FUTURE SKILLS ORGANISATION
Finance Technology Business

Jobs and Skills Councils
An Australian Government Initiative

Impact of generative AI on skills in the workplace

December 2023

Research by Mandala Partners in partnership with the Future Skills Organisation

Occupations with more **cognitive and less physical skills**, that have **higher required skill levels** are more likely to be impacted as generative AI systems are implemented.

The **primary impact on the training system will be at the university level** as occupations that generally require university qualifications typically have greater exposure to generative AI.

Within the **Vocational Education and Training (VET) system, higher level qualifications are more likely to face disruption.**

Of the three training packages within finance, technology and business, the **greatest exposure to GAI was faced in the Financial Services and Business Services training packages followed by ICT.** This is due to the presence of some occupations in ICT which require a combination of more physical skills with cognitive skills. However, the exposure in many qualifications in the ICT training package was still found to be above average.

In the Financial Services training package, the greatest exposure to generative AI is in qualifications preparing people for roles in **accounting and clerking for financial services firms.**

In the Business Services training package, the greatest exposure is seen in **administration and call centre roles.**

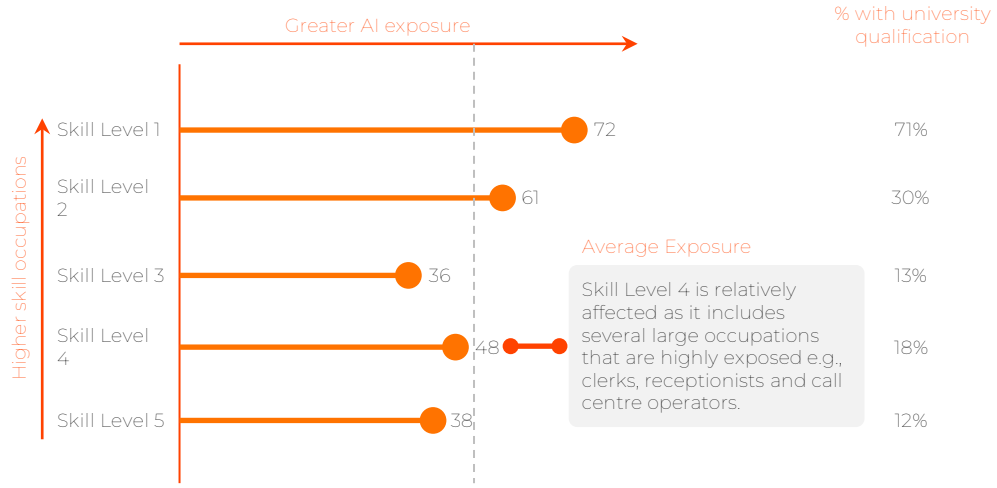
In the ICT training package, the greatest exposure is seen in **software development and programming roles.**

THE OCCUPATIONS WITH THE HIGHEST REQUIRED SKILL LEVEL ARE MORE LIKELY TO CHANGE AS GENERATIVE AI SYSTEMS ARE IMPLEMENTED.

- Higher level qualifications are more likely to be disrupted by generative AI
- When applied to Australian occupations, occupations in skill level 1 and 2 were the most exposed to AI. Occupations in skill level 1 are those that require tertiary education while skill level 2 occupations typically require a diploma. These occupations tend to rely more heavily on cognitive skills which AI excels in. This means that qualifications from universities face the greatest need to change.
- Occupations in skill level 3, 4 and 5 require Certificate 4s and below. In aggregate these occupations faced less exposure, there are still some occupations in those categories with high exposure.

OCCUPATIONS WITH THE HIGHEST SKILL REQUIREMENTS HAVE THE GREATEST AI EXPOSURE

Index, average of AI Occupational Exposure score by skill level weighted by employee numbers, % university qualification



Source: Felten et al 2023, ABS Census 2021, Mandala analysis

FUTURE SKILLS ORGANISATION
Finance Technology Business

Generative AI is a general-purpose technology that will reshape the economy and the labour market

General-purpose technologies are technologies that can induce broad and profound impacts across various sectors of the economy. They possess the potential to drastically reshape industries, spark complementary innovations, and significantly influence productivity.

Historically, general-purpose technologies have been responsible for reshaping economies and societies. The transition from agrarian to industrial economies with the steam engine, or the creation of the digital economy with the internet, are testaments to this.

Generative AI could usher in new business models, shift labour markets as certain tasks become automated, augmented or adapted, and lead to societal shifts as it changes the way we create, consume, and interact with content.

Industry estimates of the impact of generative AI in Australia range from between $45 billion to $115 billion by 2030.

Generative Pre-trained Transformers (GPTs) are a general-purpose technology (GPT)

Criteria	Description	How it relates to generative AI
Pervasiveness	Spread and adoption across a wide range of industries and tasks.	Generative AI is versatile and can be incorporated into various sectors, from entertainment (creating art/music) to finance (risk assessment) and beyond. Its algorithms can be adapted for numerous applications, making its reach expansive.
Innovation spawning	Catalyses the development of ancillary technologies and methods.	Generative AI not only stands alone but also encourages advancements in other fields. For example, it boosts the development of more efficient computational hardware, inspires new data analysis techniques, and leads to novel AI architectures and methods.
Improvement	Ability to evolve, mature, and increase in capability with time.	Like many AI technologies, generative AI is built upon iterative learning. As more data becomes available and as algorithms get refined, its accuracy, efficiency, and range of applications will grow, leading to a continually improving toolset.

*Source: Bresnahan, T., & Trajtenberg, M. (1995). "General Purpose Technologies 'Engines of Growth'", Jovanovic, B., & Rousseau, P. (2005). "General Purpose Technologies"., Supporting Safe and Responsible AI. Tech Council of Australia Submission. (August 2023), Mandala analysis.

Generative AI will affect the tasks that we perform in different ways: some automated, many augmented, and others adapted

Modes of task impact from generative AI

1 Automate

- Tasks that AI systems can manage entirely on their own will be automated, increasing efficiency and eliminating routine effort.
- The impact of automation will occur in *routine* tasks which are characteristic of low-medium levels of skill and manual jobs.
- Generative AI tools currently have issues associated with *legibility* and *hallucination which* means that they will be less likely to automate tasks in the short term.

2 Augment

- Tasks will be augmented where there is a synergy where AI enhances human abilities, allowing for collaborative work that harnesses the strengths of both AI and human judgment.
- In these tasks the AI will act as a 'co-pilot' for human tasks where a back and forth will exist between model and human capability.
- Evidence of this impact is already evident in tasks associated with writing, translation, research and software development.

3 Adapt

- Specific tasks adapt to incorporate AI-driven insights or actions, requiring humans to interpret, validate, or combine these outputs.
- Rather than an interactive relationship as exists with augmented tasks, in adapted tasks humans are more likely to play a QA role, checking and correcting work performed by the model.
- Evidence of this can be seen in tasks such as classification and editing AI generated text.

Most likely impact on lower skilled tasks, will likely take longer to occur

Most likely impact on higher skilled tasks, augmentation and adaptation will be occurring now

*Source: Acemoglu, Daron, and David Autor. (2011). "Skills, tasks and technologies: Implications for employment and earnings.", Felten, E. W., Raj, M., & Seamans, R. (April 10, 2023). "Occupational Heterogeneity in Exposure to Generative AI", Mandala analysis

To determine the impact on occupations and training products we use estimates of impact on human abilities

Human abilities are the building blocks that drive our capacity to perform tasks to achieve a given goal. The US Department of Labor has developed a systematic taxonomy of these abilities which it defines as the "enduring attributes of the individual that influence performance".

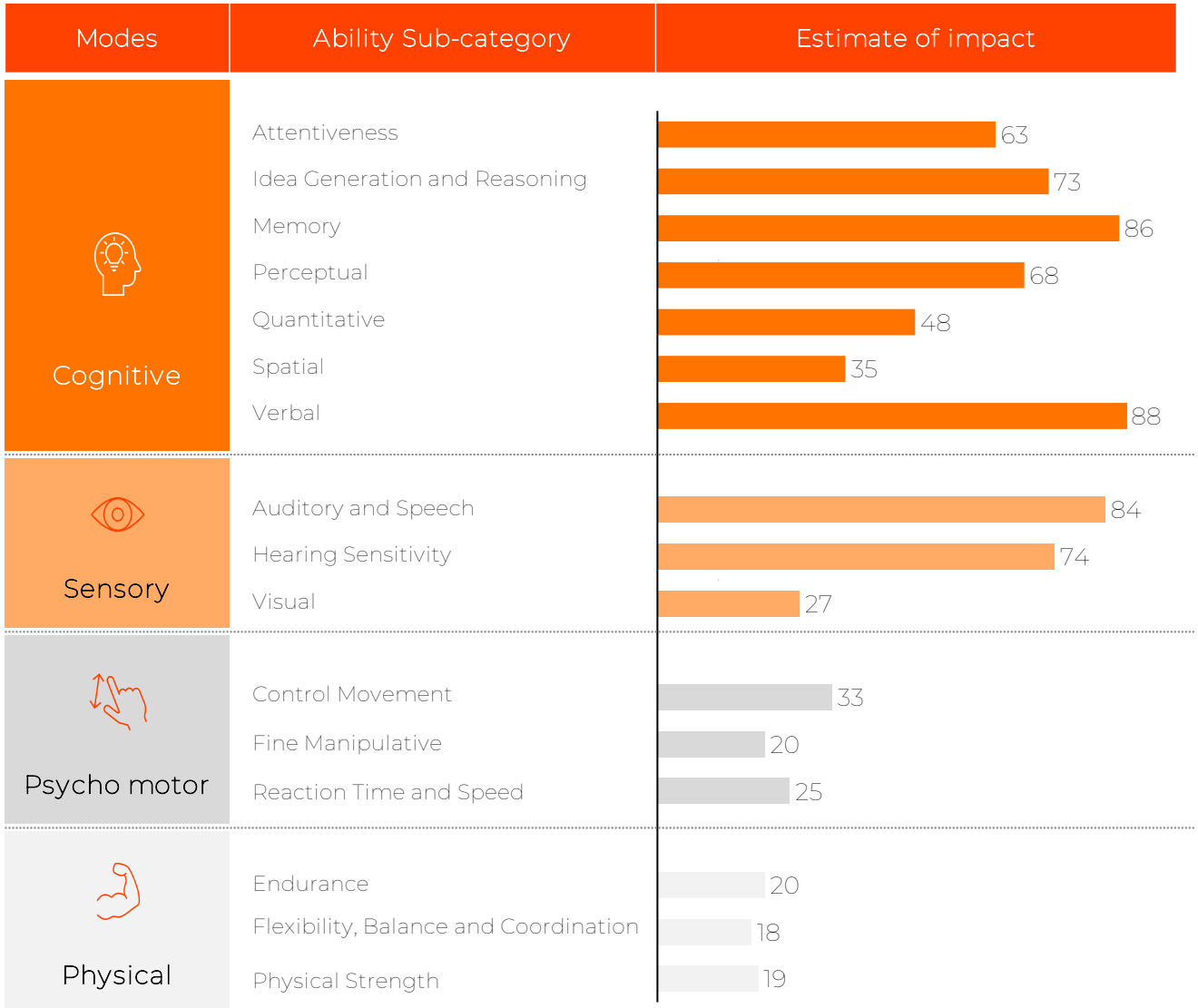
For each of these abilities, economic researchers have estimated how these abilities will be impacted by various forms of artificial intelligence.

For this study, we will be concentrating on the impacts of language models, which will have their strongest impact on cognitive and sensory abilities.

With these ability level estimates, we can then estimate the impact on other variables of interest such as occupations, industries and training products.

Cognitive and sensory abilities will be the most impacted by LLMs

Exposure of O*NET abilities to language models



*Source: Felten et al 2023, supra.

We map the ability estimates to other variables of interest such as occupations and training products

Approach	Output	Method	Considerations
Occupation	• AI exposure for each occupation • Analysis at the ANZSCO 6-digit level of 108 occupations • Used to determine the AI exposure of occupations that share characteristics	• Felten et al measured the occupational exposure to AI using Standard Occupation Classification (SOC), occupation classifications • These were matched to ANZSCO occupations using the JSC correspondence and some imputation • Characteristics of ANZSCO occupations were then derived from the Census	• Analysis of occupations is useful as they are easily relatable • There are some ANZSCO occupations that are not covered by the SOC, the AI exposure score for these occupations was imputed based on similar occupations
Qualification	• AI exposure for each qualification • Analysis at the qualification code level of 689 qualifications • Used to determine the AI exposure of qualifications that share characteristics	• Felten et al measured the occupational exposure to AI using the SOC • These were matched to qualification codes using the associated ANZSCO occupation provided by training.gov.au and the dataset above • Characteristics of qualifications were then derived from NCVER VOCSTATS	• Analysis of qualifications is useful as they are the units that students engage with • Each qualification is only associated with one occupation. However, AI exposure scores do not vary substantially between similar occupations so the results will not be substantially affected by this
Unit of Competency	• AI exposure for each unit of competency • Analysis at the unit level of 1,867 units • Used to determine the units of competency that are most in need of update	• Mandala scraping of training.gov.au for the Performance Criteria of every unit under the FSO • An LLM was used to rank the O*Net abilities that are most required by each unit • Using Felten et al's measure of O*NET ability exposure to AI, the exposure of each unit of competency was derived	• Analysis of UOCs is useful as UOCs are the base block in all training products • This approach relies on the accuracy of an LLM to associate O*NET abilities with the Performance Criteria. To ensure accuracy, Mandala sampled a percentage of units to ensure classification accuracy

*Source: Felten et al, NCVER VOCSTATS, training.gov.au, Mandala analysis

The primary impact on the training system will be at the university level

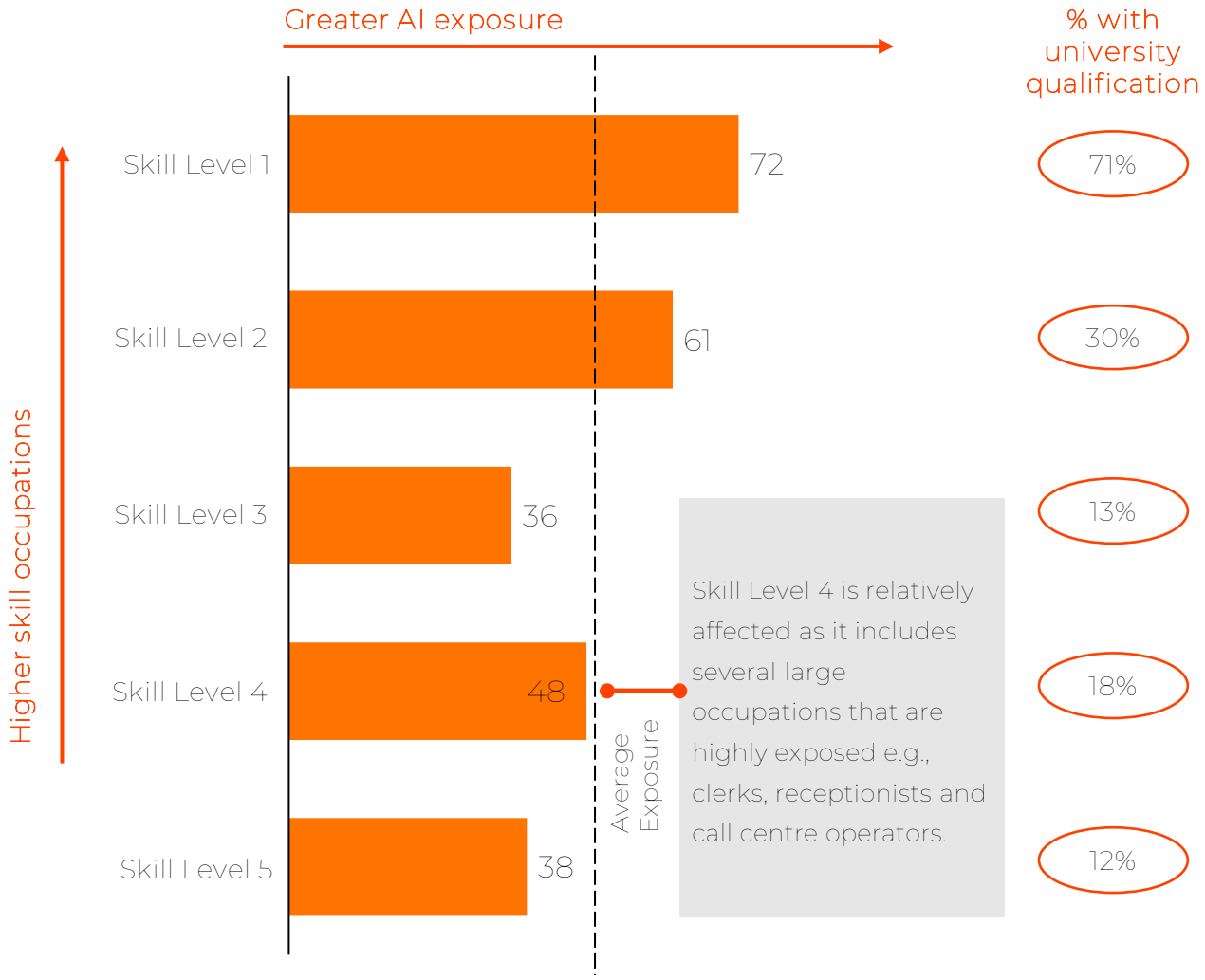
The occupations with the highest required skill level are more likely to change as generative AI systems are implemented.

When applied to Australian occupations, occupations in skill level 1 and 2 were the most exposed to AI. Occupations in skill level 1 are those that require tertiary education while skill level 2 occupations typically require a diploma. These occupations tend to rely more heavily on cognitive skills which AI excels in. This means that qualifications from universities face the greatest need to change.

Occupations in skill level 3, 4 and 5 require Certificate IVs and below. In aggregate these occupations faced less exposure, there are still some occupations in those categories with high exposure.

Occupations with the highest skill requirements have the greatest AI exposure

Index, average of AI Occupational Exposure score by skill level weighted by employee numbers, % university qualifications



*Source: Felten et al 2023, ABS Census 2021, Mandala analysis

Within the VET system, higher level qualifications are more likely to face disruption

Higher level qualifications are more likely to have a higher level of AI exposure. This is because these qualifications are used in occupations that rely more heavily on cognitive and sensory skills.

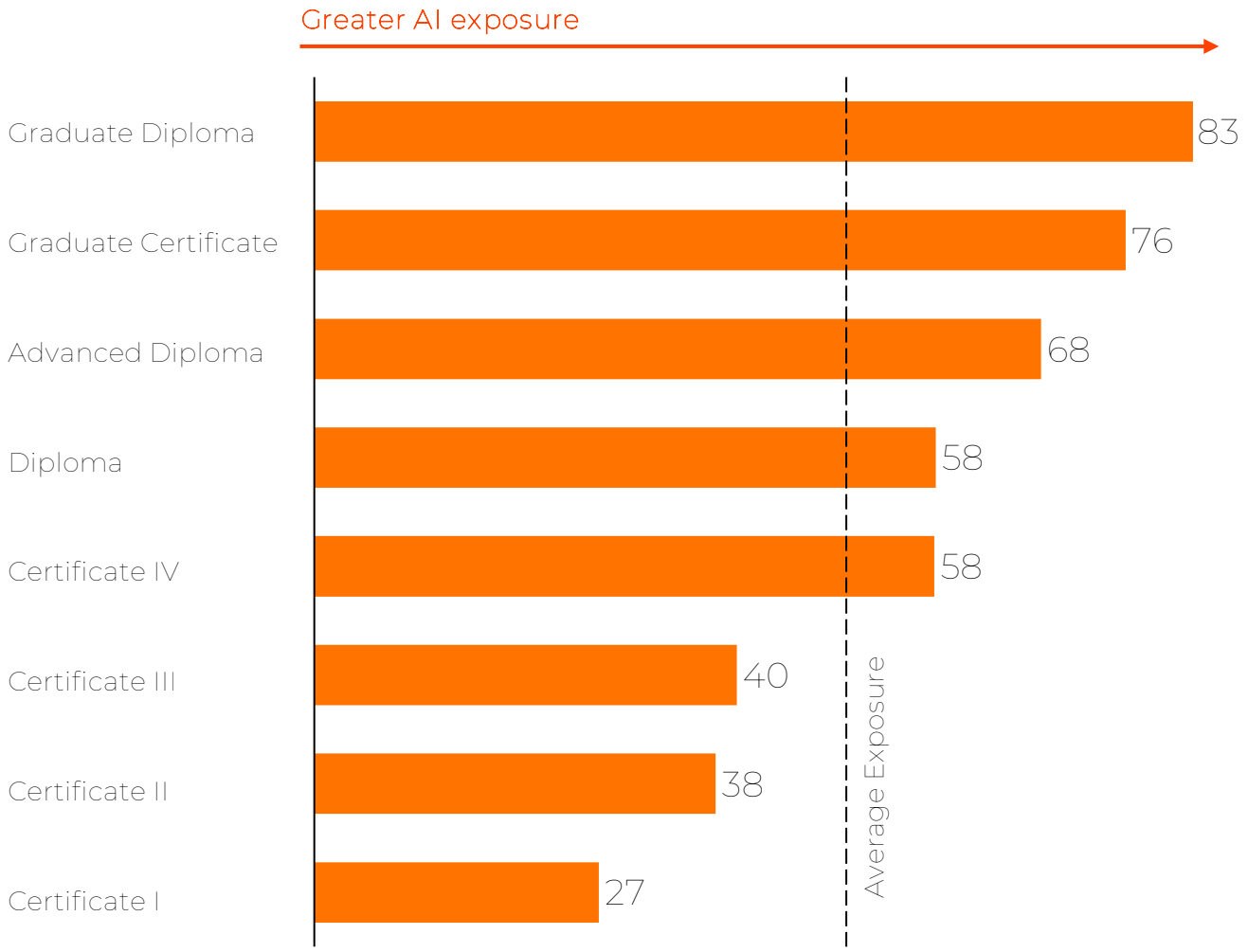
Graduate certificates and diplomas face greater AI exposure as they tend to be additional qualifications in management for exposed occupations like auditing and administration.

Other diplomas and Certificate IVs face a moderate exposure, driven by large qualifications with high exposure like the Diploma of Financial Services along with some low exposure qualifications.

Certificate Is, IIs, and IIIs face the lowest level of exposure. These qualifications face the lowest level of exposure as they tend to be required in occupations that rely more heavily on physical skills.

The graduate qualifications and Diplomas are the most impacted qualifications

Index, average of AI Occupational Exposure score by qualification type weighted by completed enrollments



*Source: Felten et al, ABS, Mandala analysis

Exposure across FSO packages varies, with financial services facing the greatest exposure

Across the three training packages administered by the FSO, the greatest exposure is faced in the Financial Services training package with ICT and Business Services following.

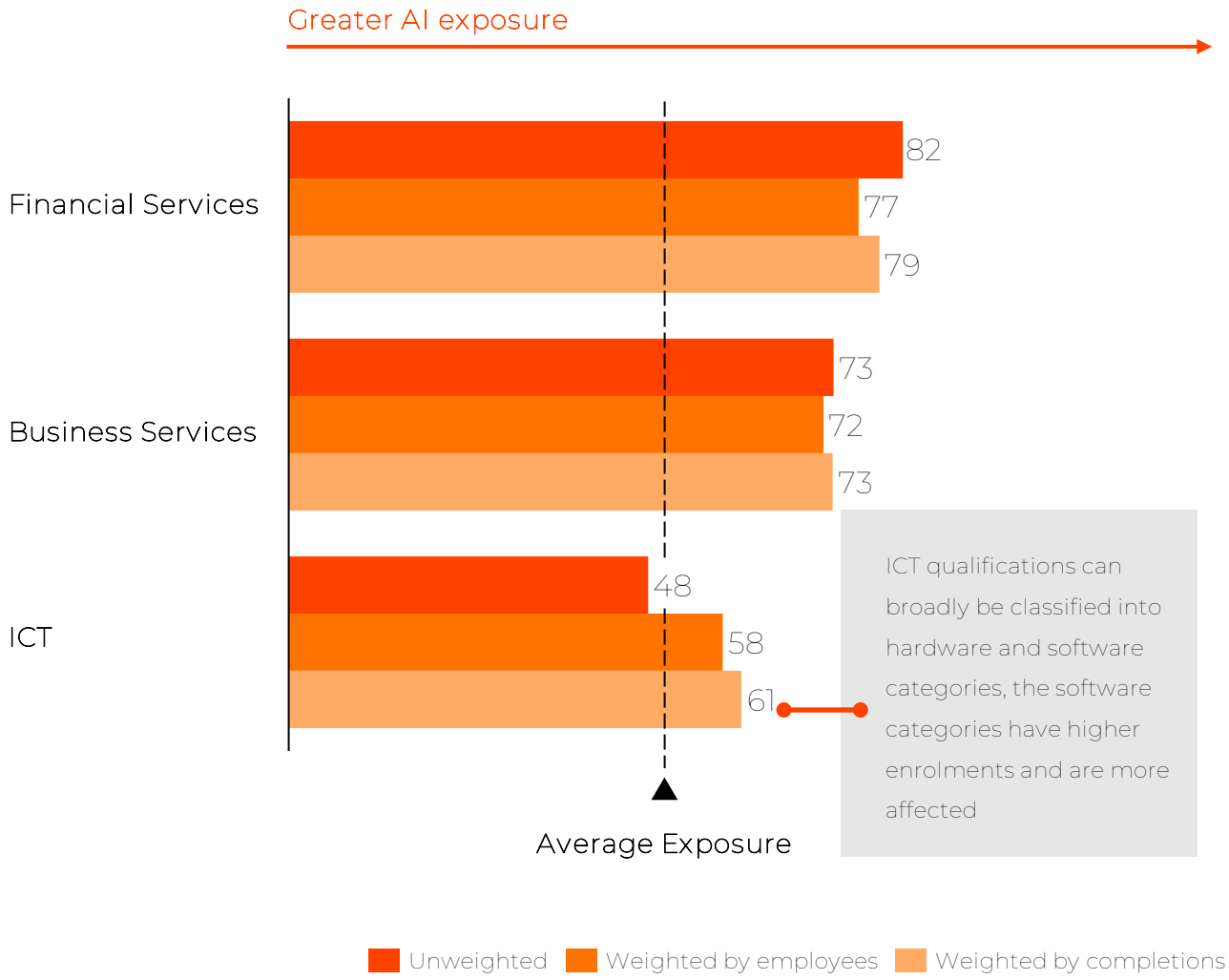
The Financial Services training package had 4,650 completions in 2022 and provides higher-level qualifications in insurance, banking and accounting. The greatest exposure is seen in qualifications preparing people for roles in accounting and clerking for financial services firms.

The Business Services training package had 24,290 completions in 2022 and provides qualifications across all levels in skills like customer engagement and administration. The greatest exposure is seen in administration and call centre roles.

The ICT training package had 3,970 completions in 2022 and provides qualifications in engineering for roles with hardware and computer science for software roles. Greatest exposure is seen in software development and programming roles.

The graduate qualifications and Diplomas are the most impacted qualifications

Index, average of AI Occupational Exposure score by qualification type weighted by completed enrollments



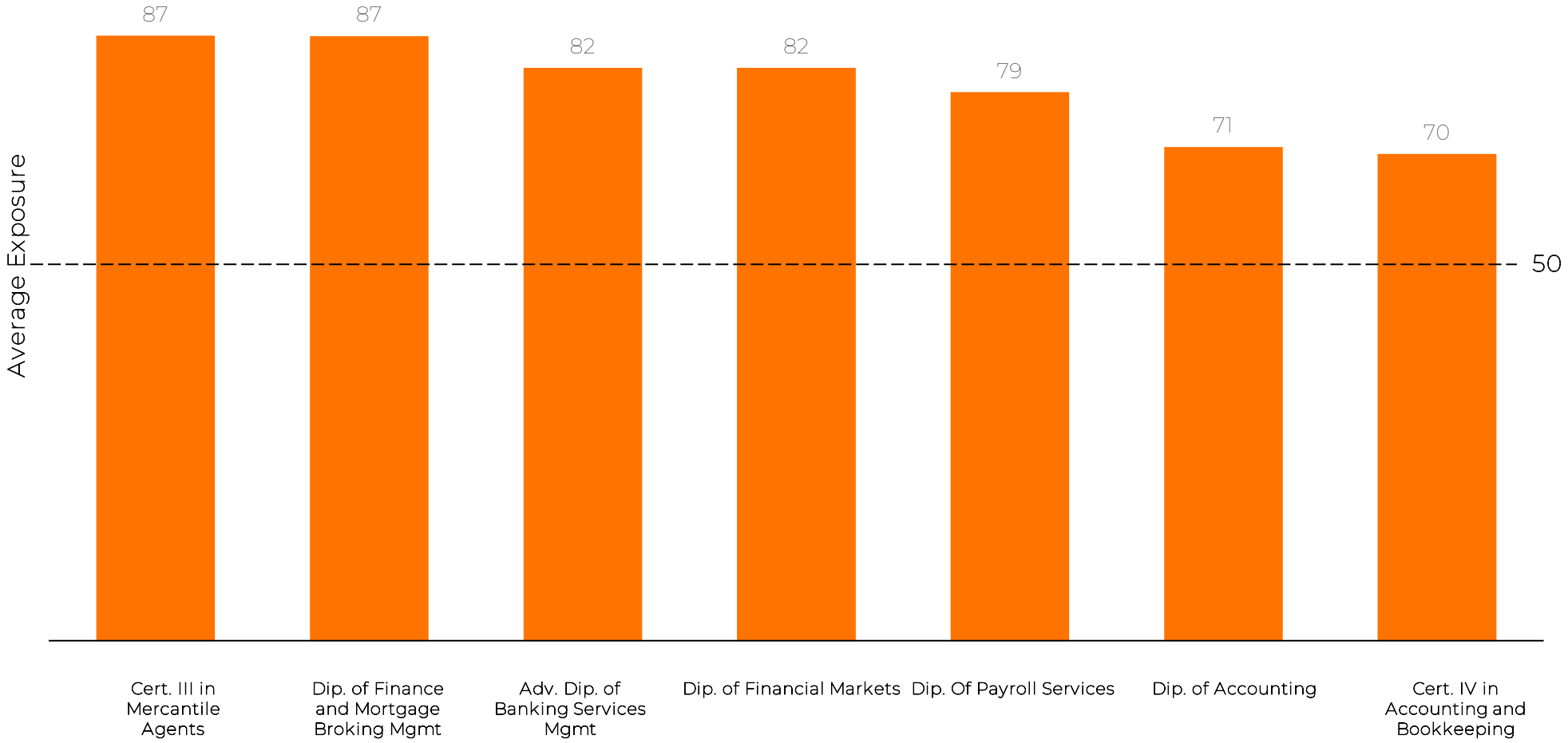
*Source: Felten et al 2023, ABS Census 2021, Mandala analysis

The FSO has qualifications across its Financial Services training package with high AI exposure

Financial Services training package have several qualifications with high AI exposure

AI Exposure, Select Qualifications, weighted by completions

Financial Services



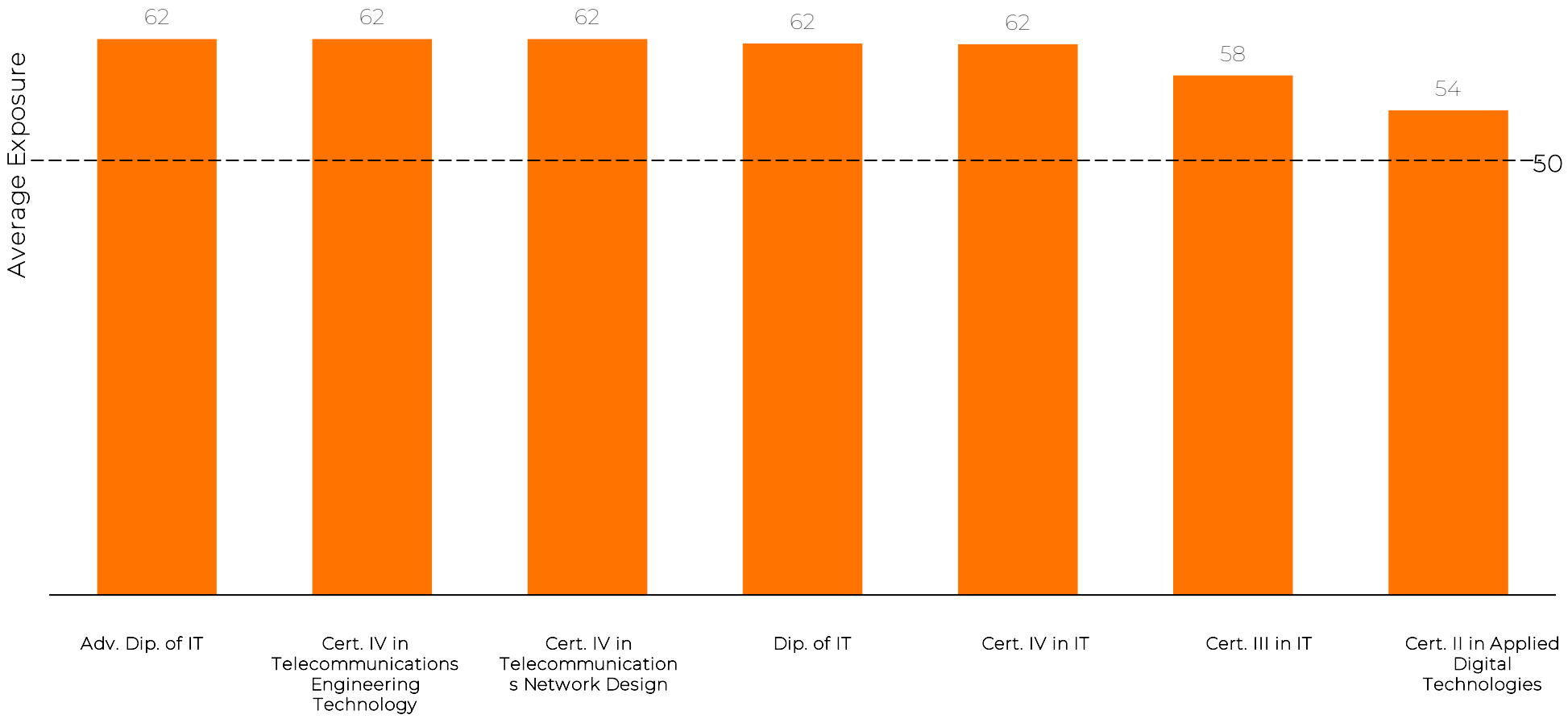
*Source: Felten et al, NCVER VOCSTATS, Training.gov Mandala analysis

The FSO has qualifications across its ICT training package with high AI exposure

ICT training package have several qualifications with high AI exposure

AI Exposure, Select Qualifications, weighted by completions

ICT



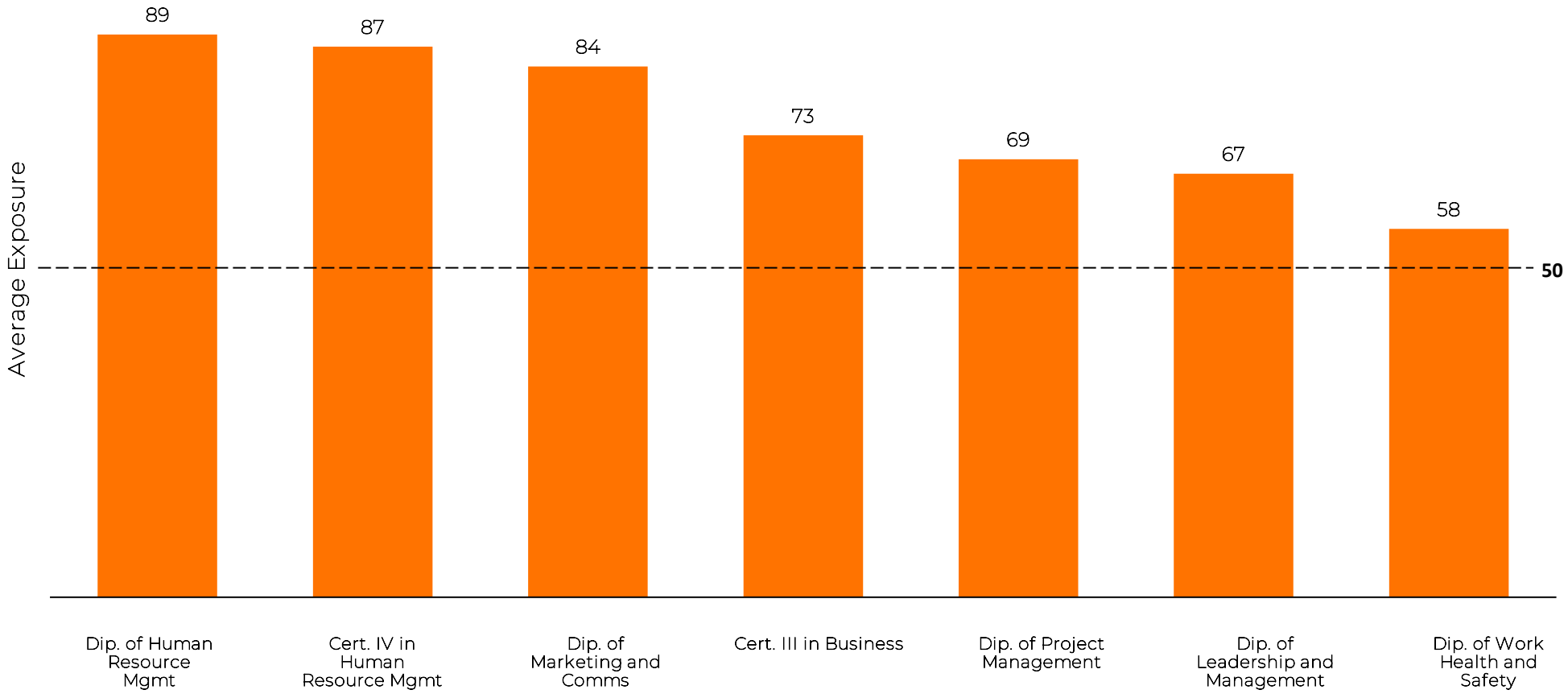
**Source: Felten et al, NCVER VOCSTATS, Training.gov Mandala analysis

The FSO has qualifications across its Business Services training package with high AI exposure

Business Services training packages have several qualifications with high AI exposure

AI Exposure, Select Qualifications, weighted by completions

Business Services



*Source: Felten et al, NCVER VOCSTATS, Training.gov Mandala analysis

We used a hybrid AI-human classifier to assess the exposure of FSO UOCs

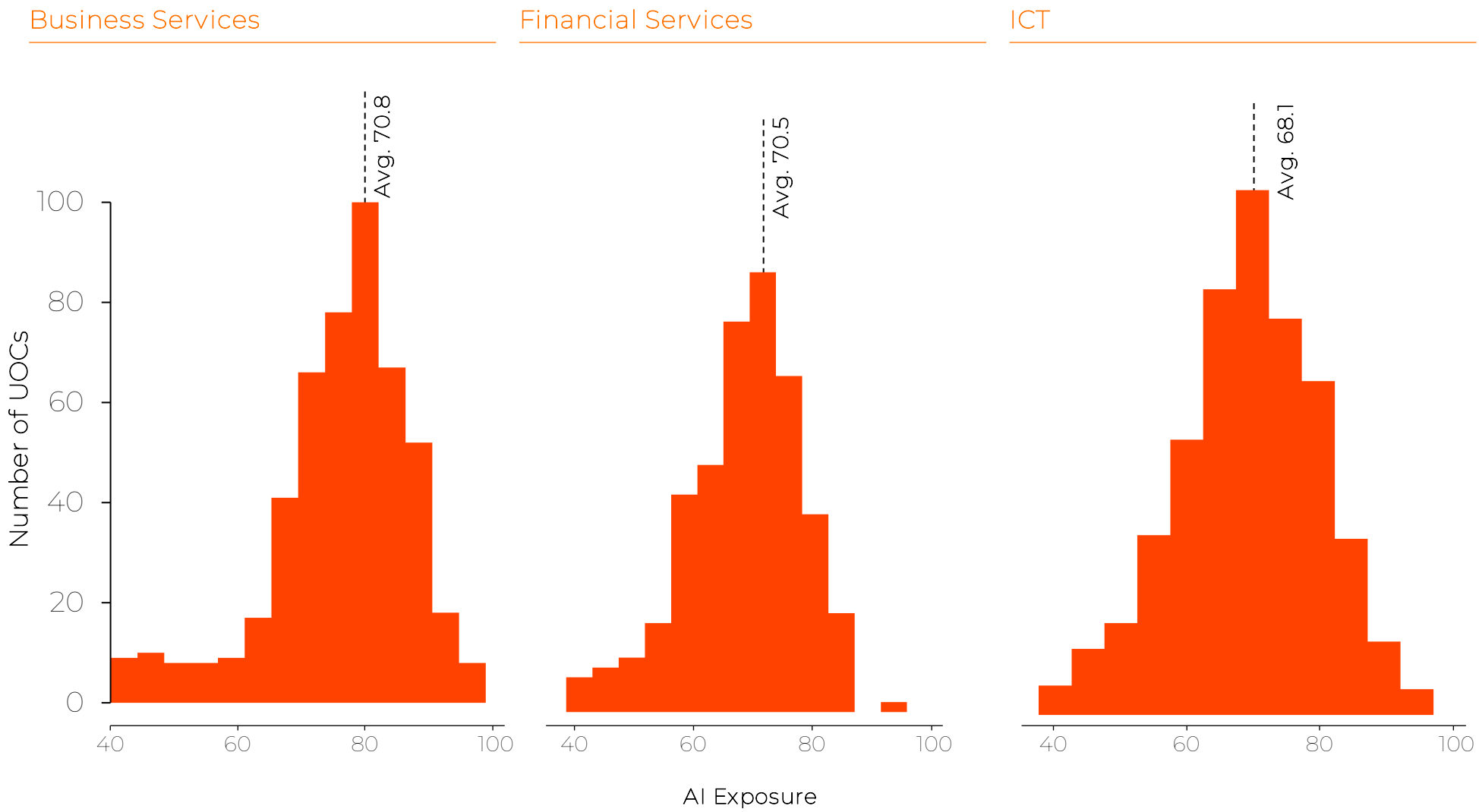
Method Stage				
	UOC Performance Criteria	GPT-4 API with Custom System Message	Abilities for each UOC checked by Mandala analyst	UOC AI exposure score
Explanation	We scraped the performance criteria for all UOCs in the FSO's training packages to extract the performance criteria which describe the substance of the competency	We then feed this data into the GPT-4 API with a custom system message to translate the criteria into abilities, which returns a list of abilities scored out of 10 for each UOC	We then perform a sense check using statistical analysis and random manual checks of the abilities that the LLM returns to ensure that they align with reasonable expectations	Finally, we multiply the ability scores by the language-model AI exposure to obtain the UOC AI exposure score
Method Stage	ICTGAM534 – Manage interactive media productions: Prepare Digital Media Team, Monitor Workplace Culture, Identify Behaviours and Attitude and Report on Team Workplace Experience	ICTGAM534: Written Comprehension 9, Deductive Reasoning 4, Problem Sensitivity 4	In this instance Written Expression could be added as an ability to reflect the need to report on team workplace experience. However, it will not substantially affect the AI exposure score	ICTGAM534 AI exposure score 60.12

*Source: Felten et al, NCVER VOCSTATS, O*NET, training.gov.au, Mandala analysis
Notes: This analysis applies to all units of competency with enrolments in the last three years under the FTB training packages, this includes imported units and units that are no longer current. ,Deductive Reasoning is the ability to apply general rules to specific problems to produce answers that make sense, Problem Sensitivity is the ability to tell when something is wrong or likely to go wrong

There is significant variation of the AI exposure for UOCs within the FSO's training packages

UOCs in Financial Services and Business Services have the highest average exposure

Distribution of units of competency by AI exposure score, FSO training packages



*Source: Felten et al, NCVER VOCSTATS, O*NET, training.gov.au, Mandala analysis

Methodology to AI report

Occupation modelling approach and assumptions

	ANZSCO Table		ANZSCO – SOC Correspondence		AI Exposure Score	
Table	ANZSCO	Attributes	ANZSCO 2013	SOC 2010	SOC 2010	AI Exposure
	139913	-	139913	11-3051	11-3051	32
	224412	-	224412	19-3051	19-3051	89
	551211	-	551211	43-3031	43-3031	45
Source	• 2021 ABS Census: attributes include the skill level of the occupation and the number of employees		• Jobs and Skills Australia: ANZSCO 2013 to O*NET-SOC 2019 correspondence • O*NET Resource Centre: Crosswalk O*NET-SOC 2019 to 2018 SOC • US Bureau of Labor Statistics: 2018 SOC to 2010 SOC correspondence		• Felten et al: Occupational Heterogeneity in Exposure to Generative AI	
Method and Assumptions	• N.A.		• ANZSCO 2013 to SOC 2010 correspondence was established using a correspondence to O*NET SOC 2019, 2018 SOC and the 2010 SOC • Where no correspondence was available, an appropriate 2010 SOC was chosen, this occurred 14 times • No correspondence was available for ANZSCO occupations that are nfd or nec		• ANZSCOs were associated with Felten's AI Exposure Score using the correspondence • Where no AI exposure score was available for a particular SOC, another SOC with an associated score was chosen, this occurred 3 times • For occupations that are nfd or nec, the average exposure was taken of similar occupations	

Qualification modelling approach and assumptions

	Qualifications Table			ANZSCO – AI exposure table	
Table	Qual Code	Attributes	ANZSCO	ANZSCO 2013	SOC 2010
	-	-	-	139913	11-3051
	-	-	-	224412	19-3051
	-	-	-	551211	43-3031
Source	• Training.gov Database of qualifications: attributes include the qualification level, the qualification title, the training package and the JSC. The database also associates each qualification code with an appropriate ANZSCO.			• Previous occupations analysis	
Method and Assumptions	• Training packages are derived from the initial 3 characters of the qualification code, i.e. ACM10110 is assumed to be in the ACM training package. This was due to inconsistencies in the TP Title field in the database. • Where an ANZSCO was chosen that did not exist, another adjacent ANZSCO was chosen, this occurred 12 times			• N.A.	

FUTURE SKILLS ORGANISATION
Finance Technology Business

Jobs and Skills Councils
An Australian Government Initiative

THANK YOU.

The Future Skills Organisation is a Jobs and Skills Council funded by the Australian Government Department of Employment and Workplace Relations.