



Roads Australia Fellowship 2023 – Group 7 Research Paper

Harnessing AI technology to make efficient, targeted recruitment decisions.

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1 Executive Summary

Human resource teams and professionals in the transport sector face significant challenges. While there have been many interventions and adjustments by Governments and the private sector, including migrant skills, offshoring work and innovations in procurement and delivery approaches, the gap in human resource capacity to meet industry demand is widening and is set to continue.

Artificial Intelligence (AI) is increasingly embedded within business and daily life processes, so AI-driven tasks are re-shaping our industry. Whilst AI technology continues to evolve and can deliver many benefits, it currently does not have the functionality equivalent to human intellectual capabilities, nor does it possess the emotion that can be used to manage the human resources functionality of a business. Other barriers, such as algorithm/data bias, potential ethics and privacy breaches, perceived threats to the labour market, and cyber security, need to be addressed to harness the full potential of AI technology. This change is needed at a whole-of-industry level to resolve the capacity gap and be future-ready to deliver the infrastructure and services communities need.

1.1 Study Design and Data

Our knowledge, experience and research inform us that AI will be the next big technical revolution in the industry. An efficient application to recruitment can support skill shortages now, and the potential industry changes that the wider AI solutions may bring in the future. We have focussed our research on attracting new talent with the skills and expertise required to generate innovations and be more responsive to future shifts. This change is needed at a whole-of-industry level to resolve the capacity gap and be ready to deliver the infrastructure and services that communities need.

To understand AI's impact on recruitment, we have analysed the current practices and assessed the potential shift in skills that the industry will need to meet future demands. This includes exploring the skills required to harness AI in our industry, the evolution in approaches to talent identification and how skills shortages are being addressed in other countries; refer to *Section 4*.

We then investigated the existing AI recruitment solutions that could be implemented within an industry company aiming to expand its talent pool. We have also assessed their benefits and barriers based on a literature review and interviews with industry professionals, refer to *Section 5*.

Finally, we have assessed how the industry may change in the future, what shift in skills may be required to fill this demand and what we need to do now to achieve successful outcomes in the short, medium and long-term future, refer to *Section 6*.

1.2 Outcomes

Based on the assessment of the current hiring processes, an industry-wide skills review needs to be undertaken for innovation to reach wider talent pools. It is unlikely that a company will be able to implement a skills-first approach if industry and educational bodies are not aligned on what skills are required for specific jobs and how these are measured beyond specific long-term qualifications or focus solely on an individual's credentials.

We have identified five main tools that are currently in existence and compared as follows.

Key Issue	HireEz	Indeed	SkillsEngine	Reejig	Linkedin Recruiter
Application to the roads industry	N	Y Using their pool of candidates	Not currently	Y	Y
Candidate review and filtering	Y	Y	N	N	Y
Skills Mapping	?	Y Limited based on its pool	Y	Y	?
Job Description Support	N	N	Y	Y	Y
Talent outreach	Y	Y	Unsure	Y	Y
Australian Data Source	N	?	N	Y	Y

The current skill set within the industry will need to adapt to the changing landscape. Technology's ever-increasing acceptance and integration into every aspect of our daily lives generates more data than ever. The increased use of AI or machine learning within the industry to manipulate and use this data will require a greater reliance on coding and problem-solving to maximise its potential. Soft skills will be in demand, as disparate disciplines must interact more readily to collaborate and drive innovation forward.

1.3 Conclusion

By having the AI assist in the process of finding and engaging the right people, recruiters can spend more time focused on the human things: making sure they are looking for the right sorts of people for their roles, sending out engaging and exciting messaging, running effective interviews that get the candidate. It is clear that **human intervention** is still required to increase and maintain reliability, mainly where the final decision-making involves considering subjective and qualitative factors such as empathy.

By embracing this transformative approach, HR departments and recruiters can unlock greater efficiency, objectivity, and diversity in their hiring processes. The introduction of AI augments human abilities, offering comprehensive insights and enabling confident decision-making. As organisations move forward, they must harness the potential of AI to create a more inclusive, transparent, and effective recruitment ecosystem. Based on our findings as outlined in this report, we have identified a road map that can be implemented through the following AI support:

- **For Step 1:** Use AI to thoroughly understand the organisation's current skills.
- **For Step 2:** Identify the skills required as AI and other advances are further adopted into our industry.
- **For Step 3:** Identify the gaps in skills across the organisation and using AI, identify external talent pool.
- **For Step 4:** Identify training required for external talent pool.
- **For Step 5:** Identify Innovations for Implementation.
- **For Step 6:** Identify gaps or barriers in implementing AI and other new technologies.

The road map will allow the industry to deliver resources efficiently and effectively to meet fluctuating capacity demands and shifting competency expectations. Roads Australia could continue to strengthen its support of its members and how it influences the industry through additional work that we have identified to be undertaken by Roads Australia in collaboration with its members, like-minded industry partners and vendors.

The future has arrived, and the marriage between AI and skills-based hiring beckons us to embark on this transformative journey together.

2 Project Team

The Roads Australia Fellowship – Group Seven comprises seven industry specialists encompassing the engineering, construction, transportation and infrastructure sectors.

Laura Evans



Laura has 20 years' experience delivering and tendering complex infrastructure construction projects.

Laura brings extensive experience in project development, business development, construction market analysis, business planning, tendering, estimating, risk management and design coordination.

Laura's experience in the delivery of multi-disciplined construction projects and her extensive estimating background enable her to apply strong financial acumen and technical understanding to drive innovative, value-for-money solutions.

Kylie Adeniyi



Kylie is an eternal optimist, passionate about sustainably bringing more diversity into purchasing and recruiting practices.

Kylie's current role has seen Major Road Projects Victoria direct more than \$200mil to some of Victoria's most vulnerable and marginalised communities, by engaging with an increasingly diverse workforce and supply chain.

Over the past 20 years, she has worked across Local and Federal Government, Healthcare, Not For Profit (Agriculture, Food Security, Education), Utilities (Electricity, Gas, Water), Transportation (Rail & Road), Mining, Manufacturing and Food & Beverage.

Michael Ampstead



Michael is a civil engineer with 18 years' of experience within the civil infrastructure industry. In that time, he has worked on various projects ranging in size from local government undertakings to some of the largest projects in Australia. Michael has project managed and led multi-disciplinary teams of varying sizes for various complex projects.

Michael's experience across various projects and sectors has provided him with a wide range of knowledge and skills within the highway sector and supporting disciplines, some of which include structures, geotechnical and hydrology. This knowledge base allows Michael to oversee all aspects of a project's development through delivery.

Nicolette Cumbo



Nicolette has over 15 years' of experience in infrastructure planning, project development and asset-owner operations management. This experience is in the transport, water, ports and freight, health and social housing sectors.

Nicolette seeks to enhance the value that infrastructure delivers to communities and enjoys playing a part in strategic definition, project and program development, developing and establishing management frameworks, and optimising practice. She has successfully articulated the case for change for complex and politically or commercially sensitive projects.

Amir Holakoo



Amir is a technical structural reviewer and team leader with extensive experience in design, proof engineering and independent verification of complex transport, rail, and civil infrastructure projects.

He has designed and led a range of infrastructure projects throughout Australia and overseas. Amir has a strong focus on technical leadership, project and design management, structural engineering (design, assessment, proof engineering and verification), and extensive knowledge of Australian and International Standards, VicRoads Specifications and Technical Notes, MTM/V Line Specifications, etcetera.

Paula Hernandez Martin



Paula is a versatile Civil Engineer with over 10 years' experience in the Roads Industry. She has varied experience from consultancy to construction design management both in Australia and the United Kingdom.

She has specialised in road projects of different scales, from local cycling infrastructure in London to some of Victoria's largest public managed motorways projects. She currently balances her Engineering Manager role for the North East Link South Alliance with advocating for gender equality as a volunteer for the National Association of Women in Construction.

Shu Hao Wu



Shu is a Civil Engineer with 19 years of professional consulting experience spanning across both public and private sectors, including major projects. Shu has highly developed interpersonal skills to build and maintain positive relationships with stakeholders, clients and team members. Shu's skills were formally recognised when he was appointed a team leader in 2016. With this leadership role, Shu has successfully managed multidisciplinary project teams, with a track record of delivering robust and holistic solutions to budget and time. As a team leader, Shu's focus on people has centred around team building, diversity and inclusion, mentoring, safety and a growth mindset.

3 Introduction and Scope

How do we harness the emergence of AI technology to identify talent, make efficient targeted recruitment decisions and respond to demands within the industry?

Human resource capacity in our industry has been a ‘hard nut to crack’. As a key part of the engineering and construction sector in Australia and New Zealand, the transport industry has faced persistent skills shortages and flat-lined productivity. While there have been many interventions and adjustments by the Government and the private sector, including migrant skills, offshoring work and innovations in procurement and delivery approaches, the gap in human resource capacity to meet industry demand is widening and is set to continue.

We recognise the conundrum of leveraging technical innovation to attract new talent to do the current work versus attracting new talent with the skills and expertise required to generate innovations and be more responsive to future shifts. How more diverse talents and skills are sourced, attracted and developed to sustain our industry needs to change. This change is needed at a whole-of-industry level to resolve the capacity gap and be future-ready to deliver the infrastructure and services communities need.

3.1 Scope

With the challenge around human resource capacity in mind, this paper focuses on attracting people first to generate innovations for our industry and responding to future shifts. We have unpacked AI's current opportunities and potential in the recruitment process through literature reviews and industry engagement, anchoring our research to the transport industry.

Our paper explores and addresses the following themes:

- What are the skills required to harness the emergence of AI technology?
- How can AI shape the future of our workforce and industry?
- How do we target new entrants to the industry?

Our research aligns with RA's Strategic Plan 2022 – 2024¹ by linking RA's Capacity policy stream to Data and Technology as a key enabler of RA's vision for “a diverse, inclusive, sustainable and values-led organisation and industry.”

The Strategic Plan highlights that Capacity and Data and Technology policy streams are in spheres of influence but does not define how these come together and what outcomes can be achieved. Our research contributes to defining these attributes.



¹ Strategic Plan 2022 – 2024; 2022; Roads Australia - [Roads-Australia-Strategic-Plan-2022-2024.pdf](#)

3.2 Objectives

We aim to develop a roadmap towards an industry with a more diverse talent pool that is future-prepared and aligned with data and technology developments of AI in recruitment.

Our research objectives are to:

- Understand the potential pool of available resources and authoritative commentary through a literature review. Refer to *Section 5*.
- Identify the barriers preventing new and diverse talent from joining our industry by canvassing the views of our industry. Refer to *Section 6*.
- Understand the shortages that exist for skills in the industry and identify the causes and potential steps to be taken to alleviate these strain points. Refer to *Section 7*.

3.3 Methodology

To meet our aim and objectives, we have undertaken a literature review of a broad range of publications and case studies covering topics from current recruiting practices, case studies of AI usage in Australia and overseas, and industry review reports on the engagement of different generations or minorities.

We undertook the literature review to answer the following questions:

- Identifying the skills and training new graduates seek and developing by reviewing ABS data on graduate intakes and outtakes. Refer to *Section 5*.
- Understanding how skill shortages are being addressed in other countries. Refer to *Section 5*.
- Identifying the AI available technologies that could support skills mapping to link the shortages and resources identified. Refer to *Section 6*.
- Identifying how AI available technologies may re-shape the industry. Refer to *Section 7*.
- Identifying the skills that the future industry will require. Refer to *Section 7*.
- Identifying the skills and expertise that will become obsolete with the rise of generative AI in engineering and other AI process simplification in construction. – Refer to *Section 7*.

We have also undertaken seven interviews with recruiting professionals from a variety of companies:

- Three Tier one construction contractors: Spark (WeBuild, CPB and GSC consortium), Laing O'Rourke and John Holland
- One Tier 2 contractor: Downer
- Two State Authorities: LXRA and MRPV
- One Consultancy: Stantec

A common interview structure was developed and has been included in Attachment 1 to answer the following questions:

- Understanding the potential key areas of skill shortages in the engineering and construction industries, any particular roles that remain open or unfilled for longer. Refer to *Section 5*.
- Understanding the barriers current hiring professionals face to increase the available talent pool. Refer to *Section 5*.
- Understanding the tools that current hiring professionals use to determine the skills required for a specific role. Refer to *Section 6*.
- Understanding the barriers that companies are facing to the introduction of AI technologies. Refer to *Section 6*.

We have also informally interviewed recruiting professionals and a few members of job-seeking support companies, to understand whether the barriers that the employers state they are facing align with the views of those seeking job opportunities.

4 Future skills preparedness - Taking a whole of skills market view?

4.1 What is the current state of skills and talent resources? How does this relate to the skills required to harness AI in our industry?

To begin with, we have reviewed the current status of available resources in the industry and discussed this view with talent acquisition professionals. The latest data published by the Australian Council of Engineering Deans (ACED)² shows total enrolment in engineering courses has increased only slightly from previous years. This increase was attributed to international enrolments, while domestic enrolments continued declining, as shown in Figure 1.

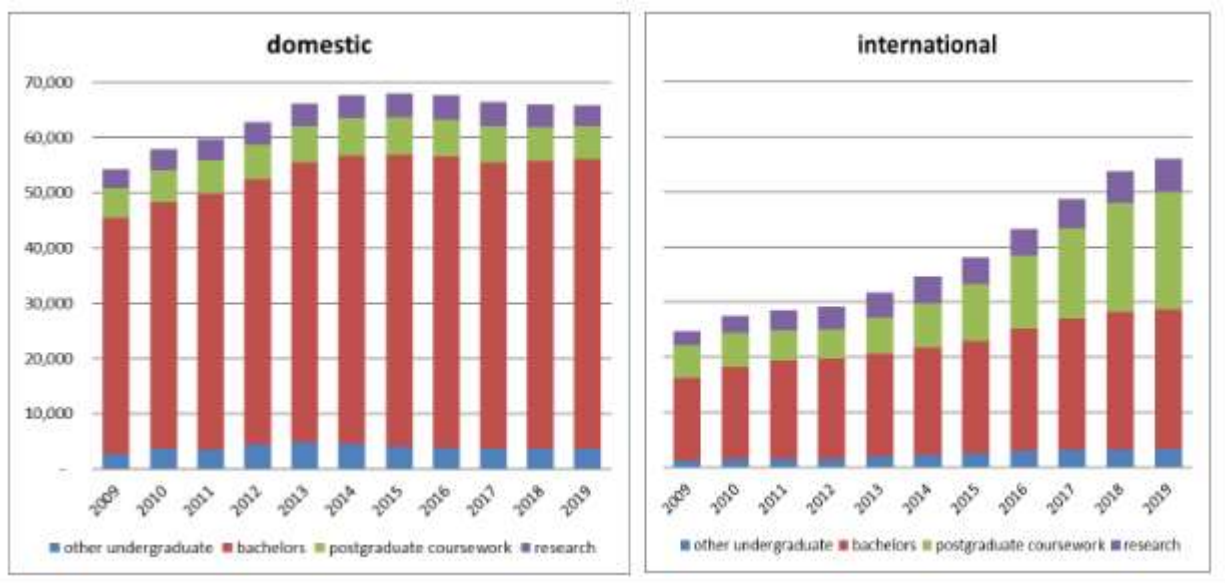


Figure 1: Total Engineering Enrolments For Domestic and International

This would appear to be backed up by the latest data from the Australian Bureau of Statistics (ABS)³, which shows the top 3 most common fields of tertiary study were:

1. business and management
2. teacher education
3. nursing.

This is also consistent with data published by the Australian Government – Department of Education, which shows engineering was ranked 7th by total student numbers (approx. 7% of all undergraduate students in Australia)⁴.

This data backs up the continued shortage of engineers experienced by our industry and the importance of fostering science, technology, engineering and mathematical (STEM) skills as part of the broader education curriculum⁵ to address the skills shortage experienced in Australia.

² Australian Engineering Higher Education Statistics 2009 – 2019; December 2020; Australian Council of Engineering Deans - [ACED Engineering Statistics](#)

³ Education and Training: Census; 28 June, 2022; Australian Bureau of Statistics - [Education | Australian Bureau of Statistics \(abs.gov.au\)](#)

⁴ 2021 Student Summary Tables; 9 February 2023; Department of Education - [2021 Student summary tables - Department of Education, Australian Government](#)

⁵ Statistics; Learn why statistics are important for the future of engineering; 21 October 2022; Engineers Australia - [Engineers Australia | Why statistics are important for the future of engineering](#)

We note the ABS reports artificial intelligence as one of the fastest-growing qualifications in Australia since 2016, where the number of graduates has increased by 204%. However, it should be noted that this only equates to 603 people, representing a minimal number of total university graduates over the same period⁶.

Based on the feedback collated from industry engagement, it is evident that recruiting the 'right' talent has been a common challenge experienced across the transport industry over many years. The impact is common across the public sector, private consultants, contractors, and recruiters. Many of the respondents to our survey cited the unavailability of candidates in the market to start with as the main barrier to recruitment. The time it takes to fill vacancies is exacerbated by the spike in demand due to record spending by the State and Federal governments.

Of those with different answers, difficulties with specialist roles were mentioned repeatedly. When asked about the number of CVs received per role, engineering roles were mentioned occasionally as having a high number of candidates compared to specialist roles. It was also considered that some companies that showed more innovative talent acquisition approaches, barriers were related to the limits that hiring managers would set to the specific expectations on candidates rather than an actual lack of skills.

Even though 70% of respondents stated that they have faced challenges recruiting, most respondents also stated that the average time it takes them to fill a role is 5 to 10 weeks, highlighting that the barriers may not be as bad as perceived.

On the opposite side, when we asked companies that support job seekers what they perceive the main barriers to recruitment are, they stated the need for candidates to provide local experience, PR or citizenship status and local degrees are keeping a large pool of qualified, experienced engineers from overseas from accessing the Australian labour market easily.

Case Study: Career-Seekers, a social enterprise assisting overseas qualified refugees and asylum seekers to secure employment

Career-seekers was founded in 2015 and has since supported hundreds of refugees and asylum seekers into work. They explained to the team that setting clear expectations on both sides is the most critical part of a successful placement and subsequent employment. Due to the significant differences between the construction industry in their home countries, this could be contrasted with the challenges that any individual with no construction experience in Australia may face when entering this industry. They suggest that the pace of the work, the complexity of the environment, the technology that may be commonplace, and Australian standards all presented a steep learning curve for their candidates – regardless of the skill or education they hold.

How they address these challenges could easily be applied to candidates entering construction for the first time from other industries. These strategies include internships and mentoring, encouraging note-taking, reinforcing that asking questions is key to learning, and familiarising themselves with the technology used within the workforce before commencing work. The benefits employers have seen is that once the initial barriers are overcome, they have secured a skilled practitioner with skills they would not get from entry-level staff.

4.2 Skills required to harness AI in our industry.

The integration of artificial intelligence (AI) into the industry has the potential to revolutionise various work activities. It is essential to differentiate between the use of AI for automation and the application of AI as generative technology, as they have different implications for the workforce.

⁶ Education and Training: Census; 28 June, 2022; Australian Bureau of Statistics - [Education | Australian Bureau of Statistics \(abs.gov.au\)](https://www.abs.gov.au/education)

The impact of AI and automation is not uniform across all job roles. While some routine and repetitive tasks may be automated, other aspects of work will require a human touch. This transformation of tasks within occupations underscores the importance of adaptability. Jobs that once consisted mainly of routine work now demand a blend of technical and soft skills. This could lead to a significant shift in the skills required for workers in the industry, with a greater emphasis on data analysis and advanced IT skills.

Four types of work activities will see an increase in demand because of advancements in AI technology: working with machines (technology skills), applying specialised expertise (higher cognitive skills), interacting with stakeholders (social skills), and managing, teaching and developing people (emotional skills).⁷

Error! Reference source not found. shows the change in hours worked by skill category, 2016-30 (step-up labour demand, mid-point automation)⁸

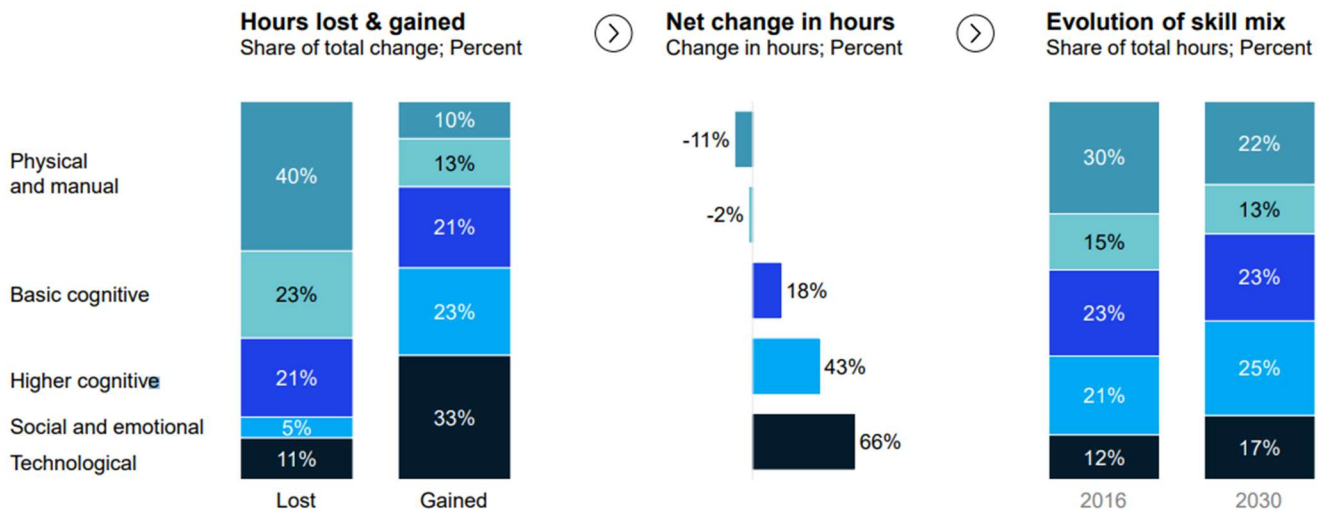


Figure 2: Change in Hours Worked by Skill Category

The McKinsey Report (referenced above) reflects that less than 16% of firms currently adopt AI technologies, which could reflect that the impact of automation and AI implementation is years away for our industry.

Given the relative delay of the engineering and construction industries in adopting new technologies, there is a clear opportunity for the sector to adopt solutions that have already been developed and tested. The main activities where AI is likely to be adopted in construction in the short-term future are:⁹

- **Cost Control:** AI will assist in predicting cost overruns, considering factors like project size and management competence, helping expedite project delivery.
- **Building Information Modelling (BIM):** BIM utilises AI to identify and mitigate clashes between different sub-teams' 3D models, ensuring efficient planning and design.
- **Risk Mitigation:** AI solutions will help monitor and prioritise risks on construction sites, automatically assigning priority to issues and rating subcontractors based on risk scores for effective risk management.
- **Project Planning:** AI can optimise project planning by assessing various combinations and alternatives based on similar projects, correcting itself over time.

⁷ Australia's Automation Opportunity; Reigniting productivity and inclusive income growth; March 2019; McKinsey & Company - [Australia's automation opportunity: Reigniting productivity and inclusive income growth.](#)

⁸ Australia's Automation Opportunity; Reigniting productivity and inclusive income growth; March 2019; McKinsey & Company - [Australia's automation opportunity: Reigniting productivity and inclusive income growth.](#)

⁹ Artificial Intelligence, how it will impact the Construction sector; CareerMakers - [Artificial Intelligence, how will it impact the Construction sector?](#)

- **Productivity Monitoring:** The automation of construction machinery for repetitive tasks like concrete pouring, bricklaying, and welding can be further enhanced by AI through real-time monitoring and data analysis.
- **Increased Safety:** AI can analyse job site photos for safety hazards and correlate them with accident records, enabling the computation of risk ratings for improved safety measures.
- **Addressing Labor Shortages:** AI and data science can optimise labour and machinery distribution across job sites, boosting productivity and addressing labor shortages.
- **Off-Site Construction:** Autonomous robots in off-site factories will assemble building components efficiently, with human workers finishing detailed work on-site.
- **AI for Post-Construction:** AI can monitor assets and address problems after construction, leveraging data stored in BIM to prevent issues before they become major defects.

Adopting AI could increase productivity by up to 50% and reduce building costs by up to 20%. AI is not expected to replace human labour but will make operations more efficient and reduce errors and injuries. In an extreme scenario of AI adoption, the following skills or jobs are most likely to be replaced by AI solutions in the industry:

- Heavy equipment operators, due to the automation of plant
- Bookkeepers who collect, store and analyse data
- Surveyors, due to the robotization of data collection through drone technology
- Receptionists through automated check-in
- Proofreading and the correction of spelling and grammatical errors
- Quality control inspectors, through the automated monitoring of as-built elements can identify defects or deviations from design specifications
- Traffic controllers, through the introduction of smart management systems
- Brick-laying, repetitive steel fixing and concrete pouring.

While AI will streamline practices and replace some roles, it will not replace all the need for human involvement in industries. AI cannot replace roles that require human skills, such as reasoning, creativity and empathy and the co-ordination of several roles to bring something together. The following skills will be in high demand in an AI filled near-future.

- **Data Analysis:** Proficiency in data analysis will be crucial for interpreting the vast amounts of data generated by AI systems. Engineers and construction professionals will need to extract actionable insights from data to make informed decisions.
- **Programming and AI Development:** Understanding programming languages and the ability to develop, customise, and maintain AI systems will become increasingly important. This includes machine learning, deep learning, and AI software development skills.
- **Digital Literacy:** Familiarity with digital tools and software platforms related to AI and automation will be essential. This includes proficiency in using BIM software and other AI-related tools.
- **Cybersecurity:** As AI systems become more integrated, the need for robust cybersecurity practices to protect sensitive data and AI systems from cyber threats will grow. Professionals should be well-versed in cybersecurity best practices.
- **Robotics and Automation:** Understanding how to operate and maintain robotic construction equipment and automation systems will be critical for those working on construction sites.
- **Human-AI Collaboration:** The ability to work alongside AI systems and understand their outputs will require a skill set focused on collaboration and effective communication between human and AI workers.
- **Problem-Solving and Critical Thinking:** AI can handle routine tasks, but humans will still be needed to solve complex problems, make decisions, and adapt to unexpected challenges.
- **Adaptability:** Given the rapid evolution of AI and technology, professionals in construction and engineering will need to be adaptable and willing to learn new skills as technology advances.

- **Regulatory and Ethical Knowledge:** Understanding the regulations and ethical considerations surrounding AI use in construction will be crucial to ensure compliance and responsible AI implementation.
- **Project Management:** AI can assist in project planning and management, but professionals will need to oversee AI systems and ensure they align with project goals and timelines.
- **Continuous Learning:** The construction and engineering industries will require a commitment to lifelong learning to stay up-to-date with emerging AI technologies and best practices.
- **Creativity and Innovation:** While AI can optimise processes, human creativity and innovation will remain essential for designing unique solutions and pushing the boundaries of what's possible in construction and engineering.
- **Communication and collaboration skills:** These skills are vital for working with others in multidisciplinary teams and communicating the results and implications of AI to various audiences.
- **Transport and logistics skills:** These skills are important for identifying and defining the problems and opportunities that AI can address in the road and transport industry.

Looping back to whether the current status of skills and resources is ready for this transformation, there is growing evidence that the emergence of AI technology is increasingly becoming popular amongst students and educators, including in the teaching of engineering as part of higher education courses. In its submission to Federal Parliament on the inquiry into the use of AI technology in education¹⁰, Engineers Australia (EA) cited that when AI technology is used correctly, it can materially improve the learning experience for students, given the ability for educators to be able to tailor the delivery of course materials to suit a student's current learning capabilities and understanding which in turn will facilitate a deeper understanding of the topic. There is also an increase in demand for using AI technology, particularly from under-resourced educators as it enables them to efficiently generate course materials and activities required by their students. EA's observation was based on research from the US where it identified the following benefits that AI technology could bring to the learning environment:

- AI technology can generate many examples to improve teaching effectiveness and learning outcomes.
- AI technology can provide multiple explanations of learning outcomes so different individuals more easily understand it.
- AI technology can prepare tests for students to undertake more efficiently.
- AI technology can be used to assess student learning.
- AI technology can be used to distribute practice of important ideas to students.

Case Study: AI use in education at John Holland

An example of the use of AI in education can be found at John Holland through its mandatory training of employees. Online mandatory training is carried out at John Holland, and as participants progress through the training courses, they are questioned on the topics being taught. Responses to these questions, allows the platform to detect a participant's proficiency in the subject matter and either speeds up the delivery of the content, or slows it down, delivering more detail, based on the individual taking the course and their pre-existing level of understanding of the subject and their needs.

Notwithstanding the demand from both students and educators, the way AI technology is adopted and integrated with the current curriculum varies amongst educators. This is primarily because most engineering courses accredited by EA have set learning pathways and outcomes that were developed before the emergence of AI

¹⁰ AI in education submission to parliamentary inquiry; August 2023; Engineers Australia - <https://www.engineersaustralia.org.au/sites/default/files/2023-08/AI-in-education-Submission-to-Parliamentary-Inquiry-%28Cth-July-2023%29.pdf>

technology. As such, there is growing evidence that educators, including those in engineering programs, face the challenge of how assessment processes can reliably verify student learning and their capabilities.

To overcome these challenges and to recognise the importance of AI technology, EA has put forward the following recommendations in its submission to Federal Parliament:

- Set of standards to be developed and adopted by educators and students around the ethical and effective use of AI technology in the curriculum.
- Guidance on how to acknowledge and provide evidence on the use of AI technology in teaching materials by educators and how students can do the same within their formal assessments.
- Fast tracking the understanding of AI technology so it can be effectively integrated within the engineering curriculum. More importantly, it will allow users to use this tool more effectively to attain the skills required for future employment.

Based on these observations raised by EA, it is clear that the emergence of AI technology is impacting the industry's future skills preparedness, especially in the absence of changes to the current engineering curriculum. The focus will, therefore, remain on an individual's credentials rather than taking a whole of skills view.

With this in mind, the successful integration of AI in the industry hinges on the adaptability and continuous learning of the workforce. While AI may automate specific tasks, it also creates new opportunities for those prepared to acquire the right skills¹¹. The AI era calls for a holistic approach that combines technical proficiency, soft skills, education, and organisational adaptability. By embracing these principles, individuals and organisations can harness the full potential of AI technology while ensuring the sustainability of the industry and its workforce.

Case Study: Australian Spatial Analysis, A Work Integrated Social Enterprise

Australian Spatial Analytics (ASA), which was founded in 2020, has the core mission to create an inclusive workplace for neurodiverse young adults to undertake professional spatial data services. Their staff use their unique cognitive talents, such as attention to detail, pattern recognition and memory retention, to deliver image analysis, data cleansing and processing for multiple industries, including telecommunications, energy, conservation, travel and resources. With the team being 80% neurodiverse, they hire for diversity, utilise a skills-based assessment and undertake what they call a "non-traditional review" of any CVs they receive. They also consider any challenges candidates may face in a traditional interview and other stressors that neurodivergent individuals face in an interview setting.

Construction companies within Victoria are already realising the benefits of working with people with visual problem solving and pattern detection skills that are superior to those without autism. One Tier 2 construction company shared with us that the support organisations like ASA provide has changed how they look at disabilities in general. Due to the success of their relationship with ASA, they have expanded their relationship to take on candidates who have been identified as ready to transition to main-stream employment opportunities. However, they suggest that this would not be possible without a supportive leadership team and culture.

4.3 What are the current approaches to talent identification and recruitment? What is the evolution trend?

As highlighted by our industry engagement, workforce development in the engineering and construction sector is not generating the quality and volume of resources and skills necessary to meet the infrastructure delivery agenda. This stifles productivity and innovation. A key enabler to break through barriers is the approach to recruitment including talent sourcing, attraction and conversion, to deliver the people and skills needed.

¹¹ State of Australia's Skills 2021: now and into the future; National Skills Commission - [State of Australia's Skills 2021: now and into the future \(National Skills Commissions\)](#)

Through our industry engagement, we asked talent acquisition managers whether they placed higher importance on qualifications or skills. While the first answer was skills for all of them, upon further discussion, it was evident that this wasn't the case when specifically talking about engineering roles.

Our summary findings on current hiring processes are:

- The private industry relies on internal recruitment processes supported by online job boards such as LinkedIn, Seek or PageUp.
- The public sector relies on internal promotion more than the private sector.
- Most companies have skills mapped and they all stated that skills are more beneficial to a role than qualifications. However, when asked about what criteria they use to shortlist applicants, 85% of respondents cited proven experience, with some specifically mentioning experience in competitor companies and projects. This reflects a lack of interest or practice in recruiting outside of traditional pathways.
- The public sector is moving away from traditional practice and has some interesting new practices that the rest of the industry should look into. The Victorian State Government has a Competency Framework in some Project Offices with role segmentation that comprises skills breakdown, tailored recruitment strategy and succession planning for each role. This has supported Government agencies to transfer resources within the transport cluster and/or consolidate for greater efficiency. This year, this has enabled the Government Transport Cluster to pivot in response to curtailing rail programs and projects and consolidation in managing major roads programs.
- Despite the lack of qualified engineers in the market, only some of the respondents to our survey have searched for potential suitable candidates outside of the industry to fill vacancies. Where this approach has been adopted, it has also been limited only to related industries.
- The engineering world excludes viable talent as there is a focus on traditional sources of talent with desired qualifications rather than more flexible approach that considers candidate's potential, transferable experience and non-location-bound talent availability.
- The main attributes to attract talent to an organisation, focus on replacing a resource(s) and augmenting or adding to the skills profile to respond to a change in business need. It is considered that a candidate understands the brand and, therefore, the employment value proposition the employer offers.
- Only one of the interviewed companies stated having attempted to use AI for matching skills to required roles, however, the effective use of AI in this area was limited by the company's lack of documented evidence around the skills required for specific roles. They have since taken the step back to understanding more about the data required to make the best use of AI tools in skills mapping, by documenting its employees' current roles, the capabilities required to deliver their roles, and the development and skill acquisition individuals are undertaking to deliver on their current role as well as what their next role and desired career path is.
- Moving forward, it is anticipated that individuals will be rewarded for their ability to demonstrate skill acquisition and expertise. They will do this by gathering as many accreditations and recognitions of professional experience (referrals/testimonials).

The above findings align with the position of the World Economic Forum (WEF)¹², which, in a recent report noted organisations across all industries identify skills gaps and the inability to attract talent as the key barriers preventing industry transformation. Whereas more than 6 in 10 employers have identified a shortage of skilled talent as the top barrier to business transformation over the next five years, only 3 in 10 have considered introducing flexibility into formal education requirements to widen their talent pool.

A Report by Gartner for HR¹³ recommends that recruiting functions must consult on the skills acquisition decision, source from the total skills market and leverage labour market intelligence to effectively shape the workforce. Gartner recommends pivoting to a labour market insights-driven approach that can accelerate workforce

¹² Putting Skills First: A Framework for Action; 2 May 2023; World Economic Forum - [WEF_CNES_Putting_Skills_First_2023.pdf](#)

¹³ Advancing Recruiting's Value Through Uncertain Times; 28 September 2020; Gartner Research

development (refer Figures 3 and 4), especially under the current dynamic of post-COVID-19 pandemic plus AI disruption.

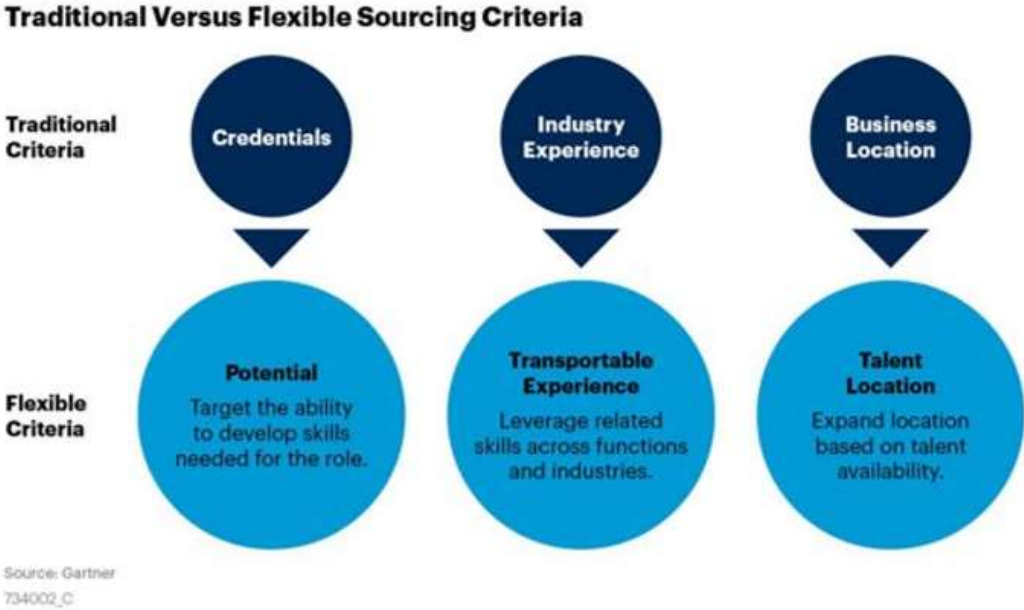


Figure 2: Tradition Versus Flexible Sourcing Criteria

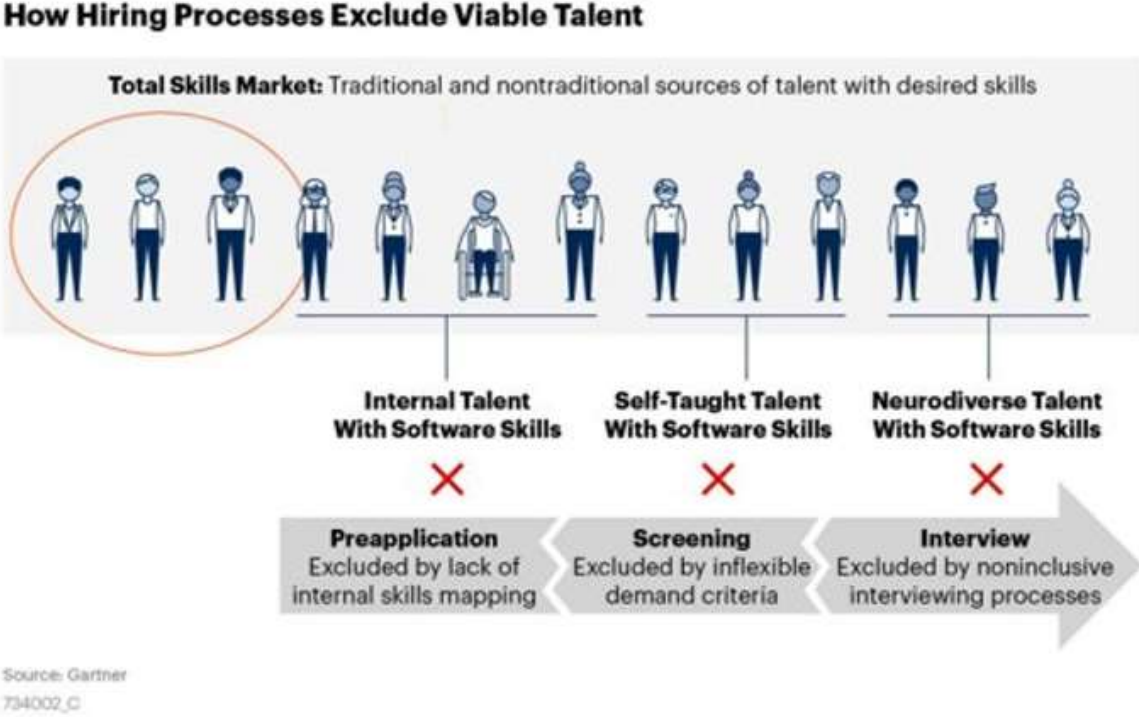


Figure 3: How Hiring Processes Exclude Viable Talent

The above Gartner report determined the following steps required to uncover the total skills market that is industry-wide practice:

- **Action 1:** Identify where sourcing strategies and processes limit access to people with the necessary skills/viable talent
- **Action 2:** Map skills
- **Action 3:** Define flexible sourcing criteria to broaden the search
- **Action 4:** Skills availability through alternative employment models and under utilised skills from within the organisation
- **Action 5:** Adaptive Employment Value Proposition (EVP) leveraging market insights, data analytics and 360 degree engagement to create a compelling vision for candidates.

The WEF recommends that to ensure a skill-first approach is successful, a 5 step Framework for action should be followed, as seen in Figure 5:

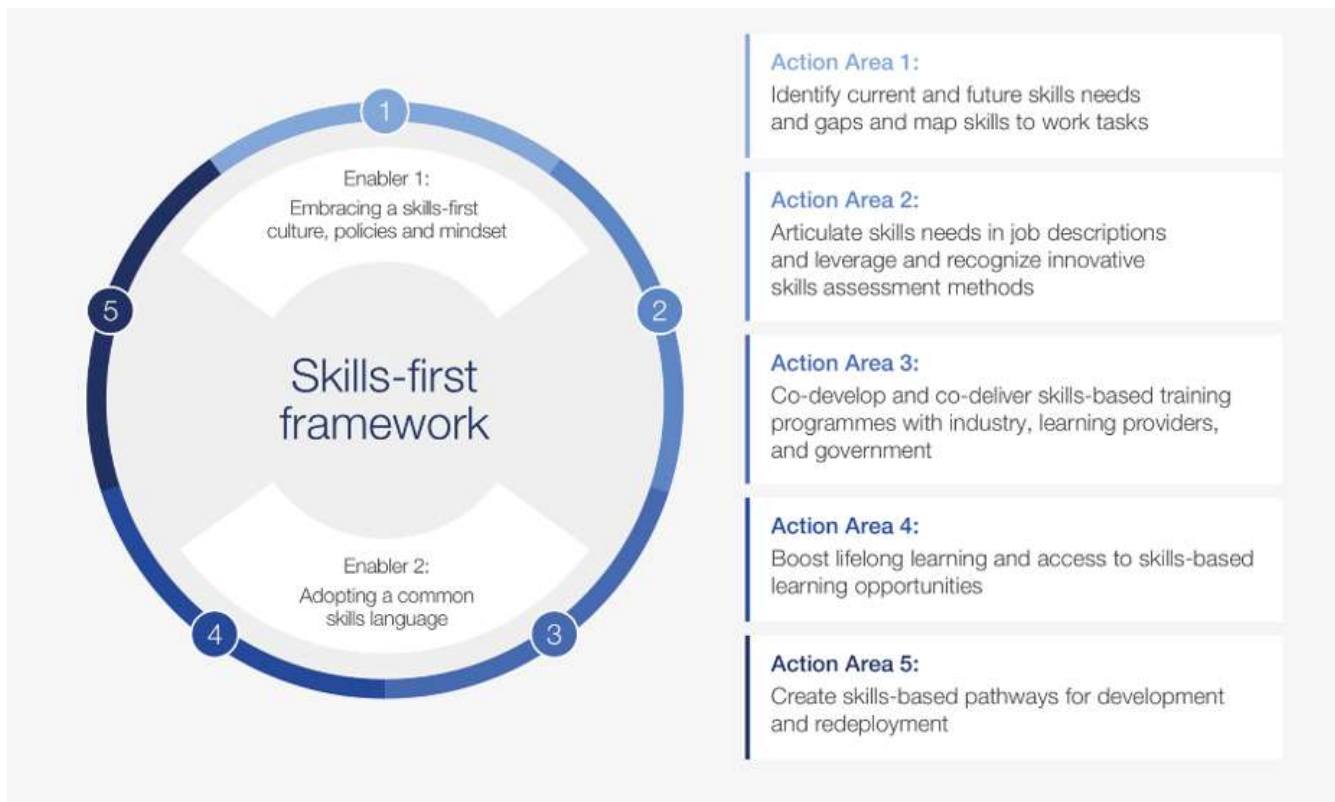


Figure 4: Skills First - A Framework for Action¹⁴

*Note the above framework is not required to be used in any specific chronological order. Companies can choose to address key steps first to tackle specific issues. It may take 24-36 months to obtain the necessary stakeholder buy-in, investments and technology partners for a skills-first culture to take root.

The two most important enabling factors in adopting a skills-first approach were:

- **Embracing the philosophy of having a skills-first culture** involves building organisations that commit to growing their talent, reward lifelong learning and curiosity, and value workforce diversity. At a country level, a high-level national body that provides expert advice and leadership on labour-market trends and current, emerging and future workforce skills needs can help enable a skills first culture across the country. While we will dive into how this is being done in other countries in Section 4.4, it should be noted that Australia has created a world-leading example in the National Skills Commission¹⁵.

¹⁴ Putting Skills First: A Framework for Action; 2 May 2023; World Economic Forum - [WEF_CNES_Putting_Skills_First_2023.pdf](https://www.weforum.org/publications/putting-skills-first-2023)

¹⁵ National Skills Commission, Australian Government – <https://www.nationalskillscommission.gov.au/>

- **Having a common language to talk about skills:** This approach will provide more effective collaboration and coordination on skills between learners, learning providers, policy-makers and employers. For the latter, this approach highlights commonalities between skills needs across business functions and opportunities for organisation-wide skills training and internal mobility. For learning providers, this can lead to delivering work-relevant training, preparing an industry-ready workforce for today and tomorrow. For policy-makers, a National skills taxonomy may offer support both on the supply side of the labour market and on the demand side, supporting employers to articulate job descriptions regarding skills to find suitable candidates.

Case Study: Implementing Gaming Skills into Transport Automation Solutions¹⁶

There are several successful industry examples where employers have been evolving and adapting their recruitment process via skills profile rather than the conventional approach of recruitment through the use of position descriptions. The new recruitment process has allowed employers to access the total skills market to uncover the right talent that suits their current and future operational needs. For example, this has already been taking place at the container terminals in Botany Bay in Sydney where candidates with gaming backgrounds and even chefs have been employed to operate and control robot cranes instead of traditional forklift or crane operators. This example shows that these 'alternative' candidates have meaningful and transferable skills gained from gaming or previous professions, where they are already used to working in a multi-tasking and fast-moving environment, which can be deployed immediately to the roles they are employed to undertake. On the other hand, training of traditional forklift or crane operators may take years to achieve the same outcome.

4.4 Understanding how skill shortages are being addressed in other countries

4.4.1 Europe

Skill shortages are a significant challenge for the European industry, as they affect the sector's competitiveness, sustainability and safety. Some of the reasons for this shortage are the ageing workforce, the low attractiveness of the profession, the lack of qualified candidates, and the high turnover rate.

To address this challenge, the European Union has launched several initiatives and policies, such as the European Skills Agenda for 2025¹⁷, and the European Year of Skills 2023¹⁸ These initiatives aim to:

- Invest in skills training for workers and learners, especially in digitalisation and decarbonisation, transforming the road industry.
- Encourage diversity and inclusion in the workforce by attracting more women, young people and third-country skilled workers to the sector.
- Make it easier for workers to move and work across countries by facilitating the recognition of qualifications and certificates across borders.
- Promote the image and reputation of the road industry by highlighting the benefits and opportunities of working in the sector.

¹⁶ Why gaming skills are landing young people high-paid jobs, 17 February 2023. Australian Financial Review - [Why gaming skills are landing young people high-paid jobs](#).

¹⁷ European Skills Agenda; European Commission - [European Skills Agenda](#)

¹⁸ European Year of Skills; European Commission - [European Year of Skills 2023](#)

The road industry also needs to cooperate with the EU, the Member States, and the social partners to implement these initiatives and to develop innovative solutions to reduce skill shortages. For example, some of the possible actions are:

- Creating a common European framework for the training and certification of road transport professionals based on the latest standards and best practices.
- Developing a European platform for exchanging information and good practices on skills development and recruitment in the road industry.
- Supporting the creation of networks and partnerships between road transport companies, education and training providers, and public authorities, to foster collaboration and mutual learning.
- Raising awareness and interest among potential candidates, especially young people, about the career opportunities and prospects in the road industry.

4.4.2 United State of America

In the US, some of the causes of the skill shortages are the aging workforce, the low supply of new workers, the high demand for specialised skills, and the competition from other industries. Some of the consequences of the skill shortages are the increased labor costs, the delayed or canceled projects, the reduced economic output, and the missed opportunity to upgrade the infrastructure. There are different ways that skill shortages are being addressed across the road industry in the US, depending on the level and scope of the intervention. Some of the possible solutions include:

- At the national level, the Government is supporting the development of a comprehensive strategy that can scale to meet the labor demand, such as by increasing the funding and incentives for vocational education and training, expanding the immigration and visa programs for skilled workers, and promoting the diversity and inclusion of underrepresented groups in the industry¹⁹.
- At the state and regional level, the authorities are collaborating with the industry and the education providers to align the curriculum and the certification standards with the employer needs, to create regional talent pipelines and networks, and facilitate the mobility and retention of workers across different locations¹⁹.
- At the sector and occupation level, employers have been investing in the upskilling and reskilling of their existing workforce, adopt new technologies and processes that can enhance the productivity and efficiency of their operations, and partner with other stakeholders to share the best practices and the resources^{19,20}.
- At the individual level, workers can pursue lifelong learning and career development opportunities, acquire new skills and qualifications that are in high demand, and explore different pathways and options within the industry.

4.4.3 Solutions to transfer to Australia

With the above European and US experiences in mind, the following short-, medium- and long-term solutions have been identified:

Short to Medium term focus

In the short to medium term, companies can adopt the following strategies:

- Streamline the hiring process by prioritising application reviews and simplifying interviews and onboarding procedures.
- Adopting a skills-based hiring approach rather than one solely based on credentials.
- Recognise factors that workers value beyond competitive wages, such as autonomy, flexibility, and support, to improve staff retention and attraction.

Research indicates that these factors have become increasingly important in the post-pandemic workplace.

¹⁹ Will a labor crunch derail plans to upgrade US infrastructure?; 17 October 2022; G Hovanian, A Kumar and R Luby - [Will a labor crunch derail plans to upgrade US infrastructure?](#)

²⁰ Critical Industry Skills Shortages Under Spotlight; 22 August 2023; Big Rigs - [Critical industry skills shortages under spotlight](#)

Long-term strategies

It is important to recognise that addressing workforce shortages necessitates a comprehensive, multi-faceted approach. Longer-term workforce development policies that could be implemented to address the challenges facing the workforce today are.²¹

- **Rethinking how we measure the quality of secondary education:** It is necessary to shift from a sole focus on university readiness to a career readiness approach, a broader concept that includes preparing students for various post-secondary pathways, including jobs that do not require a tertiary degree. The emphasis is on a skills-based approach, which can be enriched by reimagining apprenticeships to involve younger students and vocational talent earlier in their careers.²²
- **Increasing the participation of underrepresented groups in Career Technical Education (CTE):** Such as women, minorities, and veterans. Companies are encouraged to widen their recruitment pool by considering candidates from alternative educational paths, like technical degrees or hands-on experience. This can be done by recruiting more individuals from these groups into CTE programs, improving worksite conditions, and other incentives to retain these future professionals.
- **Strengthening collaboration between industry, education, and government:** To ensure that CTE programs are meeting the workforce's needs, ensure that education is raising awareness about the industry and cultivating a skilled future workforce.

²¹ Improving the U.S. Workforce Development System; Construction Industry Institute - [Improving the U.S. Workforce Development System](#)

²² Bridging the Labor mismatch in US Construction; 28 March 2022; G Hovanian, R Luby and S Peloquin - [Bridging the labor mismatch in US construction](#)

5 Generating Innovations – What are we capable of?

5.1 Current extent of use of AI in recruitment

While in the previous section, we have presented the industry's current status and potential to adopt different AI solutions, our report focuses on the potential uses of AI in recruitment. This is because we believe that, while different AI tools may improve the productivity of different roles, a strong innovation in recruitment can assist the industry in unlocking the hidden talent that already exists in adjacent fields and, therefore, potentially provide a more sustainable solution that can assist industry in facing the challenges that the skill shifts that AI can bring.

AI is currently used for several different steps of the recruitment process:

For the talent search stages: [HireEz](#) is an AI-powered recruiting platform that helps companies automate their recruitment process and find qualified candidates. HireEz can screen resumes, schedule interviews, and conduct background checks. It can also be used to identify potential candidates who may not be actively looking for work or who may not have the traditional qualifications required for a particular role. HireEz goes beyond job boards and LinkedIn to access more than 800 million profiles with information from more than 45 online platforms.

It offers several features that make it a valuable tool for companies, including:

- Access to a large pool of candidates: HireEz has access to a database of over 800 million candidates from 45+ open web platforms. This gives companies access to a much wider pool of candidates than they would be able to reach on their own.
- AI-powered candidate matching: HireEz's AI algorithm considers the candidate's skills, experience, and interests, as well as the job description and the company culture, when making matches. This helps to ensure that candidates are placed in roles where they are most likely to be successful and productive.
- Automated outreach: HireEz can be used to automate the outreach process, sending personalised messages to candidates on behalf of the company. This can save recruiters a significant amount of time and effort.
- Engagement tracking: HireEz tracks the engagement of candidates throughout the recruitment process, so that recruiters can see who is interested in the role and who is not. This helps recruiters to focus their time and attention on the most promising candidates.

For resume screening and talent matching: Indeed²³ is a popular job search website that uses AI to match candidates to jobs. Indeed's AI algorithm considers the candidate's skills, experience, interests, job description, and company culture when making matches.

Indeed uses AI in several ways to help companies hire faster and more efficiently. Some of the keyways that Indeed uses AI for hiring include:

- Candidate matching: Indeed uses AI to match candidates to jobs based on their skills, experience, and interests. This helps companies to find candidates who are a good fit for their open roles.
- Resume screening: Indeed uses AI to screen resumes for keywords and skills relevant to the job description. This helps recruiters to identify qualified candidates quickly and easily.
- Sourcing: Indeed uses AI to identify potential candidates who may not be actively looking for work or who may not have the traditional qualifications required for a particular role. This helps companies to reach a wider pool of candidates and to find the best talent for their open roles.
- Chatbots: Indeed uses chatbots to answer 'routine or basic' questions from job seekers and employers immediately and is available 24/7. This can help to save time and effort for both parties. It can also free up recruiters' time for them to focus on candidates that are further advanced in the recruitment process.

²³ What AI Can Do For Your Recruitment – And What it Can't; 16 May, 2023; A McLellan - [What AI Can Do for Your Recruitment – And What It Can't](#)

Combining a few of the above tools into the largest job search engine in the world, [LinkedIn](#)²⁴ is a social media platform for professionals that can be used to find and connect with potential candidates. LinkedIn's AI-powered recruiter tools can help companies find candidates with relevant skills and experience and are a good fit for the company culture.

LinkedIn offers several AI-powered recruiter tools that can help companies to find and hire qualified candidates faster and more efficiently. Some of the key AI-powered recruiter tools that LinkedIn offers include:

- **Recommended Matches:** LinkedIn's Recommended Matches feature uses AI to match candidates to jobs based on their skills, experience, and interests. This can help recruiters find qualified candidates quickly and easily, even if they are not actively looking for work.
- **Likelihood of Interest:** LinkedIn's Likelihood of Interest feature uses AI to predict how likely a candidate is to be interested in a particular job. This can help recruiters to prioritise their outreach and to focus their time on the candidates who are most likely to be a good fit for the role.
- **AI-Assisted Messages:** LinkedIn's AI-Assisted Messages feature uses AI to help recruiters craft personalised messages to candidates. This can save recruiters time and effort and help increase the response rate from candidates.
- **Talent Insights:** LinkedIn's Talent Insights feature uses AI to provide recruiters with insights into the talent market, such as the most in-demand skills and the most competitive companies. This information can help recruiters to develop more effective hiring strategies.

For the optimisation of Job descriptions and Candidate CVs: [SkillsEngine](#) is a non-profit initiative located in Texas that aligns employers, educators and job seekers to create a common skills-based platform with a unified skills language. Although based in the US, they have partnered with more than 40 educational institutions and generated more than 1,800 job profiles. They assist:

- Employers, through AI based job description writing support, ensuring biases are removed from the entry requirements
- Job Seekers through AI based CV review that identifies their skills.
- Educators through AI based generation of skills profiles of their courses for jobs, curricula, credentials and more
- Recruiters/Talent managers through their AI-based interview question generator ensures the questions are unbiased and focused on skill identification.

A workforce intelligence platform: [Reejig](#) provides complete visibility of the skills and potential of an organisation's workforce. Reejig allows you to find, mobilise, reskill, or upskill talent to assist in decision making regarding talent

- **Profiling of employees, roles and candidates:** Reejig extracts skills from employee data, social data and learning data, examples being from school transcripts, CVs LinkedIn and social media profiles. This provides an overall picture of an individual including leadership attributes and core competencies
- **Planning for the future:** By finding the interrelationships between a person's skills and the skills required for a role, skills adjacencies and skills gaps can be identified to help keep the right skills in the right place at the right time.

Beyond the above tools, we have investigated the actual uses of AI tools within the recruiting industry. Recent research by the Society for Human Resource Management (SHRM)²⁵ in the US reflects the current status of use of AI in recruitment as follows:

²⁴ New AI Tools Let You Identify and Message Candidates Faster; 9 August, 2023; B. Anderson - [New AI Tools Let You Identify and Message Candidates Faster](#)

²⁵ Fresh SHRM Research explores use of automation and AI in HR; 13 April 2022; Society for Human Resource Management (SHRM) - [Fresh SHRM Research explores use of automation and AI in HR.](#)

- As of April 2022, 1 in 4 organisations researched reported using AI for HR-related activities, including but not limited to hiring.
- Of those who use the tools, over 2 in 3 HR professionals stated that using AI tools reduced the time it took to fill positions.
- Most of the use occurs in larger companies, with 42% of employers with 5,000 or more workers reporting using AI, compared to 16% of employers with less than 100 workers.
- 1 in 4 organisations reported that they plan to use AI in recruitment in the next five years.
- While 30 per cent say the use of automation or AI improves their ability to reduce potential bias in hiring decisions, 46 per cent would like to see more information or resources on identifying any potential bias when using these tools.
- 85 per cent of employers that use automation or AI say it saves them time and/or increases their efficiency.
- 64 per cent of HR professionals say their organisation's automation or AI tools automatically filter out unqualified applicants.
- Over 2 in 3 HR professionals say the quantity of applications they must manually review is somewhat (44 per cent) or much better (24 per cent) due to their use of automation or AI.
- 92 per cent of organisations that use automation or AI source some or all these tools directly from a vendor.
- 19 per cent of organisations that use automation or AI have experienced those tools accidentally overlooking or excluding qualified applicants or employees.

The above results are relatively aligned with our industry findings, which reflect that while all but one of our respondents stated knowing that there are available AI tools for recruitment, less than half confirmed using them, and out of those that use them, most of them limit its use to the basic AI tools that come available with the common web base platforms they use for advertising (mainly LinkedIn).

About 70% of our respondents stated that using AI in recruitment recognised it as beneficial, most specifically mentioning efficiency and one respondent mentioning the increase in quality of the applicants due to using AI to review CVs. We also asked the industry whether the use of AI had increased the available pool of resources they now recruit from. However, the responses were very varied, many of them leaving this question unanswered and, therefore not providing a clear conclusion.

5.2 The role of AI in recruitment, the benefits and barriers

For AI to take root in the industry, it has to address its most fundamental problems. The shrinking workforce and ongoing talent crisis represent a real threat, so retaining talent is more important than ever. Using gathered data and machine learning algorithms, AI can draw inferences about an existing workforce or a pool of potential hires. According to McKinsey and Co., it can identify potential leaders, predict attrition rates, or identify employees in danger of leaving. Companies being able to make data-driven hiring decisions will help ensure they're attracting the best talent and ascertain their employees are happy and engaged.

In this section, we explore the benefits and barriers of implementing AI based tools such as those mentioned above for the different steps in the recruitment process.

5.2.1 Benefits

Improved efficiencies in recruitment

AI can quickly analyse large volumes of data to identify the right match quicker than humans. McKinsey and Co. have completed their research into how generative AI can reshape how talents are recruited. Their findings concluded generative AI tools are easily accessible and estimate that 80% of current jobs can incorporate some form of generative AI into activities²⁶. Generative AI can also help managers write better job requirements by focusing on the skills required to succeed. It can do this quicker than humans can.

²⁶ Generative AI and the Future of HR; 5 June, 2023; B Hancock, B Schaninger and L Yee - [The impact of generative AI on human resources | McKinsey](#)

The use of AI to target a skills-based approach will further unlock productivity, as is identified in OECD research²⁷ on adult skills has identified a strong link between the effective application of skills and productivity. At the same time, Deloitte²⁸ has found that organisations building a skills-first culture are 63% more likely to achieve results across 11 key business and workforce outcomes. For workers, using skills proficiencies as the basis for career development conversations can help both employees and employers be accountable and responsible for employees' growth and success, leading to greater equity and transparency.

Casting a wider net

AI technology allows for effective searching and identification of potential candidates who may not have applied for specific roles but hold the prerequisite skills and experience.

With further development in AI technology, the recruitment process could be transformed to the point where AI technology can predict which candidates will most likely succeed through predictive analysis.

An example of this is Beamery, a talent management platform that can collate billions of data points from across the internet and use this to help client organisations find potential candidates who are likely to succeed in the role. It can also use the same technology to assist current employees within client organisations with diversity, identifying career pathways and predicting the skills and capabilities required for future roles.

This benefit is further expanded when combined with the use of AI for skills mapping. According to research by LinkedIn²⁹, globally the pool of potential candidates can increase, on average, by nearly 10 times when using a skills-first approach. One recent estimate³⁰ predicts that by 2030, approximately 85 million jobs could go unfilled globally because of lack of applicants with the skills to take them, resulting in USD8.5 trillion in unrealised annual revenues. According to WEF data, on average, only 51% of a country's working population is employed in roles well matched to their formal education level. 29% (197 million people globally) work in roles for which they are considered 'under-educated', and 20% in roles for which they are 'over-educated'. Workforce under-utilisation varies from around 4-6% of the working population in Thailand, Czech Rep and Vietnam, to 27% in Brazil, 30% in Iraq and 43% in South Africa. This workforce under-utilisation rate is not to be ignored in Australia, as it accounts for 20% of the working population³¹. More than 100 million out of 638 million people covered by this analysis are under-utilising their existing skills.

Reduction in bias

McKinsey and Co.'s research into how generative AI can reshape the way talents are recruited found that it can play an enabling role in [accelerating the shift](#) from credentials to the skills that candidates are actually capable of contributing to the workplace by looking for keywords that demonstrate capabilities and skills (e.g. reviewing potential candidates' LinkedIn profile and what they post)³².

As AI can review large volumes of CVs efficiently, bias can be reduced as organisations can avoid the initial process of shrinking the pipeline of candidates for time-constrained staff who have to manually review this information.

In addition, regularly monitoring, auditing and calibrating the AI algorithm can reduce the risk of bias in the outputs generated as corrective actions can be implemented.

With a skills-first approach and the efficiencies of reviewing large volumes of CVs, AI will open up opportunities for more individuals to participate in the labour market and encourage candidates from non-traditional backgrounds to consider applying for roles. This is particularly important in countries where there is no gender parity in upper secondary education (only 24% of countries have currently achieved this) as women are less likely to hold

²⁷ OECD Skills Strategy Tlaxcala (Mexico); 16 June 2021; Organisation for Economic Co-operation and development (OECD), - [OECD Skills Strategy Tlaxcala \(Mexico\): Assessment and Recommendations | READ online \(oecd-ilibrary.org\)](#)

²⁸ The Skills-Based Organization: A new operating model for work and the workforce; 8 September, 2022; Deloitte - [Skills-based organizations | Deloitte Insights](#)

²⁹ Building the Agile Future; 2023: LinkedIn Learning - [2023 Workplace Learning Report | LinkedIn Learning](#)

³⁰ Future of Work: The Global Talent Crunch; 2018; Korn Ferry - [KF-Future-of-Work-Talent-Crunch-Report.pdf \(kornferry.com\)](#)

³¹ Statistics on Underemployment and Labor Underutilization; 16 January 2023; International Labour Organisation (ILOSTAT) - [Statistics on unemployment and labour underutilization - ILOSTAT](#)

³² Taking a Skills Based Approach to Building the Future Workforce; 215 November, 2022; McKinsey & Company - [Taking a skills-based approach to building the future workforce | McKinsey](#)

qualifications. The intersection of factors such as low income, race, gender, conflict and disability can further exacerbate these gaps. Research has also shown a positive link between workforce diversity and innovation³³.

The previously mentioned research by the SHRM also highlighted the below perceived benefits by industry:

- 25% of respondents use some form of AI technology to support HR-related activities mainly in recruitment. Of the respondents that use this tool, 67% observed tangible benefits particularly in the time it takes to fill vacant positions. Other observed benefits include:
 - Improves the quality of candidates identified.
 - Improves potential bias in hiring decisions.
 - Improves their ability to identify diverse talents.
- The main tasks completed by AI technology in the recruitment process is mainly around:
 - Communication with applicants during the recruitment process
 - Review and screen large volumes of CVs.
 - Automate candidate searches.
 - Customise or target job postings to specific groups of talent.

When we asked the local job seeking support professionals what potential benefits AI could bring to increase the pool of available talent, they suggested that:

- AI can support the simplification of job descriptions to ensure the tasks and daily activities are clear for those who may not be familiar with the industry or even the Australian market.
- AI can assist in ensuring the job advertisements are based on a skills-first approach rather than specific years of local experience or qualifications.
- AI can assist the job advertisement follow-up by providing a “minimum % requirement”. It is widely known³⁴ that women tend to apply to jobs that don’t meet all the requested requirements less frequently than men do in the same qualification situation. Indicating a minimum % requirement in the position advertisement may encourage more people from diverse backgrounds to apply.
- AI can support automation of the steps to be followed to apply and subsequent recruitment process, providing the candidate with status at each stage and feedback where required.

5.2.2 Barriers

While there are many benefits to what the world of AI can produce and deliver for the industry, limitations exist. The barriers to its implementation and uncertainties in its advancement as a technical innovation are discussed below.

Perceived threat to the labour market: The increase in productivity comes at the expense of current roles and the challenges of redeploying these resources into other parts of the industry. As explored in Section 5 of this report, the reality is that the changes that AI will introduce will transform the market but not reduce job capacity or impact the ability of people to get employed.

Algorithm and/or data bias: The effectiveness of technology is closely tied to the quality of its algorithms and input data. Hidden biases within the algorithm or dataset may only become apparent as patterns emerge. Furthermore, there is a risk that algorithms are developed with their creators' biases. For instance, research suggests that AI facial recognition systems developed by individuals of one ethnicity may struggle to accurately identify individuals of different ethnicities.³⁵

There are also risks on the CV scanning tools as they become inherently biased compared to existing company data. When looking for CVs of people similar to the currently top performing employees, the company may end up with a homogenous pool of candidates, which resembles the existing ones. If the existing workforce is not diverse, it won't resolve the company's lack of diversity.

³³ Diversity, Equity and Inclusion 4.0; June 2020; World Economic Forum; [WEF NES DEI4.0 Toolkit 2020.pdf \(weforum.org\)](#)

³⁴ Women only apply when 100% qualified? Putting received wisdom to the test; 8 March 2022; L Nicks, Dr F Gesaiarz and Dr L Torres - [Women only apply when 100% qualified? Putting received wisdom to the test](#)

³⁵ To Build a Less-Biased AI, Hire a More-Diverse Team; 26 October, 2020; M Li - [to-build-less-biased-ai-hire-a-more-diverse-team](#)

When used to increase the number of candidates of certain minorities (i.e. women or POC), if the training data comes mostly from white male employees it will associate gender-related stereotypes to success (i.e. playing football or being described as a “rockstar”). In this case, the algorithm may return the top 10 male employees, but it won't know which female CVs are better than the others. This will result in 10 brilliant male candidates and 10 random females, making it more likely for the job to go to a male.

There have been several cases of AI powered tools for candidate review being clearly biased and discriminatory (i.e. Amazon and HireVue), which have resulted in laws being passed requiring companies to disclose the use of this type of AI tools. This highlights the need that hiring managers should retain control over decision-making. Companies should use AI to audit their recruiting practices. As the correlations of these algorithms are not yet mature.

Generative AI relies heavily on historical data, which inherently carries historical biases. By relying on generative-AI-driven tools, there is a risk that we are inadvertently perpetuating these inherited biases.

However, it should be noted that recent research by the WEF³⁶ suggests that addressing inherent biases in AI technology might be more straightforward than tackling human biases. This is because:

- AI fairness must be a priority as humans design the algorithms and produce outcomes that rely on past decision-making patterns – regardless of whether it is right or wrong. What we actually want from AI technology is fairness in the outcomes generated so that we reduce the risk of perpetuating past mistakes.
- An initial approach to prioritise fairness has been to remove sensitive data such as gender, age, race, disability, marital status, household composition, health and income from the data set given to the AI technology. However, recent observations have proven this to be ineffective.
- To overcome this limitation and minimise bias, one of the suggestions put forth by the WEF is for governments or the private sector to create centralised databases of sensitive data. This would allow emerging AI technology to be thoroughly tested and corrected for potential bias before its implementation. Continuous monitoring of this testing can help assess the AI technology's decisions and its influence on fairness and ability to reduce bias.

In addition to addressing bias, it is also crucial to:

- Develop auditing standards for assessing bias in AI technology.
- Educate industry partners and members on the benefits and barriers to AI technology.

Ethics and privacy: Prioritising objectivity and impartiality in AI technology is essential. The data source must be relevant, appropriate, and of a sufficient scale to yield accurate matches. This often entails setting appropriate search boundaries, which may require companies to look beyond the confines of platforms like LinkedIn or social media to uncover tangible differences in outcomes.

AI technology holds immense potential in revolutionising talent recruitment, development, and retention processes. However, it also brings forth many challenges, including accuracy, ethics, legality, and privacy issues³⁷. These challenges have emerged as technology has advanced. In contrast, traditional psychometric assessments, developed over more than a century, have a substantial historical dataset to validate candidate assessments against subsequent performance.

Organisations planning to implement AI technology in their recruitment process should carefully consider the ethical and legal implications, especially regarding privacy. This is particularly evident as current privacy laws were developed before the emergence of AI technology. Factors to consider include:

- **Data Mining:** To what extent will organisations be tempted to mine personal information related to candidates and use it as a factor in hiring decisions? For instance, candidates' social media "likes" can be used to infer their views on politics, religious beliefs, and opinions on social issues.

³⁶ Why AI bias may be easier to fix than humanity's; 30 June 2023; World Economic Forum - [AI bias may be easier to fix than humanity's](#).

³⁷ The Legal and Ethical Implications of Using AI in Hiring; 25 April 2019; B Dattner, T Chamorro-Premuzic, R Buchband and L Schettler - [The legal and ethical implications of using AI in hiring](#)

- **Facial Recognition:** Facial recognition technology can accurately predict a candidate's mood, emotions, and truthfulness. Concerns arise when genetic information, over which candidates have no control, is factored into hiring decisions despite having no direct correlation with a candidate's subsequent success in a role.
- **Lifestyle Monitoring:** Monitoring candidates' Google reviews and online check-ins at locations or events can lead to potential misuse and discrimination in hiring decisions based on lifestyle choices.
- There is an expanding list of physical and mental disabilities: organisations need to be aware of these to ensure it does not materially influence their hiring decisions as it can be seen as discriminatory.

Protection from hackers: AI technology relies on large volumes of data and complex algorithms to function. These also happen to be the key weakness areas that require ongoing commitment by organisations to ensure their integrity. The most common threats from hackers³⁸ involve gaining access to the algorithm to make subtle changes so that it influences the output generated. Another common threat is to take advantage of the predictive function built into algorithms and provide it with false or malicious data over time, leading the algorithm to generate skewed or biased outputs. As the influence of the compromised data is gradual and over a period of time, its impact on the output generated is difficult to detect immediately.

- With this in mind, there is an ongoing cost that organisations will incur in providing robust security and protection measures that include:
 - Maintaining strict access protocols across the data environment, which feed into the algorithm.
 - Ensure there is a clear audit trail of outputs generated so this can be validated regularly for correctness.
 - Implement authentication.
 - Educating its workforce about the risks to AI technology and how to detect incorrect outputs.
 - Ongoing risk assessment is forward-looking and tries to stay one step ahead of potential hackers.

The above concerns are aligned with the findings of the SHRM report, on the challenges of using AI technology:

- 54% of respondents who use AI technology have experienced challenges including:
 - Qualified candidates are accidentally filtered out when it should not have done so.
 - Lack of resources and understanding to validate and correct the AI technology.
 - Observed patterns of bias as it relies on past decision-making patterns.
 - Lack of transparency with how decisions are made by AI technology.
- The top 5 reasons for not wanting to use AI-technology to support HR-related activities such as recruitment include:
 - Lack of resources to audit and correct the AI technology.
 - Lack of knowledge on which AI technology to use for what they need.
 - Fear of losing the 'human touch'.
 - Lack of financial support to implement.
 - Concerns around reliability of AI technology to make the 'right' decisions and not accidentally exclude suitable candidates.
- Of the respondents that use this tool, 40% say the vendors are open and transparent about the steps taken to protect against bias. With this mind, most respondents would like more information on identifying potential bias when using AI tools. Useful information include:
 - How do we effectively identify bias?
 - How do we correct bias when identified?
 - How frequently do we audit AI technology to identify bias?
 - Knowing what AI technology is available for what purpose?

³⁸ How to Protect AI From Cyberattacks – Start with the data; 22 April, 2022; A Cole - [How to protect AI from cyberattacks start with the data](#)

It is clear that a level of **human intervention** is still required to increase and maintain reliability³⁹. The recruitment process's efficiency is achieved where job roles and the criterion for success is well known (as the AI technology can quickly sort through large volumes of historical data). Therefore, emerging roles where these KPIs are not well understood and where there is a lack of historical data, will still require humans to do the work. As such, whilst generative AI is good at helping managers write better job requirements by focusing on the skills required to succeed in the job and doing this quicker than humans can, validation by a human is still required before the release of the job requirements to the talent tool. Final decision making should still sit with humans where subjective and qualitative factors such as empathy is relevant to the final outcome.

5.3 Evaluation - identifying, measuring and refining the opportunity from ideas.

Through the development of this report we have assessed the benefits of the existing AI tools presented in Section 5.1 against the challenges in recruitment presented in Section 4 and discussed potential implementation opportunities with industry.

We have identified the pros and cons of each of them to determine the feasibility of providing a single innovation that could resolve the resource availability issues Australian companies face. This comparison is presented in Table 5.1 below.

Table 5.1 Pros and Cons comparison between identified innovations

Tool	Pros	Cons	Conclusion
HireEz	<ul style="list-style-type: none"> • Access to a large pool of candidates (local and overseas) for example Sourcing Candidates from other places than LinkedIn • Diversity filters • Ability to use AI to write emails to potential candidates. 	<ul style="list-style-type: none"> • Issues with profiles that don't match criteria. • Profile info validation • Candidate contact details could be wrong. • Program user interface needs to be improved. • AI driven email templates need improvement. • Subscription module to tools they provide, and extra costs associated with it. 	<ul style="list-style-type: none"> • Good tool as it accesses multiple platforms to source candidates, the use of AI is still in early stages and needs improvement. • This tool is developed for recruiters so, given the amount of in-house recruiting in our industry it may not achieve the reach it currently has in other industries. • It is also currently only used in software development and IT industries. This means a lot of time and extensive implementation would be required until it can be successfully used in our industry, limiting its feasibility to the near but not immediate future.

³⁹ Generative AI and the Future of HR; 5 June, 2023; B Hancock, B Schaninger and L Yee - [The impact of generative AI on human resources](#)

Tool	Pros	Cons	Conclusion
Indeed	<ul style="list-style-type: none"> • Use of AI for resume scanning to find best match. • Automation tools for hiring managers (emails, meetings, chatbots) • Use of natural language processing to analyse soft skills and candidate personality. • HR Analytic • Automated Candidate Evaluation/Scoring • Existing Skills Mapping/Landscaping • Video sentiment analysis 	<ul style="list-style-type: none"> • Limited access to the candidates' profiles on its platform • Pricing can be expensive • Automation limitations • Chatbots have the potential to create a negative impression • AI and Chatbots can't evaluate human qualities 	<p>It doesn't seem to provide any further features than other job searching engines already do. Given the popularity of Seek and LinkedIn in Australia, it is unlikely that Indeed could become a widely implemented tool and therefore reduces its efficiency.</p>
SkillsEngine	<ul style="list-style-type: none"> • Collaboration between Industry, Educational bodies and candidates. • Provides a single skills-based approach. • Supports candidates in their CV writing to match what industry looks for • Supports industry in their skills definition to ensure they find the right candidates • Works with Educational bodies to align course content/certification with industry requirements • Would provide a clearer pathway between graduates and industry 	<ul style="list-style-type: none"> • US based, would need to start from 0 in Australia. • Requires the work being done with Universities, which as a result would not increase the talent pool to any different fields than where currently searched for. • Mainly improves talent acquisition at Graduate level, minor improvements feasible at mid-career paths. 	<p>Solution is aligned with the benefits of skills-mapping that we have identified as essential to optimise candidate matching. However, it is a specific programme developed in Texas with local industry and schools. It would need to be replicated and started from scratch in Australia (or in a specific state to start with), which limits its application to a near but not immediate future. As such, it is not a tool that will solve the capacity problem we currently face.</p>
Reejig	<ul style="list-style-type: none"> • Ethical Talent AI that helps enterprises find, mobilise, reskill, and upskill workforces • empowers business leaders to improve hiring, productivity, diversity, equity and inclusion, change management and more • Combines Generative AI and skills to allow leaders to understand both employee skills and an organisations role and tasks • Links to social media platforms such as LinkedIn 	<ul style="list-style-type: none"> • Quality of search results, if the information is lacking to start with 	<ul style="list-style-type: none"> • Extremely powerful platform, that prides itself on exploring skill adjacency and ensuring that an organisation can assess all talent for positions not just the talent known to the hiring manager. • To get the best benefit of Reejig, you really need to understand the roles you are filling, and the talent you have at hand to start with

A further quantitative comparison of the potential innovations has also been undertaken based on the key barriers they may face for implementation and the key barriers that the industry has advised us are limiting their recruiting capabilities. This comparison has been presented in Table 5.2.

Table 5.2 Quantitative comparison of potentially proposed innovations.

Key Issue	HireEz	Indeed	SkillsEngine	Reejig	Linkedin Recruiter
Application to the roads industry	N	Y Using their pool of candidates	Not currently	Y	Y
Candidate review and filtering	Y	Y	N	N	Y
Skills Mapping	?	Y Limited based on its pool	Y	Y	?
Job Description Support	N	N	Y	Y	Y
Talent outreach	Y	Y	Unsure	Y	Y
Australian Data Source	N	?	N	Y	Y

Based on the above, it is clear that no single tool will resolve all the problems and still support a full shift from current recruitment practices.

Within the industry, most of the respondents have indicated a preference to retaining their current recruitment practice primarily due to the following:

- A lack of understanding of the different types of AI tools available and how they can support skills mapping and talent recruitment into the workforce.
- How to effectively overcome the barriers, as discussed in this Chapter given AI technology is an emerging innovation and there remain uncertainties in its advancement as a technical innovation.
- Understanding what level of human intervention is appropriate.

Many of the respondents to our industry engagement know the future skills they want in their businesses, but they are all generally unsure where to find the right talent.

All our survey respondents know AI technology exists and the perceived benefits as discussed in the earlier sections of this report, but many have only used it to a limited capacity in their current recruitment practice. The most commonly used AI technology appears to be LinkedIn Recruiter, and none of our respondents had developed their in-house AI technology. This is consistent with observations from overseas experience. A recent US survey of HR professionals who use AI technology found that 92% of respondents use AI technology sourced from external vendors rather than developing these in-house.

Due to these limitations on the potential implementation of drastic changes, the need for the industry to work together to implement a holistic skills-first approach, and the lack of a clear single software solution that would encompass all of the required steps, we recommend that the proposed way forward is based on a roadmap of implementation of skills-first approach, rather than on the implementation of a single technical innovation. We have presented the proposed roadmap in *Section 7*.

6 Achieving our industry's potential: what could/should the future look like?

6.1 What is our time horizon/what are the different time horizons we'll examine?

To define when the future starts is impossible, for tomorrow never comes, but we can define trends from where we are today. It can be seen today that the pace of change within certain sectors is phenomenal. What was considered the norm today is often outdated before it even becomes accepted, with technology and electronics being a notable sector.

The timeframes being considered are:

- Short-term – within the next 10 years. While technologies and attitudes towards change are advancing, these changes are slow and it is anticipated the current emerging trends will take up to 10 year to reach full implementation.
- Medium term – 10 – 20 years. These trends are currently being explored and developed but not yet available and used in the community.
- Longer term – 20+ years. The foreseen changes and emerging trends are not currently being developed but are anticipated to be in the pipeline.

6.2 How will AI shape the future of our workforce and industry?

Through data-driven insights, we gain the power to make informed decisions capitalise on opportunities and pre-empt challenges. Technology equips us with the tools to create, automate and reimagine the process like never before. But amidst these advancements, we must not overlook the skills needed to navigate technologies changing landscape.

The technological gain and speed to market for AI solutions is incredibly fast. That means that the tactical “how” of things will change rapidly. Behind that are foundational behaviors and approaches to considering work that needs to change. The view of how people want to work and continue to work are cultural and long-standing behaviors and belief sets that will need considerable change management.

Areas that will require this change include;

- talent hoarding
- poor career conversations at organisations
- full-time bum on seat roles v task specific roles
- being rigid in when and how certain work is done.

There is a need to better understand demand, be clear on the work/tasks/skills required and be flexible in considering how work is delivered. Organisations must understand their talent and be flexible in considering that talent for opportunities.

A report by McKinsey Global Institute⁴⁰ outlines the impact of automation technologies on work activities and occupations in Australia. The research presents three scenarios (slow, fast and mid-point) for automation potential and adoption by 2030, depending on the speed of technology development and deployment, and the barriers to adoption.

The findings of the research estimate that 63 per cent of work activities in Australia have the potential to be automated in the mid-point scenario, and 81 per cent in the early scenario. However, due to various constraints, only 25 per cent and 46 per cent of work activities will be automated in these scenarios. It also identifies nine sectors that will account for three-quarters of Australia's automation opportunity: six highly automatable and three large and diverse. The six highly automatable sectors in Australia are: retail, administrative and government, construction, manufacturing, accommodation and food services, and transport and warehousing. These sectors are among the largest employers in the economy and have work activities that machines, such as data processing, physical tasks, and routine operations can easily perform. These sectors also face competitive

⁴⁰ Australia's Automation Opportunity; Reigniting productivity and inclusive income growth; March 2019; McKinsey & Company - [Australia's automation opportunity: Reigniting productivity and inclusive income growth.](#)

pressures and cost constraints that may drive automation adoption. However, these sectors also have work activities that require human skills, such as creativity, empathy, and problem-solving, which may limit the extent of automation. Therefore, the impact of automation on these sectors will depend on the balance between the potential and the adoption of automation technologies.

This research also highlights that the industry development will likely focus on technological solutions incorporating artificial intelligence (AI)-powered algorithms to overcome some of the industry's greatest challenges, including cost and schedule overruns and safety concerns.⁴¹

Some of the potential barriers to automation in these sectors are:

- The time and cost required to build and maintain automation systems, especially if they involve complex and customised solutions⁴².
- The lack of skills and knowledge among workers and managers to use and adapt to automation technologies, as well as the resistance to change and the fear of job loss⁴³.
- The technical and operational challenges of integrating automation technologies across different applications, platforms, and devices and ensuring their reliability, security, and compliance.
- The ethical and social implications of automation, such as the impact on human dignity, privacy, accountability, and social justice⁴⁴.
- The regulatory and legal barriers that may limit or restrict the use and deployment of automation technologies, such as the standards, codes, and permits that govern the construction industry⁴⁴.

6.2.1 Achieving the industry's potential

The hiring landscape is transforming; we must seek individuals whose skills are not current within the industry. We will need fluency in coding languages and people with skills to interpret data and trends creatively.

The future should be characterised by seamlessly integrating data, technology and human expertise to achieve our industry's full potential. Data-driven insights must guide infrastructure development and maintenance decisions, enhancing safety and efficiency. Cutting-edge technology should empower innovation, allowing us to keep pace with change. Advanced technologies like smart traffic management systems, connected vehicles, and sustainable materials will drive innovation, ensuring our roads are resilient and environmentally friendly. At the same time, people will remain at the core, utilising their creativity and expertise to harness the benefits of data and technology to optimise design, construction and management.

Hiring individuals with diverse skill set is crucial to bring this vision to life. We should seek professionals who are not only technically adept but also possess strong problem-solving abilities and adaptability. We should look to skills that can analyse data effectively, interpret trends and translate insights into actionable strategies. These skills will allow us predict maintenance needs, minimise congestion, and enhance road safety. Individuals with expertise in geospatial analysis, sensor technologies, and automation will be particularly valuable.

We should now consider people with experience in emerging technologies such as AI, machine learning, and data analytics. The industry has started but must actively foster a culture of continuous learning and collaboration with all aspects of the industry from engineers, data scientists to urban planners. Will be essential to ensure the industry stays current with these trends but remains agile to face the future change.

When we asked the industry about the future skills they need to keep being competitive in the future, the results were quite varied. Three of our respondents mentioned answers in alignment with breaking tradition looking outside the box, the other 3 mentioned more specific technology-specific roles such as specific software professionals. Interestingly, the professional external recruiter we included in our round of interviews mentioned the importance of looking overseas for the new skills required.

⁴¹ Artificial Intelligence: Construction Technology's Next Frontier; 4 April, 2018; J Bianco, S Fuchs, M Parsons and M Ribeirinho - [Artificial intelligence: Construction technology's next frontier](#)

⁴² 16 Potential Barriers to the Successful Implementation of Intelligent Automation; 12 June, 2023; Forbes - [Potential Barriers To The Successful Implementation Of Intelligent Automation](#)

⁴³ 5 Common Barriers to Automation & How to Solve Them; Worksoft - [5 Common Barriers to Automation & How to Solve Them](#)

⁴⁴ Barriers to Automation and Robotics in Construction; D Trujillo and E Holt - [Barriers to Automation and Robotics in Construction](#)

When asked whether they believed these skills existed within the current pool of resources most of the respondents were positive, but the topic about needing to look overseas was also mentioned again. It was specifically stated that Australia needs to better recognise overseas qualifications to attract different talent. It is also notable that, out of those companies that reflected more innovation in their recruitment practices, they highlighted that with the right skills mapping tools, the feasibility to find the skills within the current pools of resources would be increased.

It is also worth noting that only a small minority of our respondents stated that they would trust AI to make sole decisions within the recruiting process. Half of our respondents didn't see AI as a game-changer in the industry. Of those that were unsure, the responses varied between the need to oversee the process through a human lens and the benefits of AI, which are most reflected when a large amount of data is available, which the recruitment process does not provide.

6.3 What does the infrastructure of the future look like?

It has been noted that the built environment does not change as readily as compared to other sectors⁴⁵, often, the built environment is reactive to external influences rather than being proactive and at the forefront. These external influences we believe are:

Data

Data volume for a long time now has been exponentially increasing. The product from advancements in other sectors now generates a wealth of data initially created for the developers' use is now seen as an invaluable source of information to inform other sectors, in this case, transport. Data and technology are linked, cheaper technology now enables sensors and metrics to be collected on nearly all connected devices⁴⁶. Data capture is obtained more readily, stored in greater volumes, analysed more efficiently, and transferred near instantaneously. Live and historical data is now utilised in today's decisions and informs future needs. Google Maps 'directions' is a notable example of daily trips utilising live captured data and historical data used to plan future transport corridors.

Technology

Technology has and will constantly be advancing. We forever manipulate the built environment through science, materials, computing, engineering or health. Technology is seen to be making our lives easier and becoming integrated into nearly everyone's daily routine.

Technology integrates into the road network at many levels, with advancements in materials used in its construction, the vehicles that use the network and the way that the network is managed and operated. As noted, the advent of cheaper connected technology generates data that can be utilised effectively⁴⁷.

People

People influence the built environment at both the macro and micro levels. People at the macro level will drive change through choices and actions, environmental, socioeconomic and governance. While at the micro level, people influence the built environment by wanting to interact directly, through decision-making, connections or functionality.

People are becoming aware of the impact they have directly on the environment, with 'climate change' being a threat to all of us at a global level. The drive to change and undo our impact on the environment is now at the forefront of every decision and conversation⁴⁸. This will influence and drive change through every level of construction and operation.

⁴⁵ Disrupt or die: Transforming Australia's construction industry; November 2022; Australian Constructors Association - [Disrupt or die Australian Constructors Association](#)

⁴⁶ The current security challenges of vehicle communication in the future transportation system; 2018; Dai Nguyen, H. P. & Zoltan, R.

⁴⁷ Future scenarios for the infrastructure digitisation: The road ahead; 2023; Tommaso Muciaccia, Pietro Tedeschi [Future Scenarios for the infrastructure digitisation](#)

⁴⁸ Infrastructure 4.0: Achieving Better Outcomes with Technology and Systems Thinking; May 2021; World Economic Forum; [Infrastructure 4.0 Achieving Better Outcomes with Technology and Systems Thinking](#)

Based on current trends, we anticipate the following defining milestones will occur:

<10 YEARS

Short Term

Data:

The volume of data generated by vehicles, tracking and sensors will exponentially expand. This data will require analysts to assess and interpret initiating a recruitment shift from reactive to proactive management.

Technology:

Increase in electric vehicles in both personal and commercial areas. EV vehicle take up will require charging infrastructure uptake, far in advance of several locations in each town and will lead to EV charging technicians and constant development.

People:

With sustainability and carbon neutrality gaining momentum from the people, an initial impact on the Industry is the need for solutions. This will require scientists to help maintain the momentum and create the product of tomorrow.

10-20 YEARS

Medium Term

Data:

Expanded beyond all expectations, with smarter cars now including active pothole avoidance, road surface monitoring and roadside scanning as standard, data is now actively shared between cars through an industry standard. Analysts were unable to keep up and now leverage off AI to monitor the network in near real time, actively managing the network and maintenance tasks.

Technology:

Autonomous vehicles are becoming mainstream, especially within logistics transport now needing little human intervention. AI / remotely piloted construction machinery now emerging on sites undertaking routine work, now only needing input when non standard events occur. Programmers are needed constantly to adjust and patch automation software. With remotely operated vehicles, computer gamers are in high demand with their ability to drive vehicles using 2D displays.

People:

With carbon neutrality being the norm, people are now wanting carbon reversal. Polluting industries will need an active carbon reversal policy, diversifying products and processes to generate a negative carbon effect. Scientists will be in ever greater need and will leverage off AI to develop new materials

>20 YEARS

Long Term

Data:

The dawn of fully automated vehicles arrives, with connected vehicles, people and infrastructure. Transport is now truly 'end to end', data capture reaches critical mass, allowing multiple AIs to route manage, maintain and develop itself.

Technology:

Automated vehicles was the beginning. Robotics being the next chapter, robots will start to take over routine, dangerous or heavy tasks.

People:

With a phased shift to AI self-perpetuating transport and built environment orchestrated by AI. People will interact with their environment at a near sub-conscious level, this relationship will provide the beginning for more creative freedoms and expansion into the future

6.4 What current and future skills are needed?

The skills needed to drive the industry into the future will constantly evolve to keep pace with data, technology, and people. Some of the skills are already present within the industry, others would need to come from diverse industries such as tech companies, data houses and research institutions, where these industries will bring fresh perspectives and creative solutions.

The skills needed will be a blend of both technical ability and adaptability⁴⁹. Technical skills will enact the change, but adaptability will encourage it. The key skills needed are:

- Coding proficiency
- Ability to interpret data and trends creatively
- Geospatial analysis
- AI machine learning, both coding new engines and fixing existing ones.
- Automation
- Strong problem skills
- Data privacy
- Cyber security.

In the ever-evolving landscape of data, technology and people, the future will likely demand a new spectrum of skills yet unknown. Adaptability to emerging technologies such as quantum computing, blockchain outside of currency, and augmented reality will be crucial. Soft skills will also continue to advance with emotional intelligence, cross-cultural communication, and creative problem solving will gain prominence as collaboration across diverse teams becomes the norm.

Finally, understanding ethical AI and a commitment to responsible data usage will be essential in a world where technology plays an increasingly integral role in our lives⁵⁰.

⁴⁹ Infrastructure Workforce and Skills Supply; October 2021; Infrastructure Australia; [Infrastructure workforce and skills supply](#)

⁵⁰ Responsible AI: How to make your enterprise ethical, so that your AI is too; Kal Kanev; [Responsible AI DXC technology](#)

7 A Roadmap to the Future - how do we get there?

7.1 A roadmap that helps industry be future-prepared

A successful road map will lead to the implementation of innovations and new technologies. Based on the findings reflected in previous sections, we believe Figure 5 can be implemented using the identified AI support:



Figure 5: AI Implementation Roadmap

7.1.1 Recommendations for Roads Australia and Transport Industry

Based on the literature review and survey results, we recommend Roads Australia undertake the following additional work in collaboration with its members, like-minded industry partners and vendors:

- Explore the potential to create a 'centralised data set' for thorough and rigorous testing of emerging AI technology to mitigate the risks of bias.
- Challenges of implementing AI in the industry given the lack of data. The industry is not as data-rich as other industries, such as healthcare or finance. This makes it challenging to train AI models that can accurately predict outcomes. Therefore, the largest companies will likely benefit more, particularly in the short term.
- Overcome resistance to change among some professionals. Many people in the industry are reluctant to adopt new technologies, even if they have the potential to improve efficiency and safety, given they are traditionally trained to be risk-averse and to hold a strong preference for the predictability. For example, there appears to be evidence from our industry engagement to suggest that the lack of engineers in the market may be a false perception. We know that an organisation with over 1,000 qualified engineers looking for their first opportunity in the industry and their experience in applying for jobs is often overlooked. Whilst outside the scope of this research project, most companies and recruiters may have simply based their decisions on their standard recruitment processes that have gone unquestioned for too long. These have also contributed to the lack of diversity and recruitment of people from the same talent pool.

AI is not the answer, at least not on its own. It is likely to remain a supporting tool that can be used but has limitations. The feedback collated from our industry engagement would appear to suggest that the industry is taking a measured consideration of AI technology. At this stage, the use of AI technology in recruitment will remain for talent search, and it benefits the recruitment process by making it more time efficient. It is currently not seen as a 'silver bullet' that will fill vacancies by recognising transferable skills and competencies to address the capacity issue experienced by the industry or the skills required in the future. Therefore, plugging the capacity/skills gap with AI technology for talent search is a secondary benefit subject to the current industry understanding and uptake.

Ultimately, it is a maturity journey with companies and their readiness to take this road. This would once again appear to be validated by a recent US survey of HR professionals⁵¹, where it was evident that the use of AI technology is mainly adopted by larger organisations (typically with more than 5000 employees) and only a small proportion (approx. 16% of respondents to the US based survey) are small to medium sized firms (typically with fewer than 100 employees). The same survey also found that for companies that have yet to use AI in recruitment, only 1 in 4 reported that they plan to use AI in recruitment in the next five years.

⁵¹ Fresh SHRM Research Explores Use of Automation and AI in HR; 13 April, 2022; Society for Human Resource Management (SHRM) - [Fresh SHRM research explores use of automation and AI in HR](#)

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Attachment 1

Interview Structure

CURRENT PRACTICE

- 1) What type of roles does your company recruit/is it interested in?
- 2) How do you recruit?
- 3) How many CVs do you typically receive for a job application?
- 4) What criteria do you use to short list applicants?
- 5) Have you had difficulties recruiting for your company?
- 6) What are your barriers to recruitment?
- 7) How long does it typically take you to fill a role from advertisement to placement?
- 8) Do you use a recruitment tool / application / website to process your applicants?
- 9) What do you perceive is more beneficial to a role, skills (direct or compatible) or educational obtainment?
- 10) Have you mapped the skills of your workforce?
- 11) Have you looked outside of your sector to identify people with compatible skills?

FUTURE PRACTICE

- 12) What do you think are the future skills your firm needs to remain competitive? Please list.
- 13) Do you believe these future skills exist amongst the current pools of resources your firm employs or has access to?
- 14) How would your company find these skills?
- 15) Did you know that AI can be used for recruitment?
- 16) Do you use AI for recruitment?
- 17) Are you aware of any existing AI tools for recruitment?
- 18) If you do use AI for recruitment has it been beneficial?
- 19) If you do use AI has this provided a wider range of responded candidates?
- 20) Would you trust AI to short list candidates based on criteria for recruitment?
- 21) Do you see AI as a game changer / shifter in recruitment?
- 22) How will AI in recruitment affect you and/or your organisation?