention difficulties, general skill shortages and a rapidly ageing workforce (Government Skills Australia 2015; Transport and Logistics Skills Council 2015; Gekara, Snell & Chhetri 2015).
- The diversity of these sectors and their sub-sectors, in terms of functions, technologies and nature of work and occupations, means that the findings of the study are likely to be broadly replicable across other sectors.

The two key methods for data collection and analysis informing this report are discussed in the following two sub-sections. Firstly, we undertook a digital skills demand analysis by looking closely at how much digital skills content is contained in recent job advertisements on popular recruitment platforms. We further examined details of the kinds of skills employers are looking for and how they are articulated. Secondly, we undertook an extensive, in-depth analysis of the content of the relevant industry training packages to determine the extent to which digital skills content is embedded in the training for qualifications within the selected occupations. The goal was to determine whether or not there is a skills formation mismatch; that is, the difference between what industry employers express they want (based on job advertisements) and what the training system is producing.

## Online job vacancy-based digital skills demand analysis

To determine the current demand for digital skills for the transport and logistics, and correctional services and public safety sectors, we analysed 1708 job advertisements relating to the 32 ANZSCO<sup>1</sup> occupations identified as growing in demand in the 2015 environmental scan reports. This involved initially reviewing three jobs websites (that is, <www.seek.com.au>, <www.hays.com.au> and <www.jobsearch.gov.au>) to determine the most appropriate source and the extent of duplicate job advertisements across the websites. Our preliminary comparison and analysis revealed that all jobs listed on <www.hays.com.au> and <www.jobsearch.gov.au> (the premier job vacancy platforms) were also listed on <www.seek.com.au>, but not vice versa. Therefore, to avoid duplication we used <www.seek.com.au> as the primary source for our analysis.

Taking the job titles from the environmental scan reports we individually and manually searched for each job title (for example, 'customs broker') in <www.seek.com.au> in the period between 13 October and 15 November, 2016. The search was nationwide in scope. Each job title returned a different number of hits. For instance, 'logistics manager' returned 2980 hits, while 'production clerk' returned 17. To achieve some balance across the job titles we capped the analysis of each job title at the first 35. In total, 1708 jobs were searched, of which only 204 referred to digital skills.

The analysis of the job advertisements took place using two approaches. Initially, we developed a heuristic tool to help categorise digital skills based on a pilot investigation stage. The tool captures categories of digital skills (for example, 'data entry', 'warehouse management system') in a spreadsheet format. Each occurrence of a digital skill was recorded in the spreadsheet, but, while the spreadsheet guided the analysis, we remained open to the unexpected digital skills that appeared. We then captured complete phrases referring to digital skills such as 'Using Electronic Data Interchange (EDI) Enterprise, you will be able to demonstrate the ability to compile and classify entries, provide advice' and grouped these by job title. In total, 286 phrases were extracted. This enabled us to develop a deeper understanding of the nature of the digital skills required for each job title, including the skills description, nature of demonstration and the level of performance expected. Combined, these analysis procedures provided both depth and breadth in understanding digital skills.

Note that this methodology will not pick up skills that are assumed knowledge by the employers and, hence, not listed in the advertisements. The reader should keep this in mind when reviewing the findings. This limitation will be explored in the subsequent stages of the project.

## Training package digital skills content analysis

To explore the extent of digital skills content provided in the VET system for the 32 ANZSCO categories and the selected 74 occupations and job titles in demand, we used a computational tool (M language optimised for building advanced data mashup queries within MS Excel). We also conducted a text-mining analysis of training packages and associated qualifications and units of competence in the <www.training.gov.au> database. Training

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<sup>1</sup> ANZSCO = Australian and New Zealand Standard Classification of Occupations.

packages stipulate the industry competencies on which vocational education and training in Australia is based.

We created a text database containing the descriptions of all units of competency in each of the relevant industry training packages. The 11 training packages that constitute the database are aviation (AVI), correctional services (CSC), local government (LGA), maritime (MAR), aeroskills (MEA), police (POL), public safety (PUA), training and education (TAE), transport and logistics (TLI) and electrotechnology (UEE). Then, taking our working definition of digital skills, and in consultation with Australian Industry Standards<sup>2</sup>, we developed a comprehensive list of 44 search terms (table 1). These search terms were then partially stemmed, grouped into five categories of digital skills, and then searched across the text database. Table 1 illustrates the search term categories, search terms and examples of text strings extracted from units of competency.

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<sup>2</sup> Australian Industry Standards (AIS) is a government-funded not-for-profit organisation that develops skills standards across a range of Australian industries, <<http://www.australianindustrystandards.org.au/about-us/>>.

**Table 1 Digital skills categorisation and search terms and sample content extraction results**

<b>Search term category</b>	<b>Search terms</b>	<b>Examples of digital skills text string extracted from units of competency</b>
Digital device	computer, hardware, information technology, information technologies, infotechnology, mobile, communication technology, keyboard, digital device, digital tools, touchpad, tablet, 3-D printing, GPS	<i>operating infotechnology devices used within the workplace in accordance with operational requirements</i> <i>selecting and using relevant computer, communications and office equipment</i>
Data and information processing	software, internet, data, database, web, social media, social network, wiki, information processing, data entry, data retrieval, big data, online, text messaging, online collaboration, analytics	<i>use management information system to collect, store and retrieve data to support the preparation of business plans and/or budgets</i> <i>using information technology for data analysis, recording and reporting</i>
Enterprise information systems and analytics	information system, information systems, enterprise systems, analytics, big data analytics	<i>selecting and appropriately applying technology, information systems and procedures to complete workplace tasks.</i> <i>using offender information system and files</i>
Security and privacy	information security, information privacy, online security, virus, data breach, copyright, digital risk, online safety	<i>handling and storing information securely and safely</i> <i>identify relevant copyright, moral rights and intellectual property issues and legislation relevant to the use of information from databases.</i>
Digital innovation	process innovation, system/process analysis, system/process design, system/process development, system/process improvement, system/process innovation, digital marketing, app development, system evaluation, digital assessment, digital service, process improvement	<i>identifying potential areas for inspection process improvement as a quality system activity</i> <i>analysing requirements for improved computer applications, evaluating relevant software, investigating appropriate hardware enhancements, implementing system improvements and measuring systemic improvement</i>

Through this process, we extracted text strings containing the digital skills search terms, for example:

- technology skills to use calculators, computers, software programs and printers for the preparation of airfare calculations
- using basic computer and information technology skills to access internal and external information and data on risk
- analyse current work processes to access information and data to assist in identifying areas for improvement.

These were recorded alongside the unit of competency containing it, along with unit status (core or elective units) and unit type (unit or assessment). The results were reviewed and if undesirable (that is, not digital skills-relevant) the search results were filtered, leaving a total of 4957 text strings. These search strings were contained in 758 unique units of competency across the 11 training packages. We also mapped the text strings to the 32 ANZSCO codes, 74 occupation/job titles, qualification code and title, and corresponding training packages.

# Findings

In this section we discuss the results from the two key analyses described above.

## Digital skills demand analysis results

### Overview

Because there is no standard approach or framework for measuring digital skills, we began our analysis by exploring the way in which employers framed the digital skills requirements related to specific jobs. This showed that employers frame demand for digital skills by referring to specific software and hardware tools. This occurs by means of their referring to tools in general terms such as email, smartphones and enterprise resource planning (ERP) systems. Some employer vacancy advertisements also referred to specific applications, such as MS Excel and Pronto. Therefore, in our analysis, the term ‘digital skills’ is synonymous with tools whereby the digital skills are defined in terms of the tools to which they are applied. The one exception is ‘analytics’, which was used to refer to both the synthesis of digital information and the subsequent decision-making. We created a list of these digital skills, and this guided the rest of our analysis. During this exercise we noted that the lack of detail associated with the nature of the digital skills means that viewers of the job advertisement needed to infer the level of skill by understanding the digital tool (for example, Pronto) within the context of the role and position level.

Our analysis is divided into two sections. First, we review the frequency of digital skills mentions by sector and occupation in demand. We also group this analysis by the high-level ANZSCO occupation classification: managers; professionals; technicians and trade workers; community and personal services workers; clerical and administrative workers; machine operators and drivers; and labourers. This allows us to draw inferences on the types of digital skills in demand by occupation/sector, as well as by type/level of role.

Second, we go beyond the frequency of digital skills mentions and analyse the language describing the digital skills per ANZSCO category. This offers a deeper level of analysis, allowing both digital skills and descriptions of the level of those skills to emerge from the job advertisements. For instance, where a job was advertised as requiring ‘excellent knowledge of MS word’, we recorded both ‘excellent knowledge’ and ‘MS Word’.

While our analysis is exploratory, the combination of both levels of analysis of the job advertisements is suggestive of two significant findings:

- Firstly, that there are different digital skills demands within and across sectors (for example, logistics and aviation), as well as across occupation categories (for example, manager and clerical and administrative workers);
- Secondly, the proficiency needed for digital skills varies significantly across occupation categories.

This suggests that a framework could be developed to define the digital skills and level of proficiency for a given occupation or occupation category. Such a framework would be useful to help map digital skills requirements. It would also to support the description of digital skills and the evolution in their demand over time. There is further wide variation in the job description for seemingly very similar jobs requiring very similar skills, which shows

that employers tend to take very different approaches to writing job advertisements for very similar jobs. This could largely be as a result of a lack of a standard template. Perhaps more critically, it may reflect a lack of a uniform approach to articulating specific digital skills needs.

## Transport and logistics occupations

In this sector occupations were drawn from all the major industries, including logistics, road transport, rail transport, aviation, maritime and port operations.

### Logistics (transport and logistics)

Logistics as a sector had the largest number of occupations searched and also represented the broadest framing of digital skills (see figure 2). In total, 17 categories of digital skills were captured. Computer literacy was mentioned explicitly, or implicitly<sup>3</sup>, in all of the jobs advertisements, which is consistent with the types of digital skills in demand for the advertised positions.

The most in-demand skills related to electronic data interchange (EDI); enterprise resource planning (ERP)/material requirements planning (MRP)/systems applications and products (SAP)/Oracle; MS Office and radio frequency (RF) scanners. However, even within this sector there was variation; for instance, EDI-related skills were primarily in demand for freight-forwarding operators. In contrast those related to RF scanners were predominately in demand for forklift operator/reach stackers and warehouse/store assistants. MS Office skills, on the other hand, were in demand across almost all the occupations, except for forklift operator/reach stackers and transport trainers.

Analytics was the most unexpected skill in demand. This was typically represented as the need to synthesise information and data for decision-making – predominately for warehouse/store assistants. This reflects the growing digitisation of warehouse work. Transport trainer was the only occupation in which no mention of digital skills was recorded.

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**The most in-demand skills related to electronic data interchange (EDI); enterprise resource planning (ERP)/material requirements planning (MRP)/systems applications and products (SAP)/Oracle; MS Office and radio frequency (RF) scanners.**

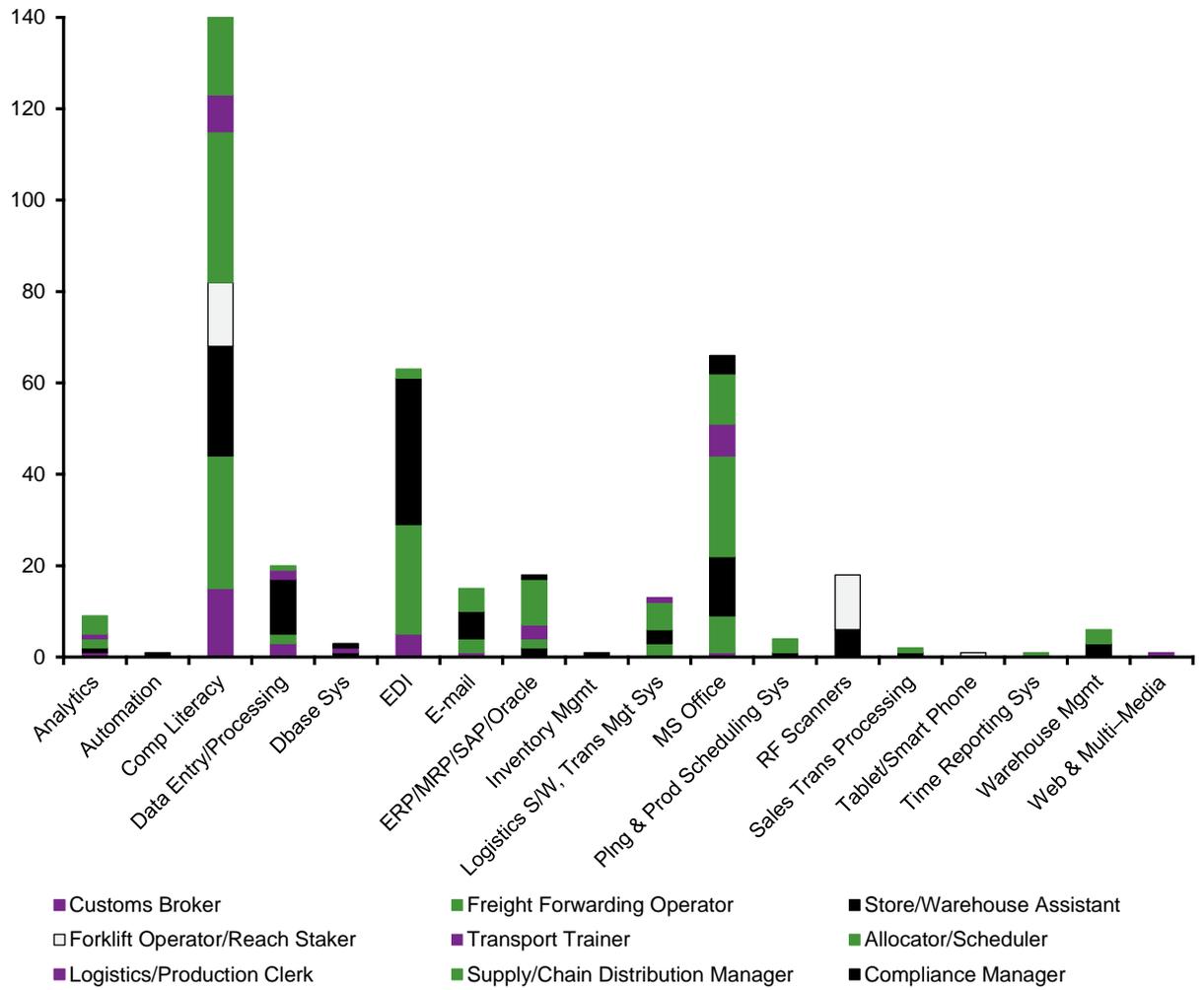
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**Analytics was the most unexpected skill in demand.**

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<sup>3</sup> There were cases where computer literacy was mentioned directly, for example in the form of “the ability to use computers to develop and send documents”. In some cases it was mentioned as part of a more indirect reference to what people should be able to do, e.g. be able to read and respond to emails.

**Figure 2 Logistics digital skills demand**



## Road transport (transport and logistics)

The road transport sector provided less diversity than logistics in terms of digital skills. Computer literacy was in demand across the sector. Beyond this however there was diversity within the sector (see figure 3). RF scanner-related skills were in great demand for forklift operators/reach stackers, while store/warehouse assistants and freight-forwarding operators required digital skills relating to MS Office, databases and specific logistics/transport/inventory management software. This is consistent with the computerised nature of their work and accords with the requirement noted in the same occupation in transport and logistics above. The demand for skills to operate tablets and smartphones featured in a few job advertisements. Although small, it represents the emergence of a new digital skill. The new digital skill was for bus/tour/coach drivers who operate vehicles increasingly fitted with high-tech operations touchpads and communications technology. No digital skills were, however, referred to in the job advertisements for truck drivers.

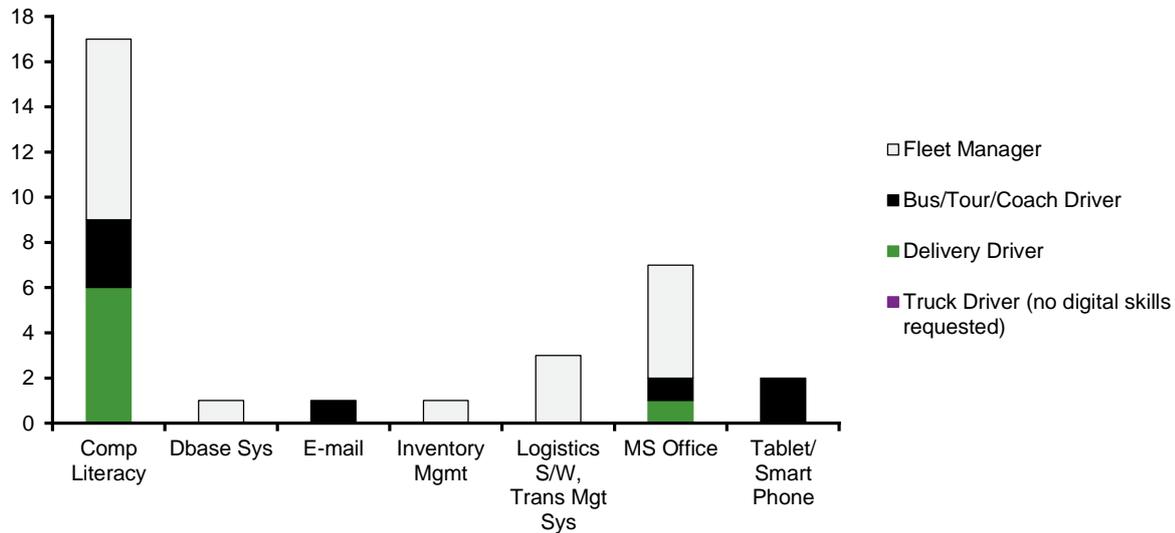
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**Computer literacy was in demand across the sector.**

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**The new digital skill was for bus/tour/coach drivers who operate vehicles increasingly fitted with high-tech operations touchpads and communications technology.**

**Figure 3 Road transport digital skills demand**

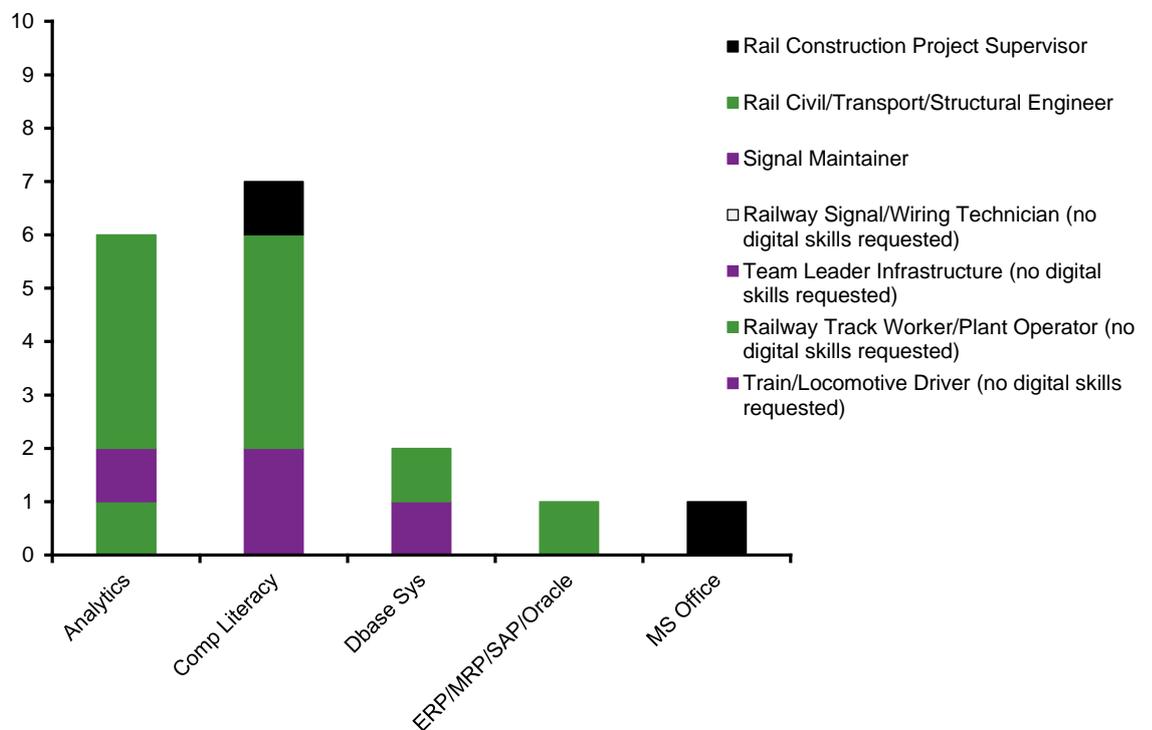


## Rail transport (transport and logistics)

The rail civil/structural engineer occupation indicated some emphasis on analytics skills. This may reflect the need for these workers to make sense of digital data and make planning decisions for engineering roles.

The demand for digital skills for the rail sector was relatively low (see figure 4). Beyond computer literacy, many occupations did not refer to any digital skills. No digital skills were referred to for train/locomotive driver, railway track worker/plant operator, team leader infrastructure or railway signal/wiring technician. MS Office skills were, however, in demand for fleet managers, which is similar to store/warehouse assistants and freight-forwarding operators in the road transport sector (there were a few other similarities between rail and road transport). The rail civil/structural engineer occupation indicated some emphasis on analytics skills. This may reflect the need for these workers to make sense of digital data and make planning decisions for engineering roles.

Figure 4 Rail transport digital skills demand



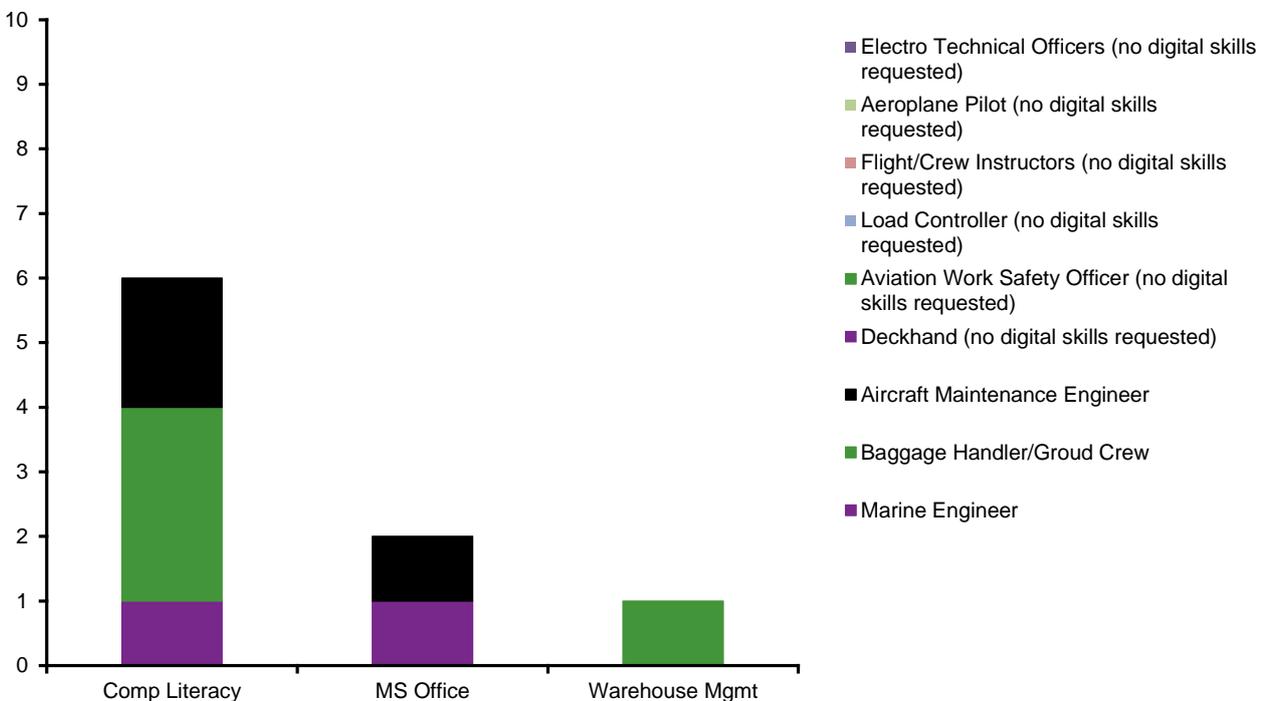
## Aviation, maritime and ports (transport and logistics)

We combined the aviation sector with maritime and ports because of the low numbers of job advertisements for occupations in demand in these sectors. Overall, the job advertisements here referred to the least number and variety of digital skills amongst those we analysed (see figure 5). Computer literacy was the most referred to as a generic digital skills category. The advertisements for jobs in aeroplane pilot, flight/crew instructors, load controller, aviation work safety officer, deckhand and electro-technical officer occupations did not refer to any digital skills. This is somewhat surprising, considering that a high level of digital competencies might be an expected requirement, particularly with regard to pilots and flight crew. Similarly, it would be expected that people working across the broader maritime transport industry would require a significant level of digital skills in the operation of ships, for example.

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**Computer literacy was the most referred to as a generic digital skills category.**

**Figure 5 Aviation, maritime and ports digital skills demand**

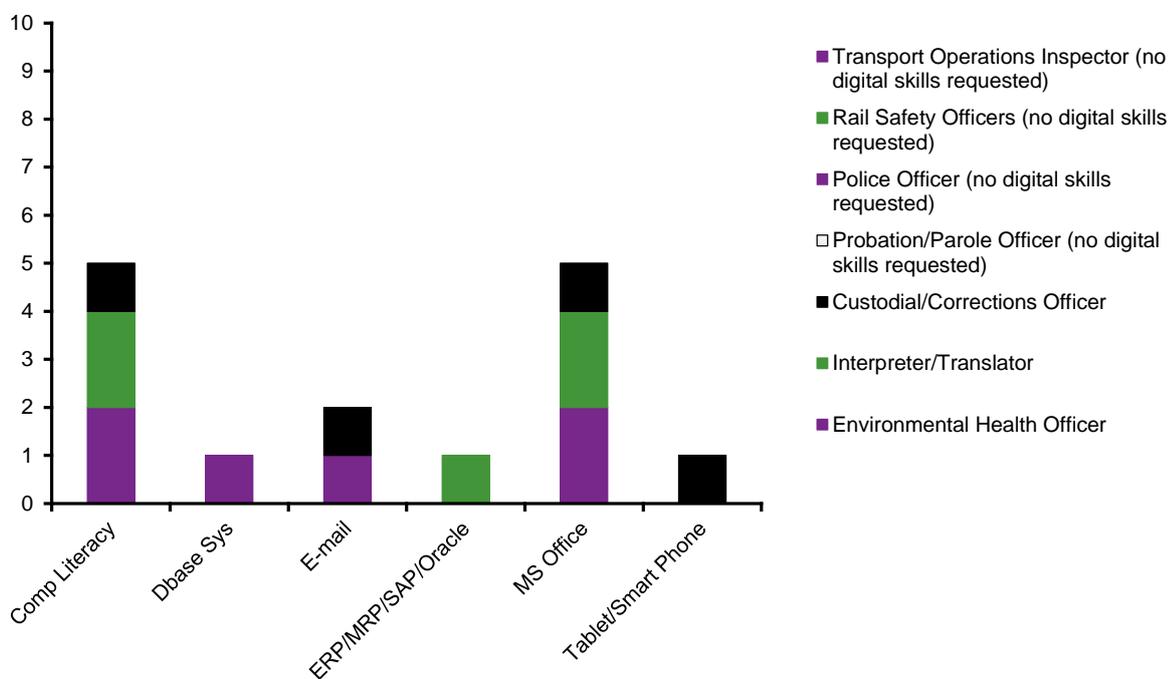


## Public safety and correctional services sector

The occupations probation/parole officer, fire fighter (auxiliary/volunteer), police officer, rail safety officer and transport operations inspector did not refer to digital skills.

The public safety and correctional services sector had a very low representation of digital skills. Beyond MS Office, computer literacy and email, there was little emphasis on the digital component of the work (see figure 6). The occupations probation/parole officer, fire fighter (auxiliary/volunteer), police officer, rail safety officer and transport operations inspector did not refer to digital skills. This may be linked to the strong professional identities associated with roles such as police officer and fire fighter combined with the traditionally non-technological nature of these occupations. Yet at the same time, occupations like police officers are increasingly relying on digital technology, in particular, frontline police officers.

Figure 6 Public safety and correctional services digital skills demand



## Analysis of digital skills by job categories

While the analysis given above sheds some light on the digital skills in demand by occupation, it does not provide an understanding of the types of digital skills required for certain occupation classifications, for example, for managers or labourers. We therefore analyse the frequency of digital skills using the ANZSCO codes to group the occupations. These results, which are illustrated in figure 7, show a clustering of skills around ERP/MRP/SAP/Oracle, EDI, MS Office<sup>4</sup> and computer literacy, with less frequency of demand for the other skills.

Significantly, figure 7 suggests digital skills patterns linked to certain occupational categories. For instance, managerial occupations have the highest need for skills associated with ERP/MRP/SAP/Oracle and MS Office. While the analysis by sector/occupation showed that analytics skills are in demand in logistics and rail transport, the analysis by occupational classification shows that it is particularly in demand for managerial-level positions. This reflects the nature of managerial work, which is office-based and significantly reliant upon computer and computer-based systems. Skills such as data entry and transaction processing were, conversely, not in demand for managers. The use of RF scanners was almost entirely represented by machine operators and drivers. Clerical and administrative workers had the highest frequency of EDI skills demand. While it is difficult to extract definitive conclusions from our sample, the data indicate different digital skills across different occupation classifications. This finding implies a digital skills maturation, whereby skills fall into different levels of application along an occupational hierarchy, from operational staff to managerial.

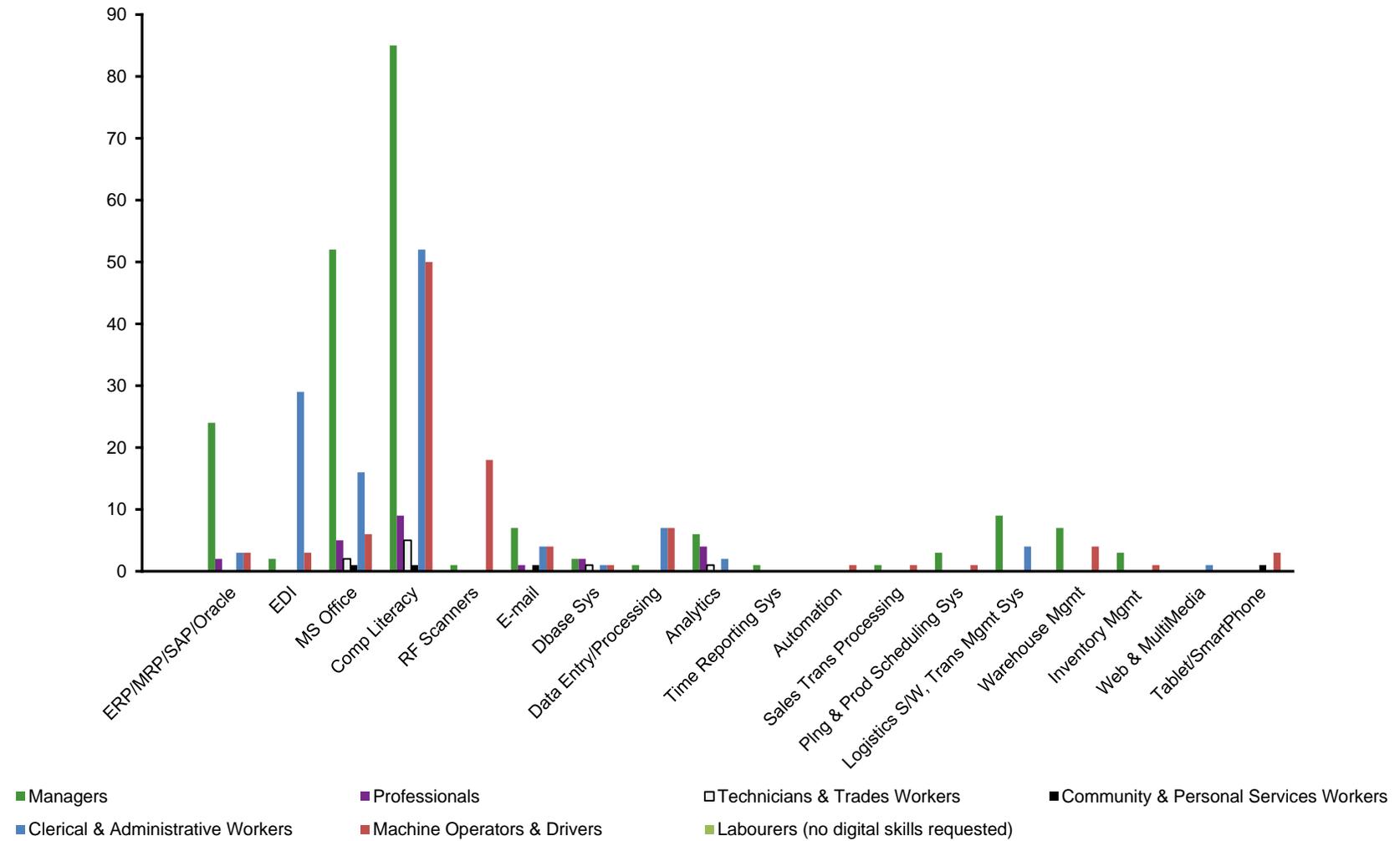
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**The use of RF scanners was almost entirely represented by machine operators and drivers. Clerical and administrative workers had the highest frequency of EDI skills demand.**

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<sup>4</sup> These are digital platforms

Figure 7 Frequency of digital skills by ANZSCO major group categories (transport and logistics / public safety and correctional services)



## Digital skills and skills descriptors by job category

To cluster and represent the results of the text extraction from the job advertisements we used WordClouds (images representing the frequency of recurrent words in a text). The size of the word indicates its frequency of recurrence. We have produced wordclouds for each of the ANZSCO occupational classifications. For each occupational classification we created a WordCloud to capture the frequency of 'digital skills descriptors'. These are represented in figure 8.

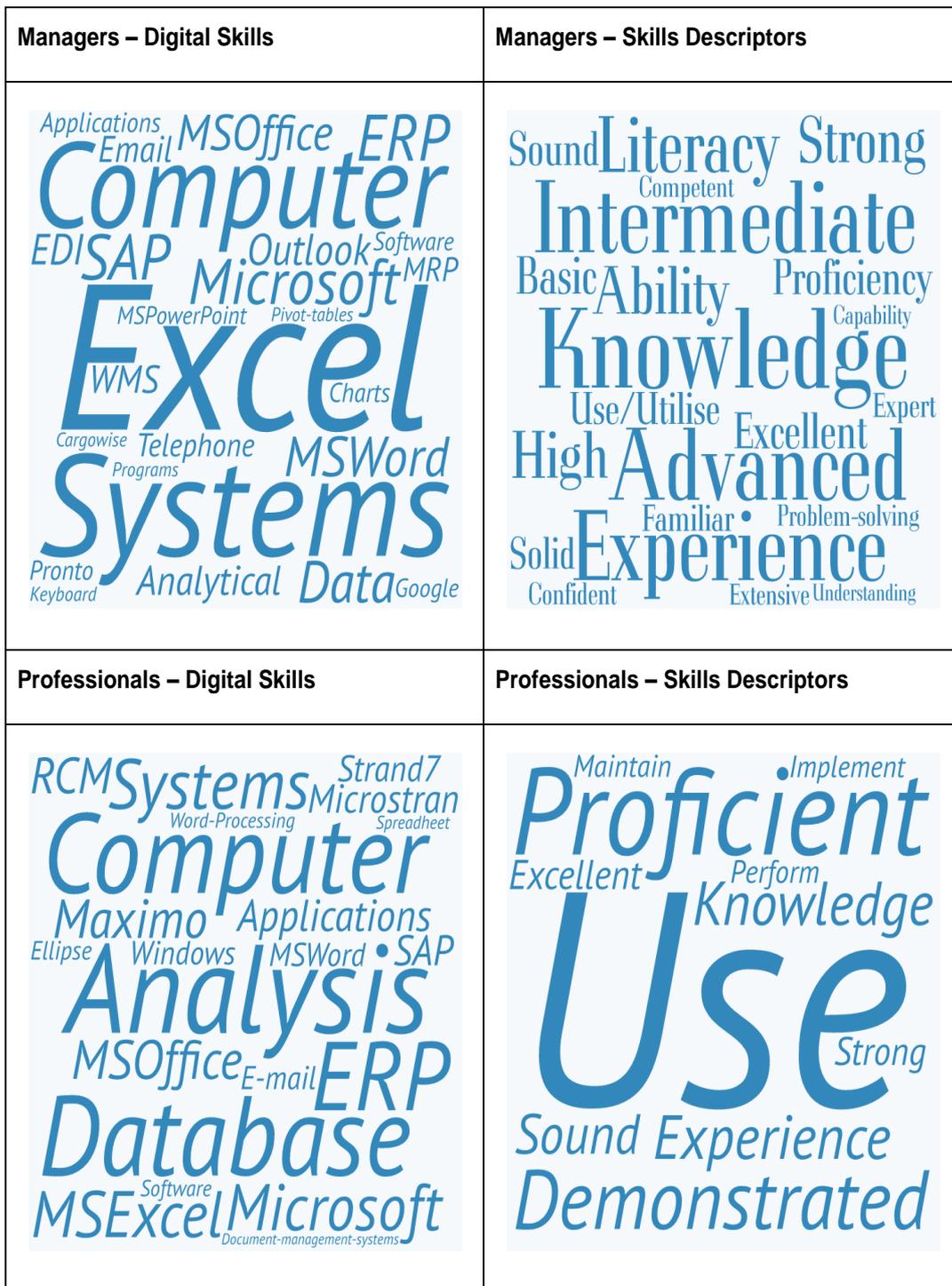
The WordClouds suggest a pattern of different digital skills and levels of expected digital competence from targetted job applicants in different occupational classifications. For instance, within the managers, professionals, clerical and administrative workers category, the terms 'advanced', 'intermediate', 'demonstrated' and 'excellent' were the dominant descriptors. These were used to a lesser extent in the other categories. Within these categories there is also a clear theme of domain-specific software applications, such as Pronto, Maximo, Google, Stron7 and freight management systems. We note the significant mention of analytical skills, as well as the specificity associated with this, such as pivot tables, charts and MS Excel. Amongst machine operators and drivers there were different skills required which were associated with specific workplace tools such as System Management Controller (SMC), SEQUOS, eParcel and Ostendo<sup>5</sup>. These corresponded with a range of terms such as 'intermediate' and 'strong' alongside 'simple' and 'basic'.

Amongst community and personal services workers and technicians and trade workers we note more common and broad reference to digital skills, such as 'internet' and 'technology'. The exceptions are the terms 'tablets' and 'smartphones', which, while common in everyday life, are an uncommon skill requirement for work contexts (as suggested by our frequency analysis). The skills descriptors for these occupation classifications were also suggestive of awareness and experience rather than advanced knowledge.

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<sup>5</sup> These are software packages.

**Figure 8 Digital skills and skills descriptors WordClouds by ANZSCO major group categories (transport and logistics / public safety and correctional services)**



Clerical & Administrative Workers – Digital Skills	Clerical & Administrative Workers – Skills Descriptors
Machine Operators & Drivers – Digital Skills	Machine Operators & Drivers – Skills Descriptors

**Community & Personal Services Workers – Digital Skills & Skills Descriptors (combined)\***



**Technicians and Trade Workers – Digital Skills & Skills Descriptors (combined)\***



Where digital skills are specifically highlighted in job advertisements, employers identify not only the required skill but also suggest the level of performance expected.

Levels of performance seem to differentiate along an occupational hierarchy.

This WordCloud analysis reveals two important aspects:

- Firstly, where digital skills are specifically highlighted in job advertisements, employers identify not only the required skill but also suggest the level of performance expected. However, the latter is limited to very broad indications of expected competence, for example, strong understanding, good knowledge etc.
- Secondly, the results confirm the observation in the skills demand along occupational category analysis, whereby levels of performance seem to differentiate along an occupational hierarchy – from shopfloor operations staff to management. However, this differentiation is expressed loosely.

# Digital skills in training packages

Skills supply in general has mostly been subjectively defined from the perspectives of work supervisors, educators and the workers themselves. The analysis presented here is based upon the content in industry training packages. As stated earlier, the aim is to determine how, and the extent to which, digital training content is embedded in the training packages. An analysis of the skill/educational requirements for each occupation is an acceptable approach to identifying skill supply (ACT 2011, p.7).

In this section, we discuss the findings of the digital skills content analysis of the 11 training packages related to the list of occupations identified earlier. We provide an initial overview of the digital skills content analysis by training package and occupation categories and follow that with a sector-by-sector discussion.

## Overview

As explained in the methods section, a keyword search was applied across the 11 training packages. A total of 4957 text strings containing digital skills content were extracted. These search strings occurred in 717 unique units of competency across the 11 training packages. Table 2 shows the total number of units of competency in each training package, as well as the number of these units of competency that actually contained some digital skills content, based on the occurrence of one or more of the search terms.

There are three important overall observations. Firstly, the results show that the training package with the largest number of units of competency is the Transport and Logistics Training Package (TLI), while the Training and Education Training Package (TAE) has the lowest. With regard to the number of units of competency actually containing digital skills search terms, the Transport and Logistics Training Package has the highest, while the Police Training Package (POL) has the lowest.<sup>6</sup> Our methodological assumption is that if a unit of competency contains digital skills keywords, then it suggests that some form of digital skills training is embedded in that unit of competency. Thus, a higher number of units of competency in a training package containing the key words is taken to imply that the particular training package contains a higher amount of digital content.<sup>7</sup>

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**Results show that the training package with the largest number of units of competency is the Transport and Logistics Training Package (TLI), while the Training and Education Training Package (TAE) has the lowest.**

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6 Much of the Police Training Package is not for public access for security reasons. As such, we have only analysed a very small number of the total units of competency contained in the training package. This explains the low return in our search.

7 The number of units of competency containing digital skills keywords in a training package, by comparison with others, could be due to the fact that the particular training package contains more units of competency than others.

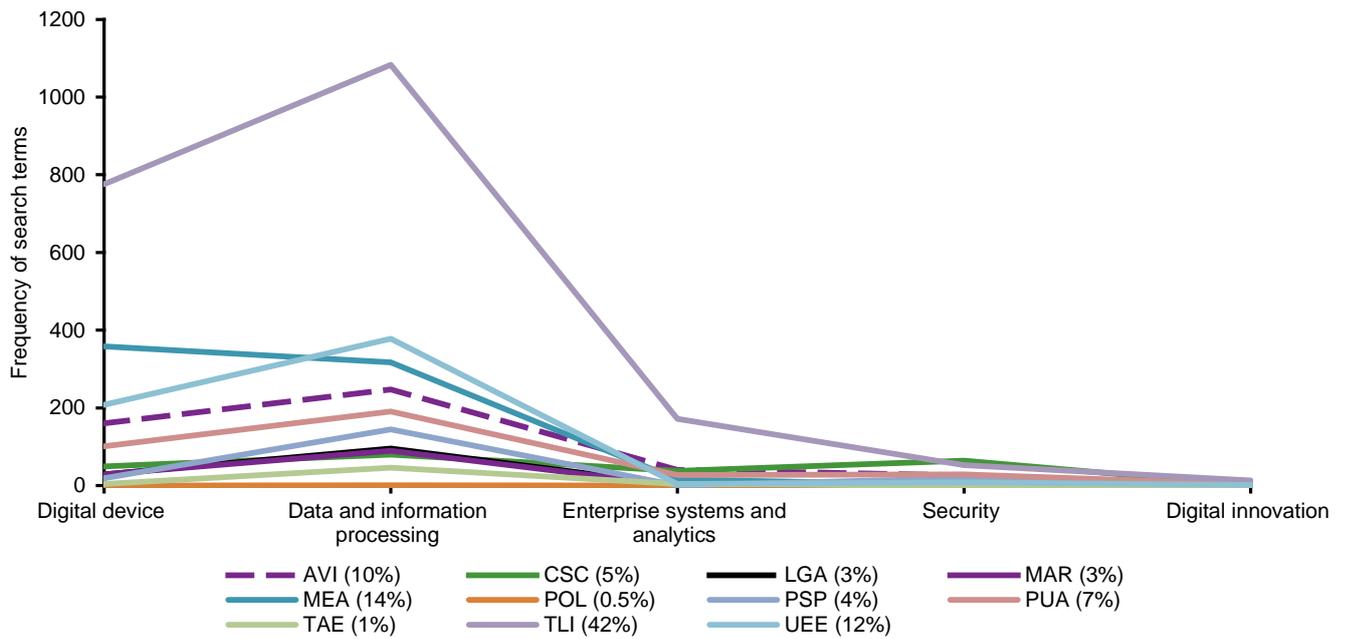
**Table 2 Distribution of digital skills containing unique units of competency across training packages**

Training package	Total units	No. of units containing digital skills search terms
TLI – Transport and Logistics Training Package	706	241
UEE11 – Electrotechnology Training Package	612	54
PUA12 – Public Safety Training Package	431	75
PSP – Public Sector Training Package	396	28
MEA – Aeroskills Training Package	262	117
LGA – Local Government Training Package	223	40
AVI – Aviation Training Package	212	98
MAR – Maritime Training Package	199	39
Pol – Police Training Package	141	3
CSC – Correctional Services Training Package	95	51
TAE – Training and Education Training Package	54	10
<b>Total</b>	<b>3331</b>	<b>758</b>

Most digital skills content refers to digital device use and information processing, whereas much less emphasis is placed on skills pertaining to enterprise information systems, security and process, and systems innovation in the increasingly digital workplace environment.

Secondly, with regard to digital skills training, the training packages appear to focus more on developing competencies in the use of hardware and software for processing data and information from organisational databases, as well as from online internet and web sources. Figure 9 shows that most of the digital skills content refers to digital device use and information processing, whereas much less emphasis is placed on skills pertaining to enterprise information systems, security and process, and systems innovation in the increasingly digital workplace environment. This finding validates the observation in the online job vacancy analysis that digital skills description mostly occurred at the lower levels of basic operations. Furthermore, industry research (Deloitte 2016; ECORYS 2016) suggests the growing use of data analytics, social media and mobile devices, with various applications across different workplaces. Yet, noticeably missing from the training packages are skills related to social media, social networks, big data analytics, online collaboration, online security, data breach, digital risk and process innovation.

**Figure 9 Distribution of digital skills across training packages**



Mounting industry evidence shows that digital skills are becoming more important for all workers, to the extent that increasingly there is only a small number of job tasks that do not require some interaction with digital technologies (Committee for Economic Development of Australia 2015). Nevertheless, the type and level of skill requirement seems to vary greatly across different occupations.

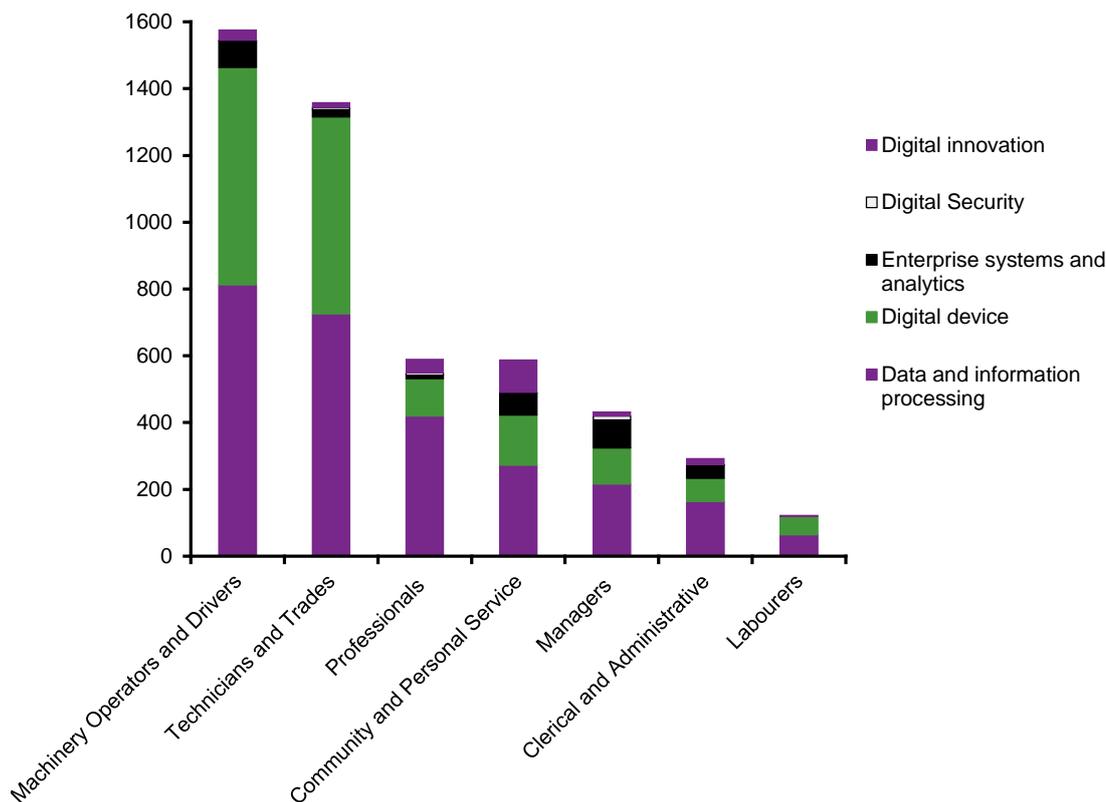
The third observation, therefore, is that digital training content is no longer only developed for higher-level managerial and information-intensive occupations but applies to all levels. Figure 10 illustrates the frequency of digital skills content by ANZSCO major occupational groups in the 11 training packages. Notably, there seems to be more evidence of digital skills content in training for machinery operators and drivers and technicians and trades than in areas where you would expect to find more evidence. This could be due to two reasons. One is a methodological issue, whereby search words like ‘hardware’ did not always relate to computer hardware, thus contributing to an overestimation in the results; the same applies to ‘systems’. A much more important reason is that much of the machinery operated and driven by these workers is now quite sophisticated and equipped with integrated data and information collection, transmission and processing applications. It therefore no longer involves merely operating levers and pedals but more use of touchpad operations. The training packages are clearly reflecting this trend. Note, however, that most of the digital skills training refers to knowledge and use of digital devices, and data and information processing. Nevertheless, why there seems to be less digital training content for professionals, managers and clerical and administration personnel, where one would expect more digital interaction, is an important question. There seems to be an underlying assumption in the training packages that these trainees have foundation digital skills, that they are already proficient in the use of computers and most of the associated applications prior to undertaking training. This raises the question, however, of where these skills are developed and how: formal primary and secondary schooling and/or on the job?

**Digital training content is no longer only developed for higher-level managerial and information-intensive occupations but applies to all levels.**

The training packages for the labourers occupational category contain the least amount of digital skills content, however they do contain digital skills content which may be more surprising.

Importantly, figure 10 suggests that the upper-level skill occupations of professionals, community and personal service and clerical and administration personnel have more training in higher-level digital applications such as ‘digital innovation and enterprise systems and analytics’. Not surprisingly, the training packages for the labourers occupational category contain the least amount of digital skills content, however they do contain digital skills content which may be more surprising.

Figure 10 Distribution of digital skills by major ANZSCO groups



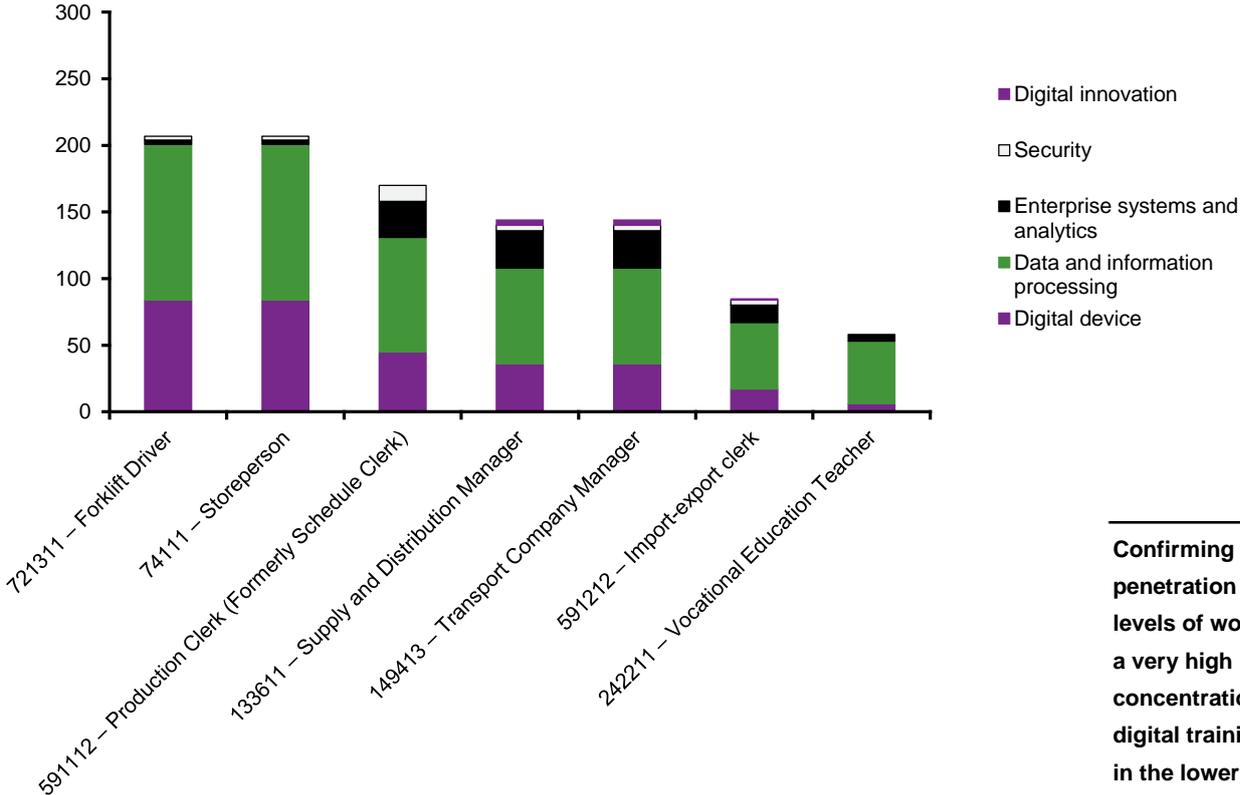
In order to develop a much clearer picture of how digital training content appears for specific industry occupations we analysed key occupations across the different sector industries. The occupations analysed are those identified as ‘in demand’ in the industry environmental scans. Examples of this analysis are discussed in the following section.

## Digital skills content in logistics (transport and logistics) training packages

We analysed digital skills-related standards in the logistics sector, with particular emphasis on seven ANZSCO code occupations, including: import-export clerk; storeperson; forklift driver; vocational education teacher/transport and logistics trainer/assessor; supply and distribution manager; production clerk; and transport company manager occupations. Digital skills development in logistics is mainly achieved through the Transport and Logistics Training Package. The exceptions are the transport and logistics trainer/assessor and the workplace trainer assessor occupations, which draw upon the Training and Education Training Package.

Consistent with earlier observations on the concentration of digital skills content, there is greater emphasis on data and information processing and digital device-related skills in the occupations analysed here (figure 11). In this occupational-level view, production clerks, supply distribution managers, transport company managers, import-export clerks and vocational education teacher all have a smaller focus on security, digital innovation, and enterprise analytics skills. Note also the digital innovation content for the two manager occupations.

**Figure 11 Digital skills training in logistics occupations**



Interestingly, and confirming the digital penetration across all levels of work, there is a very high concentration of overall digital training content in the lower skill-level occupations such as forklift drivers and storepersons. It is also an indication of the occupational changes taking place, whereby storepersons, for example, are not as traditionally expected only manually shifting and stacking boxes but rather also using sophisticated digital applications in their work. Furthermore, job tasks at this level are no longer distinctly demarcated, but rather more integrated into the wider and related operations, meaning that a forklift driver does not only operate the forklift to move boxes but is also involved in capturing, storing, retrieving and processing data related to the cargo they move.

An additional observation in this analysis, one that perhaps suggests a fundamental weakness in the incorporation of digital skills in the training content, is that only very few of the units of competency containing digital skills content are designated as core training units, as illustrated in table 3. For example, none of the supposed units containing digital skills in the Certificate II in Warehousing Operations for storepersons and forklift drivers are core. Of the 101 units of competency that match the digital skills-related search terms, only 16 are core and the remaining are elective. Of these core units, only one – TLIK2007 (Perform electronic data interchange to transmit shipping documentation) – can be considered as a unit that

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**Confirming the digital penetration across all levels of work, there is a very high concentration of overall digital training content in the lower skill-level occupations such as forklift drivers and storepersons.**

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**An additional observation in this analysis, one that perhaps suggests a fundamental weakness in the incorporation of digital skills in the training content, is that only very few of the units of competency containing digital skills content are designated as core training units**

focuses exclusively on digital skills. The core units of competency are contained in the following qualifications for customs brokers/freight-forwarding operators; allocators/schedulers; and transport/logistics manager (supply chain manager, compliance manager) occupations:

- Diploma of Logistics
- Certificate IV in Logistics
- Certificate IV in International Freight Forwarding
- Diploma of International Freight Forwarding
- Diploma of Customs Broking.

**Table 3 Core and elective digital skills training units in the Transport and Logistics Training Package**

ANZSCO codes	Core digital skills units	Elective digital skills containing units
721311 – Forklift driver	---	TLIE2007 – Use communications systems TLIK2003 – Apply keyboard skills TLIP2018 – Provide information from and about records TLIK2007 – Perform electronic data interchange to transmit shipping documentation
74111 – Storeperson	---	TLIK2010 – Use infotechnology devices in the workplace TLIA3016 – Use inventory systems to organise stock control TLIW3006 – Operate computerised mail and parcels sorting equipment
591212 – Import-export clerk	TLIK2007 - Perform electronic data interchange to transmit shipping documentation	
591112 – Production clerk (Formerly schedule clerk)	---	PSPGOV406B – Gather and analyse information TLIK2010 – Use infotechnology devices in the workplace TLIL4059 – Implement asset management systems TLIP4005 – Manage workplace information BSBMGT403 – Implement continuous improvement BSBRK401 – Identify risk and apply risk management processes
242211 – Vocational education teacher	---	BSBRES401 – Analyse and present research information TAETAS401 – Maintain training and assessment information TAEDEL501 – Facilitate e-learning
149413 –Transport company manager	---	TLIX5036 – Manage and monitor technical data and information systems
133611 – Supply and distribution manager	---	TLIO5005 – Plan and manage security procedures for the enterprise TLIK5006 – Evaluate software requirements and hardware enhancements

Accordingly, while there is strength in providing a wide range of elective units containing digital skills, allowing trainees and training providers to make the most suitable skill combinations based upon occupational and workplace differences, the failure to have digital skills embedded as core content may suggest that the training system is not up to date with the rapid digitisation of work across all occupations.

Some randomly selected examples of the texts extracted from those units of competency containing digital skills key words include:

- selecting and appropriately applying technology, information systems and procedures to market services to customers
- office, computer and communications equipment is identified and action is initiated for appropriate assignment or procurements
- relevant and appropriate materials, tools, computer and relevant software, equipment and personal protective equipment currently used in industry
- monitoring and tracking international transport of special cargo and dangerous goods, and ensuring all required forms and documentation are completed and/or required data is entered into applicable information technology systems
- selecting and applying appropriate application of technology, information systems and procedures
- selecting and using relevant computer/communications/office equipment and processes
- requirements for completing and accurately inputting data into approved border clearance software applications
- relevant workplace procedures for registration and data entry of documentation for customs clearance and/or reporting
- dumping unit quantity is reported in accordance with software application system requirements
- using relevant software application systems when classifying complex goods
- selecting and using relevant software application systems and related information
- documentation and/or software system requirements for applying GST and other indirect tax legislation as they relate to customs broking activities.

The unit, LIK2007 – Perform electronic data interchange to transmit shipping documentation – is the only core unit of competency for the logistics sub-sector. This unit involves the skills and knowledge required to perform electronic data interchange in order to transmit shipping documentation in accordance with relevant regulations and workplace procedures. It is also a core unit of competency for an import-export clerk (591212) and also applies to customs brokers/freight-forwarding operators. The digital skills developed in this unit of competency are:

- manual and computerised sources of data accessed in accordance with task requirements
- workplace procedures for the transfer and storage of electronic data and the use of related computer equipment and application software
- adapting to differences in electronic data interchange (EDI) equipment in accordance with standard operating procedures
- identifying and using computer equipment, software, processes and procedures relevant to the job context.

What these descriptions confirm is that the digital skills content in the training packages is highly generic, probably attributable to the very wide variety of technologies and systems used by different organisations. Thus, specification of training need would be left to the individual employers and training providers who develop the actual training and assessment materials.

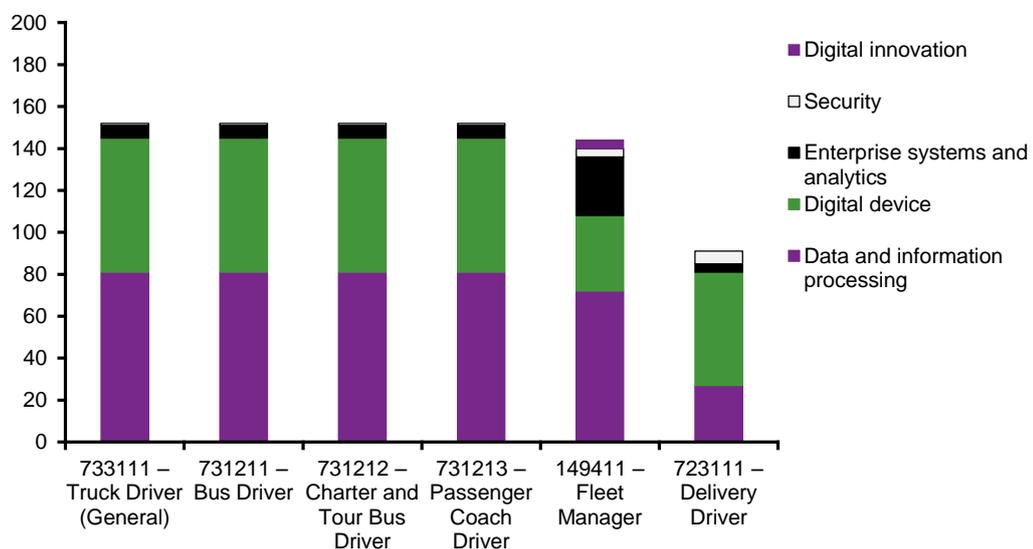
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**Digital skills content in the training packages is highly generic, probably attributable to the very wide variety of technologies and systems used by different organisations. Thus, specification of training need would be left to the individual employers and training providers who develop the actual training and assessment materials.**

## Digital skills content in road transport (transport and logistics) training packages

In the road transport industry, six ‘in demand’ occupations were identified in the 2015 transport and logistics environmental scan report. These were truck driver (general); bus driver; charter and tour bus driver; passenger coach driver; fleet manager; and delivery driver. The keyword search returned a total of 843 digital skills-related hits across 96 units of competency in the Transport and Logistics Training Package. In these occupations, as illustrated in figure 12, the skills content seems predominantly related to using hardware and software, such as computer dispatch systems, GPS devices and providing data and information to a variety of stakeholders. In addition to having these skills, fleet managers are exposed to logistics and other enterprise information systems to improve work/occupational health and safety conformance, and information systems and reporting requirements.

**Figure 12 Digital skills training in road transport**



The findings indicated that digital security and innovation skills are not important in road transport training. The analysis is consistent with the previous observation that digital skills training content is mostly focused at the basic information and data processing level, with more sophisticated enterprise systems, analytics, and digital security and digital innovation only evident for managers.

Three qualifications (Certificate II in Driving Operations, Certificate III in Driving Operations and Diploma of Logistics) are related to these six occupations. There are six core units of competency directly related to digital skills content, one of which is developed specifically for GPS-related digital skills (see table 4). Other digital skills are either delivered through elective units or embedded in units not primarily intended to address digital skills.

**Table 4 Distribution of digital skills containing unique units of competency across training packages**

<b>ANZSCO codes</b>	<b>Core digital skills units</b>	<b>Elective digital skills containing units</b>
733111 – Truck driver (General)	TLIH2001 – Interpret road maps and navigate pre-determined routes	TLIK2003 – Apply keyboard skills TLIK2010 – Use infotechnology devices in the workplace TLIE2007 – Use communications systems
731211 – Bus driver		
731212 – Charter and tour bus driver		
731213 – Passenger coach driver		
733111 – Truck driver (general)		
723111 – Delivery driver		TLIK2003 – Apply keyboard skills TLIK2010 – Use infotechnology devices in the workplace TLIB2090 – Use communication systems in a taxi
149411 – Fleet manager		TLIK5006 – Evaluate software requirements and hardware enhancements TLIX5036 – Manage and monitor technical data and information systems

For the driver occupations, the following examples of digital skills training descriptions were extracted from the units of competency in the Certificate II and Certificate III in Driving Operations:

- using global positioning system (GPS) devices to navigate pre-determined routes as required
- follow relevant workplace health and safety/occupational health and safety (WHS/OHS) procedures and guidelines concerning the use of computer equipment in the workplace, including recommended posture, ergonomic settings of chair and work station, and the use of rest periods and exercise
- follow procedures for the use of keyboards and computer equipment in the workplace
- solve typical problems that can occur when using keyboards to enter data and related appropriate action that can be taken to prevent or solve these problems
- operating and adapting to differences in keyboards, software and computer equipment in accordance with standard operating procedures
- identifying and using computer equipment, software, processes and procedures required within the job context
- implementing contingency plans when using infotechnology devices in the workplace, including using security and backup software and procedures
- accessing and/or completing electronic documentation through the use of infotechnology devices in the workplace
- applying precautions and required action to minimise, control or eliminate hazards that may exist when using infotechnology devices in the workplace
- operating infotechnology devices used within the workplace in accordance with operational requirements
- adapting to differences in software and equipment in accordance with standard operating procedures.

For fleet managers, the relevant units of competency identified in the Diploma of Logistics contained the following sample training content descriptions:

- providing leadership and working collaboratively with others when evaluating software requirements and hardware enhancements
- monitoring processes to ensure technical data and information systems continue to enable operational requirements to be attained – this may include performance metrics
- consulting and negotiating effectively with internal and external key stakeholders and resolving potential areas of conflict or concern to ensure overall technical data and information systems objectives are achieved
- completing documentation related to evaluating software requirements and hardware enhancements
- measuring operational performance improvements resulting from changes to computer technology.

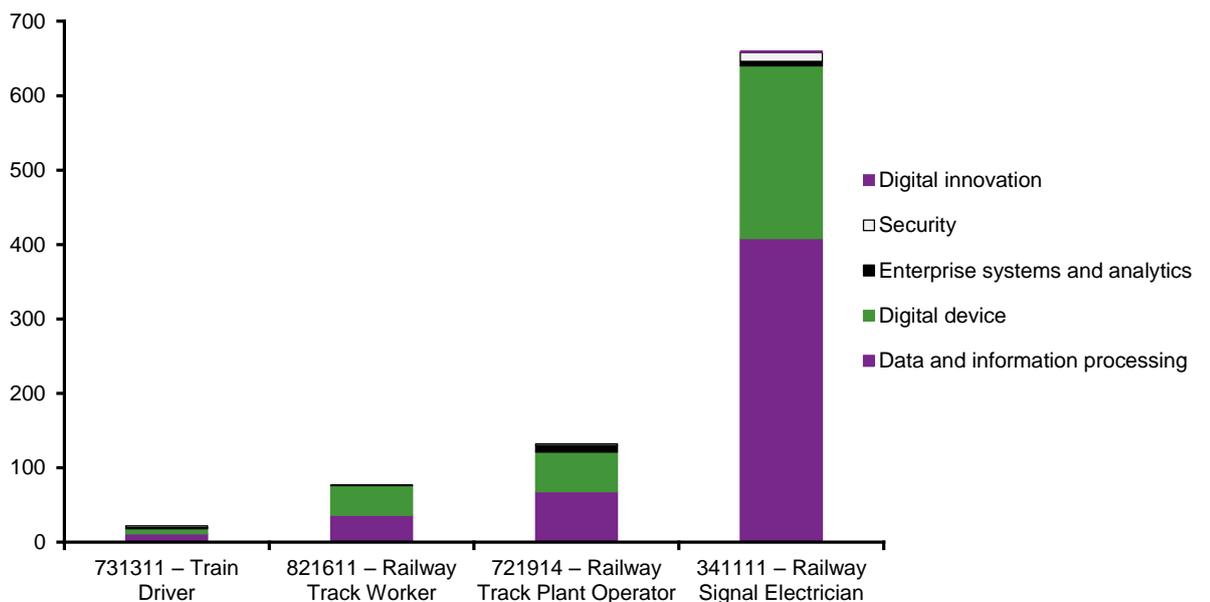
As with the analysis for transport and logistics occupations, the fleet manager training content descriptions are broad and generic enough to allow for easy adaptation to organisational and individual workplace skill needs.

**As with the analysis for transport and logistics occupations, the fleet manager training content descriptions are broad and generic enough to allow for easy adaption to organisational and individual workplace skill needs.**

### Digital skills content in rail transport (transport and logistics) training packages

The four occupations that were analysed in the rail transport sector are train driver, railway track worker, railway track plant operator and railway signal electricians. In the two training packages related to the four rail transport occupations (transport and logistics, and electrotechnology), 891 digital skills-related text strings were extracted from 133 units of competency.

**Figure 13 Digital skills training in rail transport training package**



As depicted in figure 13, most of the digital skills in rail transport were detected in the railway signal electrician occupation. Similar to other occupations, the skills focused on enabling trainees to operate information technology devices within the workplace in

**Most of the digital skills in rail transport were detected in the railway signal electrician occupation.**

accordance with operational requirements (including adapting to differences in software and equipment, entering and manipulating data using a variety of user interfaces such as keyboard/mouse, barcode reader, touch screen, and information systems). Very little evidence was found of training for higher-level digital skills. Little evidence of digital skills was found in drivers and track workers. But the apparently low digital skills content across all occupations is indicative of the physical and manual intensity still characterising rail operations in Australia by comparison with other transport and logistics industries.

Digital skills training content for rail transport occupations are mostly found in nine qualifications:

- Certificate II in Rail Infrastructure
- Certificate III in Mechanical Rail Signalling
- Certificate III in Rail Driving
- Certificate III in Rail Track Surfacing
- Certificate III in Rail Structures
- Certificate III in Rail Structures
- Certificate IV in Train Driving
- Certificate IV in Electrical – Rail Signalling

The main digital skills related core and elective units are described in table 5.

**Table 5 Rail sector core and elective digital skills units**

<b>ANZSCO codes</b>	<b>Core digital skills units</b>	<b>Elective digital skills containing units</b>
731311 – Train driver	TLIE2007 – Use communications systems	
821611 – Railway track worker		TLIK2010 – Use infotechnology devices in the workplace
721914 – Railway track plant operator	TLIE2007 – Use communications systems	TLIK2010 – Use infotechnology devices in the workplace
341111 – Railway signal electrician	TLIK2010 – Use infotechnology devices in the workplace	UEENEED104A – Use engineering applications software on personal computers TLIE2007 – Use communications systems UEENEEN116A – Maintain electronic and microprocessor-based remote control systems UEENEEN114A – Install and maintain computer based interlocking rail systems UEENEED101A – Use computer applications relevant to a workplace UEENEEN110A – Install and maintain non-vital telemetry systems

As indicated in table 5, due to the technical nature of the job, there are more digital skills-related units in the railway signal electrician occupations than in the other categories. Furthermore, as observed in occupational analyses earlier, there are more elective units of competency here than core units. Of interest also is that, although there are more industry-specific digital skills units in the railway signal electrician category, such as ‘managing software, updates, backups and virus protection and ... installing computers and associated peripherals, network switches, modems, control systems, including electronic cards, software

**The apparently low digital skills content across all occupations is indicative of the physical and manual intensity still characterising rail operations in Australia by comparison with other transport and logistics industries.**

and firmware, cabling and associated connectors, including fibre optical, coaxial, and shielded/screened and CAT 5, input/output interfacing devices and surge protection’, yet they do not form part of the assessment of the unit. This could be an indication of relatively less importance given to digital skills in this industry, once again perhaps due to the nature of the work involved.

## Digital skills content in aviation, maritime and ports (transport and logistics) training packages

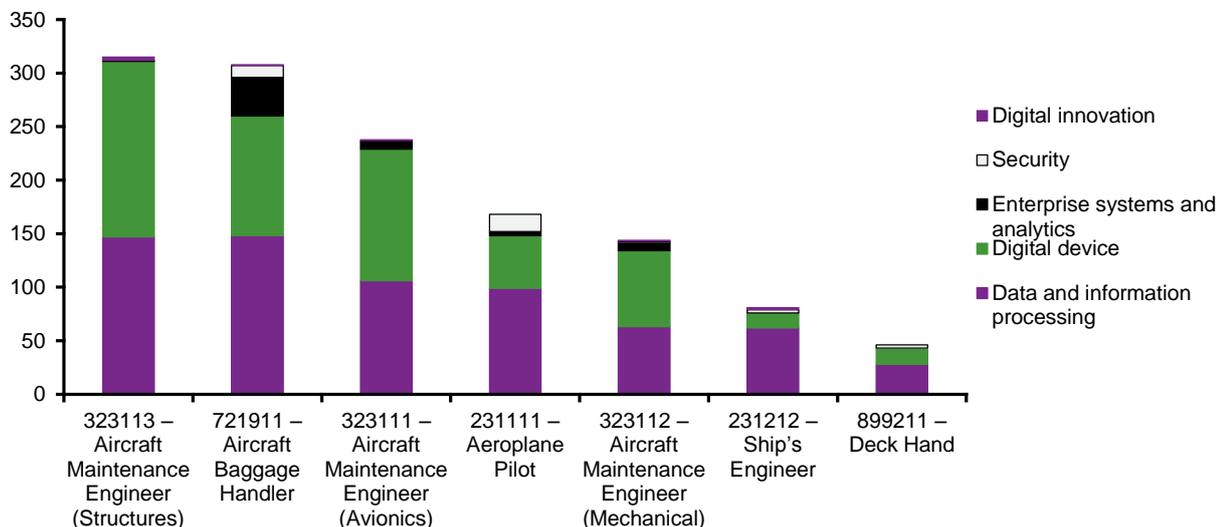
In the aviation and maritime sector, the analysis focused on seven occupations identified as ‘in demand’: aeroplane pilot; aircraft maintenance engineer (avionics); aircraft maintenance engineer (mechanical); aircraft maintenance engineer (structures); aircraft baggage handler; ship’s engineer; and deck hand. In the three training packages (aviation, maritime and aeroskills) related to these seven aviation and maritime and ports occupations, 1300 digital skills-related text strings were extracted from 191 units of competency. Generally, most of these occupations are highly technical, such that new digital technology is having an impact by changing working conditions and processes. These jobs require using a range of generic and industry-specific information technology devices; collecting, processing and interpreting airline and maritime computer data such as published fares, schedules and bulletins outlining fares and conditions; and fixing hardware.

**Most of the digital skills are in the aircraft maintenance engineer (structures) and aircraft baggage handler occupation categories.**

As depicted in figure 14, most of the digital skills are in the aircraft maintenance engineer (structures) and aircraft baggage handler occupation categories. They generally relate to digital devices and data and information processing. This observation is as surprising as the earlier one relating to forklift drivers and machinery operators and drivers in the transport and logistics occupations. Once again, this is an indication of the rapid and widespread digital penetration across all occupations. But also it shows that there are some levels and sections of the workforce where possession of digital skills may be taken for granted by the training content developers and hence implicit. Examples are aeroplane pilot, aircraft maintenance engineer and ship’s engineer, where digital skills training content seems much less evident in the results, yet these are jobs which require highly sophisticated digital skills. That most of the content also relates to ‘digital devices’ could be influenced by the ‘hardware’ search term, particularly in relation to aircraft maintenance engineer (structures) and ship’s engineer, where ‘hardware’ is used to refer to aircraft and ship parts.

**Possession of digital skills may be taken for granted by the training content developers and hence implicit.**

**Figure 14 Digital skills content in aviation and maritime training package**



Seventeen qualifications are associated with the digital skills development in these industries:

*Five are in the aviation training package including:*

- AVI60116 Advanced Diploma of Aviation (Chief Flight Instructor)
- AVI40216 Certificate IV in Aviation (Aviation Supervision)
- AVI30516 Certificate III in Aviation (Aerodrome Operations)
- AVI30416 Certificate III in Aviation (Ground Operations and Service)
- AVI50215 Diploma of Aviation (Commercial Pilot Licence – Aeroplane)
- AVI50516 Diploma of Aviation (Flight Instructor).

*Six are in the Maritime Training Package:*

- MAR30116 Certificate III in Maritime Operations (Integrated Rating)
- MAR60215 Advanced Diploma of Maritime Operations (Marine Engineering Class 1)
- MAR60115 Advanced Diploma of Maritime Operations (Marine Engineering Class 2)
- MAR40116 Certificate IV in Maritime Operations (Chief Integrated Rating); MAR50115 Diploma of Maritime Operations (Engineer Watchkeeper)
- MAR50613 Diploma of Maritime Operations (Marine Engineering Class 3 Near Coastal).

*The remaining four are from the Aeroskill Training Package:*

- MEA40615 Certificate IV in Aeroskills (Avionics)
- MEA40715 Certificate IV in Aeroskills (Mechanical)
- MEA41315 Certificate IV in Aeroskills (Structures)
- MEA50115 Diploma of Aeroskills (Avionics).

The relevant core and elective units containing digital skills are given in table 6. However, most digital-related skills are industry-specific and embedded. They are integrated as part of delivering other capabilities, such as the ability to test and troubleshoot aircraft and ship software management control systems; operating flight instruments; assisting in emergency response; and implementing vessel planned maintenance systems.

**Table 6 Aviation, maritime and ports sector core and elective digital skills units**

ANZSCO codes	Core digital skills units	Elective digital skills containing units
231111 – Aeroplane pilot	AVIM5002 – Conduct aeronautical knowledge training	AVIM5001 – Operate a simulator TAETAS401A – Maintain training and assessment information
231212 – Ship's engineer	MARL005 – Demonstrate basic knowledge of marine control systems and automation MARL026 – Demonstrate intermediate knowledge of marine control systems and automation MARL032 – Demonstrate advanced knowledge of marine control systems and automation	
323111 – Aircraft maintenance engineer (avionics)	MEA343 – Remove and install avionic system components	MEA226 – Inspect aircraft electronic systems and components MEA206 – Remove and install aircraft basic radio communication and navigation system components MEA213 – Inspect, test and troubleshoot advanced aircraft instrument systems and components MEA229 – Test and troubleshoot aircraft radio frequency navigation and communications systems and components
323112 – Aircraft maintenance engineer (mechanical)	MEA112 – Plan and implement civil aircraft maintenance activities	
323113 – Aircraft maintenance engineer (structures)	MEA343 – Remove and install avionic system components	
721911 – Aircraft baggage handler	TLIE4006 – Collect, analyse and present workplace data and information AVIF0004 – Implement aviation risk management processes	TLIP4005 – Manage workplace information BSBFLM306 – Provide workplace information and resourcing plans TLIK2010 – Use infotechnology devices in the workplace SITTTSL308 – Use a computerised reservations or operations system
899211 – Deck hand		

**A wide variety of digital skills are associated with the training packages for aviation, maritime and port-related occupations.**

A wide variety of digital skills are associated with the training packages for aviation, maritime and port-related occupations. The generic ones range from basic database management, modifying hardware and software settings, and identifying hardware, software, information systems applications, to workplace tasks and awareness of copyright and privacy laws (in terms of electronic technology), and researching and collecting data to monitor and evaluate risks.

## Digital skills content in correctional services and public safety training packages

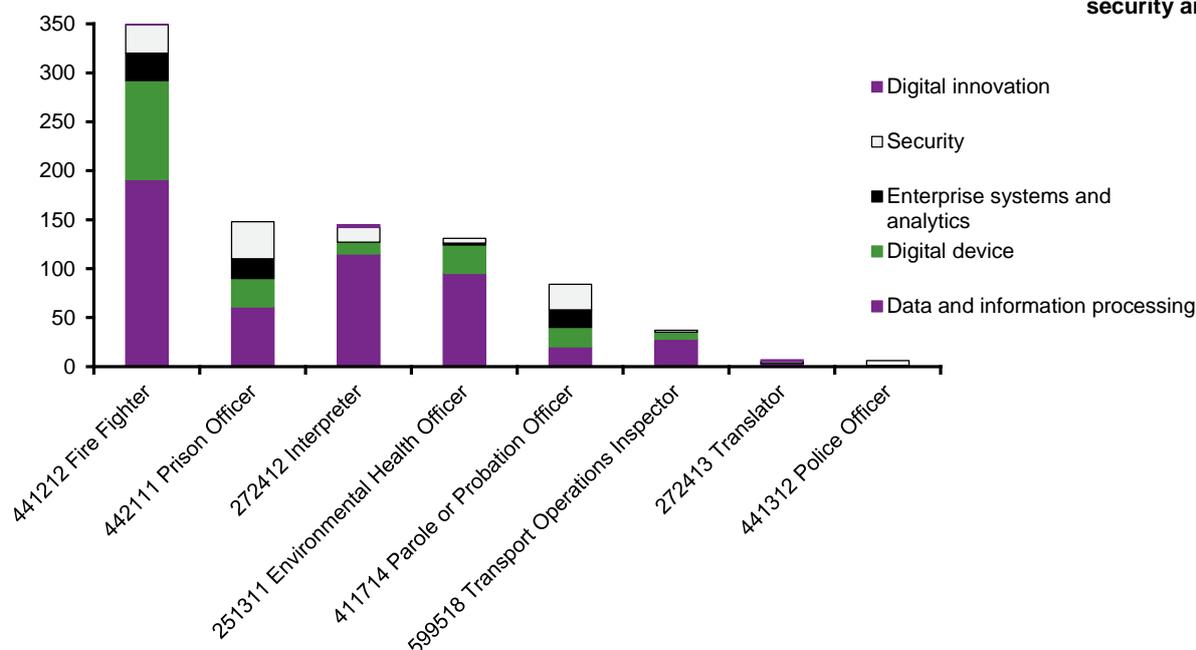
The 2015 Government Skills Australia report identified the occupations defined as ‘in demand’ that form the focus of this study. These include prison officer; parole or probation officer; environmental health officer; fire fighter; police officer; transport operations inspector; and interpreter. In seven occupations within the Correctional Services, Local Government, Public Service, Police, and Public Safety training packages there were 185 units of competency, from which 910 digital skills-related search strings were extracted.

Figure 15 represents the frequency distribution of the digital skills search strings across the seven occupations in the correctional services and public safety sectors. More than one-third of the search strings containing digital skills occurred in the training package for fire fighters, where assessment aims to determine capability to apply Geographic Information System (GIS) software to problem-solving techniques. Trainees are also expected to use management

Only six instances of digital skills were associated with the police officers' training content and virtually all of them are located in the 'POLGEN026', gather and review information for policing' unit and relate to data and information security and privacy.

information systems and technology to collect spatial data, conduct data analysis and fire investigation analysis, and maintain an innovative working environment through online learning. Only six instances of digital skills were associated with the police officers' training content and virtually all of them are located in the 'POLGEN026, gather and review information for policing' unit and relate to data and information security and privacy (see figure 15).

**Figure 15 Digital skills content in the correctional services and public safety training packages**



The 185 units of competency containing digital skills search terms contribute to a wide range of qualifications, including:

- Certificate III in Correctional Practice
- Certificate III in Public Safety (Firefighting And Emergency Operations)
- Certificate III in Public Safety (Firefighting Operations), Certificate IV in Correctional Practice
- Certificate IV in Heavy Vehicle Road Compliance
- Certificate IV in Local Government (Health and Environment)
- Certificate IV in Public Safety (Firefighting Supervision)
- Diploma of Interpreting (LOTE–English)
- Diploma of Local Government (Health And Environment)
- Diploma of Policing
- Diploma of Translating
- Diploma of Public Safety (Firefighting Management)
- Advanced Diploma of Interpreting (LOTE–English)
- Advanced Diploma of Public Safety (Firefighting Management)
- Advanced Diploma of Translating.

The core and elective units containing digital skills are given in table 7, which shows more elective digital skills units in the fire fighter training than in others. Similar to the findings in other sectors, important digital skills are designed to be developed through other units; for example, the unit designed to prepare a budget in the environmental health officers occupation has a significant element of using relevant software and information systems to analyse data. Law enforcement officers are expected to know jurisdictional policies and procedures related to data and information security, as well as current legislation related to freedom of information, human rights, and privacy.

**Table 7 Correctional services and public safety core and elective units of competency containing digital skills content**

ANZSCO codes	Core digital skills units	Elective digital skills containing units
251311 Environmental health officer		
272412 Interpreter		ICTICT203 – Operate application software packages BSBLIB407 – Search library and information databases ICTICT103 – Use, communicate and search securely on the internet databases
272413 Translator	--	--
441212 Firefighter		CPPSIS4035A – Apply GIS software to problem-solving techniques BSBINN502A – Build and sustain an innovative work environment CPPSIS3015A – Collect spatial data PUAFIR405B – Collect, analyse and provide regulatory information PUAFIR414 – Interpret and analyse fire weather information BSBINM501A – Manage an information or knowledge management system CPPSIS4026A – Read and interpret image data
442111 Prison officer	CSCORG008 – Gather and report complex information	CPPSEC3021A – Maintain and use security database CPPSEC3012A – Store and protect information
411714 Parole or probation officer	CSCORG008 – Gather and report complex information	--
441312 Police officer	POLGEN026 – Gather and review information for policing	
599518 Transport operations inspector	PSPGEN033 – Use advanced workplace communication strategies	PSPREG016 – Conduct data analysis PSPREG015 – Receive and validate data

**There is no mention of digital skills in the assessment of the units relating to environmental health officer and fire fighter. Notably, although there are a number of digital skills in the elective units for fire fighters, these were not assessed. It would appear therefore that digital skills in many cases are not assessed as part of the awarding of qualifications.**

Examples of the digital skills that make up the assessment of the units of competency related to the correctional services and public safety sector are shown in table 8. There is no mention of digital skills in the assessment of the units relating to environmental health officer and fire fighter. Notably, although there are a number of digital skills in the elective units for fire fighters, these were not assessed. It would appear therefore that digital skills in many cases are not assessed as part of the awarding of qualifications, which raises questions about how trainees demonstrate their knowledge of and competence in these skills. Furthermore, the specific nature of the sector and the associated occupations seems to impose an emphasis on privacy, confidentiality and security-related skills, including identifying and developing processes for information security breaches.

**Table 8 Examples of digital skills in correctional service and public safety**

<b>ANZSCO codes</b>	<b>Example digital skills</b>
272412 Interpreter	tools and equipment relevant to assignments, including commercial software used in assignments and office management using internet search techniques to research precedents and inform target language choices
272413 Translator	using internet search techniques to research precedents and inform target language choices
442111 Prison officer	process for referring information security breaches handling and storing information securely and safely implementing a broad application of database functions using accurate data inputting techniques to complete work tasks within designated timeframes using basic computer and information technology skills to access internal and external information and data on risk
411714 Parole or probation officer	maintain privacy and confidentiality according to legislative requirements analyse current work processes to access information and data to assist in identifying areas for improvement
441312 Police officer	jurisdictional policies and procedures related to data and information security current legislation related to freedom of information, human rights, and privacy
599518 Transport operations inspector	using information technology to access relevant legislation and procedures take a proactive approach to identify and assess the need for new or changed systems and processes for analysing data to more effectively meet objectives

# Summary observations

The objectives of this first stage of the study set out in this working paper were, firstly, to examine the growing demand for digital skills among Australia's general workforce, and, secondly, undertake a content analysis of the integration of digital content in the training packages relevant to the industry sectors selected for the case studies.

In the first stage of the analysis, online job vacancy advertisements for the occupations selected were extracted from the <www.seek.com> website and analysed for specific mention of digital skills as key selection criteria, and the levels of competency expected of applicants. The analysis reveals that only a small proportion of the advertised jobs identify specific digital skills. For those few that do, the description tends to be mostly generic and vague. We also observe that employers do not seem to expect high levels of digital skills; instead, the job advertisements suggest a very basic level of digital literacy and competency. This is surprising, considering the growing evidence of workplace digitalisation across all levels of occupations and sectors (Committee for Economic Development of Australia 2015). The job advertisements also show that, instead of employers articulating specific skill needs, they tend to describe the workplace tools with which prospective employees are expected to work.

There are a number of possible explanations for these observations. First, the rate and level at which the economy is computerising and digitising might be exaggerated, thus giving the false impression that the demand for digital skills among workers across all occupations is growing fast. Second, it could be a result of employers' inability to clearly articulate their actual needs – or an assumption that potential employees already have these skills. It may also be that employers articulate proficiency in a specific tool (for example, EDI) together with the context/role as a proxy for the level of digital competency required. However, this injects a degree of ambiguity and scope for interpretation into the digital skills requirements for prospective employees.

The digital training content analysis on the other hand reveals that there is a significant amount of digital content embedded in the industry training packages, both explicitly and implicitly. Some qualifications have units explicitly addressing digital skills, while in other units these skills are designed to be addressed implicitly and are invisible. In the analysis of the 11 training packages associated with the selected occupations, key words and terms relating to digital skills were found in a large number of units of competency. Although not conclusive, this suggests that these units are, to some extent, designed to develop digital skills. However, closer examination shows that the majority of the units of competency containing digital skills tend to be electives, as opposed to core. Furthermore, the description of digital skills training is mostly at low levels of basic digital literacy and basic application of computer devices for data capturing and processing. Once again this is contrary to general assumptions that rapid and widespread adoption of the digital technologies across all sectors and occupational levels is leading to a significant increase in demand for large amounts of digital skills at all levels. An additional observation is that digital skills standards seem to focus mainly on lower-level operational and non-supervisory occupations. One explanation for this could be an underlying assumption that people training for and entering higher-skill occupations already have the necessary digital skills. Alternatively, they are expected to sequence into these roles from the lower levels.

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**The analysis reveals that only a small proportion of the advertised jobs identify specific digital skills. For those few that do, the description tends to be mostly generic and vague.**

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**The job advertisements also show that, instead of employers articulating specific skill needs, they tend to describe the workplace tools with which prospective employees are expected to work.**

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**The majority of the units of competency containing digital skills tend to be electives, as opposed to core. Furthermore, the description of digital skills training is mostly at low levels of basic digital literacy and basic application of computer devices for data capturing and processing.**

What employers want (job advertisements) and how digital training content in the training packages is articulated indicates both differences and similarities. A key similarity is that both employers and training developers seem to have a basic and generic view of digital competency. One key difference is that, whereas employers tend to define skills from a tools perspective, the training packages seem to provide a highly open-ended and broad layout of the skills needed to equip people to work in the digital economy, meaning therefore that the way employers understand and articulate their skills needs is different from the way training package developers understand and craft technical content. This discrepancy may well be attributable to the general view that there is a lack of a uniform industry approach to conceptualising and articulating what constitutes digital skills and how they can be measured. Since the development and updating of training packages is a tripartite exercise, with strong representation from industry employers, it may be that employers are failing to clearly articulate the kinds and levels of skills they require in this area, leading training package developers to present a largely basic and open interpretation of training content.

## Next steps

While the findings from this stage of the research are important, they do raise several questions and directions for future exploration and investigation. Interviews with key industry stakeholders and industry surveys will be undertaken in order to establish clear explanations for the issues identified in this working paper.

It also seems, considering the lack of uniform articulation of digital skills needs and training content, that a 'national digital skills framework', akin to the National Literacy and Numeracy Framework, could go some way to addressing these issues. Such a framework will be produced from this research in order to guide the development of the skills required for the emerging economy and to assist employers and training package developers to frame digital skills. The framework would also provide a standardised approach for employees to reflect upon their own digital skills and needs.

The framework is also needed for the development of a digital skills content definition that encompasses the technological, informational and contextual aspects that are fundamental for the sustained productivity of the workforce in the continually transforming digital environment. This effort would be informed by existing international practices such as the European digital competency framework, which defines key components of digital competence in the five areas of: information and data literacy; communication and collaboration; digital content creation; safety; and problem-solving.

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