



D5.3 Institutional responses to shortages and gaps

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Abbreviations

AI: Artificial Intelligence

CO: Confidential

D: Deliverable

DEM: Demonstrator

DoA: Description of the Action

DoW: Description of Work

EC: European Commission

EU: European Union

GA: Grant Agreement

IPR Intellectual Property Rights

M: Month

NLP: Natural Language Processing

PC: Project Coordinator

PM: Project Manager

PO: Project Officer

PP: Programme Participants

PU: Public

RE: Restricted

SC: Steering Committee

TM: Technical Manager

UK: The United Kingdom

WP: Work Package

1 Introduction and objectives

SkillsPULSE project addresses the issue of skills shortages and gaps within the European labour market. Coordinated by Fondazione Giacomo Brodolini in Italy, the project consortium brings together eight institutions from across the European Union and UK, including the University of Jyväskylä from Finland, the University of Tartu from Estonia, the University of Lodz from Poland, the Warwick Institute for Employment Research from the United Kingdom, the Economic and Social Research Institute (ESRI) from Ireland, the National Centre for Social Research (EKKE) from Greece, and the University of Pisa from Italy.

The project operates on the fundamental recognition that skills shortages and skills gaps do not clear quickly enough from a policy-making perspective, resulting in negative consequences for individual workers, employing organisations, and economic performance in aggregate. Skills shortages refer specifically to situations where employers face difficulties recruiting qualified personnel from the external labour market because applicants lack the required skills, qualifications, or experience. Skills gaps, by contrast, refer to situations where existing workforces within organisations lack the skills required to meet business objectives and strategic goals.

This report addresses Task 5.3 within Work Package 5 (WP5), examining different approaches to identifying and responding to skills shortages and extracting policy lessons from international experience. Building upon the literature review and institutional mapping conducted in Task 5.1 and Task 5.2 case studies of Australia, Canada, New Zealand, and Singapore. These countries were selected based on their demonstrated innovation in skills intelligence, their diverse institutional approaches, and their relevance as potential models for European contexts

2 Synthesis approach

This report employs an evidence synthesis approach, integrating information from multiple sources to identify patterns, extract lessons, and formulate policy recommendations. The synthesis draws on two main evidence streams: 1) the literature review and global system mapping from Task 5.1 providing structured data on over 70 systems across six geographic regions, including information on institutional providers, system types, data sources, key functions, innovative features, target users, scale and reach, and funding models; and 2) the case studies from Task 5.2 examining institutional frameworks, governance structures, skills shortage identification systems, AI and technology integration, success features, and challenges of Australia, Canada, New Zealand, and Singapore.

The analysis identifies commonalities and differences across systems while recognising that institutional approaches operate within specific national contexts characterised by unique labour market conditions, educational systems, immigration policies, and governance traditions. Rather than prescribing specific institutional structures, the analysis emphasizes underlying principles and strategic approaches that can be adapted to diverse contexts. Attention is paid to how countries are implementing skills-first principles, recognising that this represents a fundamental shift in how societies conceptualize skills development, recognition, and utilisation.

Several limitations affect the scope and generalizability of findings. The evidence base relies primarily on publicly available documentation and reported system features rather than independent evaluation of effectiveness. Detailed case studies focus on four English-speaking developed countries, potentially limiting insights regarding approaches in other linguistic and institutional contexts. The rapid pace of technological change means that assessments of AI integration and digital capabilities reflect specific points in time and may not capture recent developments. Contextual differences in governance structures, labour market institutions, and policy priorities limit direct transferability of specific approaches to European settings.

3 Global landscape of skills intelligence systems

Task 5.1's mapping identified over 70 institutions and information systems operating across six geographic regions. These systems demonstrate substantial diversity in institutional arrangements, technological sophistication, and policy integration, yet share common objectives of identifying skills needs and facilitating better labour market matching. Task 5.2's detailed case studies of Australia, Canada, New Zealand, and Singapore provide insights into institutional models, revealing both successful approaches and persistent challenges. Emerging from this analysis is the recognition that traditional qualification-based approaches increasingly seem to be considered inadequate for addressing rapid technological change, demographic shifts, and evolving work organisation patterns. This involves reconceptualisation of how countries operationalize skills intelligence, moving beyond traditional credential-based frameworks toward more granular, dynamic approaches.

3.1 System types and functions

The mapped systems can be categorised into several distinct types based on their primary functions. **Analytics tools and AI-based systems** utilize advanced data processing to provide real-time labour market intelligence. Examples include Austria's Berufsinfomat, a ChatGPT-based chatbot from the Austrian Public Employment Service, provides career information on occupations, training pathways and expected earnings based on AMS labour market data, and Belgium's Jobbereik ('Job Reach') system developed by VDAB, which uses deep learning and graph analytics to match user competencies with job opportunities.

Online information platforms aggregate and present labour market data through accessible digital interfaces. Canada's Job Bank managed by Employment and Social Development Canada and Australia's Jobs and Skills Atlas maintained by the Australian Government exemplify this category, provide comprehensive labour market information through user-friendly platforms that support career planning and training decisions. Australia's recent development of a National Skills Taxonomy represents an evolution of such platforms toward more sophisticated skills-first frameworks enabling translation between jobs, qualifications, and experiences through common skills languages.

Classification and taxonomy systems provide standardised frameworks for describing occupations and skills. Estonia's Skills Register OSKA system, implemented by the Estonian Qualifications Authority under the Ministry of Education and Research and Canada's National Occupational Classification represent sophisticated taxonomies enabling consistent communication and skills matching across diverse stakeholders. Recent international developments emphasize the importance of linking these classification systems to granular skills taxonomies rather than relying solely on occupational or qualification categories.

Forecasting and anticipation systems produce forward-looking intelligence regarding future skills needs. Estonia's OSKA system coordinated by the Ministry of Education and Research and Czech Republic's Kompas managed by the Ministry of Labour and Social Affairs provide medium-term forecasts supporting proactive training investments and education planning. Leading forecasting systems increasingly focus on anticipating skills rather than occupational demand, recognising that skills requirements within occupations evolve more rapidly than occupational structures themselves.

Integrated ecosystems combine multiple functions within comprehensive platforms. Singapore's SkillsFuture ecosystem coordinated by SkillsFuture Singapore demonstrates integration of skills intelligence, training provision, career guidance, and employment services within unified digital platform.

4 Insights from international case studies: Effective systems for preventing skills shortages

Task 5.2's case studies of Australia, Canada, New Zealand, and Singapore show how different institutional architectures shape skills intelligence and shortage prevention, and demonstrate distinct institutional models, each with strengths for different contexts. Across all four countries, systems combine robust taxonomies, mixed-methods evidence (quantitative indicators plus stakeholder input), and explicit policy linkages.

4.1 Institutional models

4.1.1 Centralised Model

Australia's skills intelligence system underwent significant organisational reform in 2023 with the establishment of Jobs and Skills Australia (JSA) (<https://www.jobsandskills.gov.au/>), replacing the National Skills Commission (NSC) as the primary federal agency responsible for skills forecasting, labour market analysis and policy advice. While skills forecasting and labour market intelligence had been well-established functions for decades, the institutional reform reflected efforts to improve coordination between skills forecasting and workforce development policy and to strengthen the authoritative voice on national skills needs. Operating under the Department of Employment and Workplace Relations (DEWR) (<https://www.dewr.gov.au>), Jobs and Skills Australia serves as the authoritative voice on skills needs and labour market intelligence at the national level.

The institutional architecture demonstrates a federalist approach that balances national consistency with regional responsiveness. Jobs and Skills Australia works collaboratively with state and territory training authorities, industry skills councils, and employer organisations to gather localised intelligence while maintaining unified national assessment frameworks. This federated model allows the system to capture regional variation in labour market conditions while providing nationally consistent data that can inform both federal policy and state-level workforce development strategies. Regular consultations with Jobs and Skills Councils representing different industries ensure that the formal quantitative assessments incorporate industry-specific knowledge and contextual understanding.

The governance structure emphasizes evidence-based decision making through multiple complementary mechanisms. The formal institutional framework includes regular reporting requirements, transparent methodologies, and public release of findings. Advisory mechanisms ensure that diverse stakeholder perspectives inform both methodological development and interpretation of findings. Methodologies are updated annually to incorporate new data sources (such as the transition from Australian and New Zealand Standard Classification of Occupations, ANZSCO 2022 to the new Occupation and Skills Classification Australia, OSCA 2024 taxonomy). The system demonstrates commitment to continuous improvement through regular review of assessment methodologies and incorporation of new data sources and analytical techniques as they become available.

4.1.2 Distributed Model

Canada's approach to skills intelligence reflects the country's federal structure, operating through a distributed institutional model that balances national coordination with provincial and territorial autonomy. The Labour Market Information Council (LMIC) (<https://lmic-cimt.ca/>) serves as the primary

coordination mechanism, functioning as a pan-Canadian organisation dedicated to improving the quality and accessibility of labour market information. Established in 2017 following recommendations from the Advisory Panel on Labour Market Information, the Council operates through multi-stakeholder governance involving federal and provincial governments, employers, unions, education providers, and Indigenous organisations.

The institutional model recognizes that in Canada's constitutional framework, provinces and territories hold primary jurisdiction over education and training while the federal government manages immigration policy and certain aspects of labour market programming. This division of authority necessitates sophisticated coordination mechanisms to ensure coherent skills intelligence across jurisdictions. The Labour Market Information Council facilitates this coordination through research programs, data infrastructure development, stakeholder engagement, and knowledge mobilisation activities that bridge federal and provincial systems.

Employment and Social Development Canada (ESDC), (<https://www.canada.ca/en/employment-social-development.html>) the federal department responsible for labour market policy, maintains its own research and analysis capacity while coordinating with the Labour Market Information Council and provincial counterparts. The Labour Market Information Council is an independent non-profit organisation with multi-stakeholder governance including representatives from federal/provincial governments, employers, labour organisations, and education sectors. This multi-level institutional structure creates both complexity and richness, enabling deep understanding of regional variation while maintaining capacity for national-level analysis and policy coordination. Provincial and territorial governments operate their own labour market research functions, producing jurisdiction-specific intelligence that informs local training priorities and workforce development strategies.

4.1.3 Focused Model

New Zealand's approach to skills intelligence demonstrates a streamlined institutional model that integrates skills assessment with immigration policy and broader labour market intelligence. The Ministry of Business, Innovation and Employment (MBIE) (<https://www.mbie.govt.nz>) serves as the primary government agency responsible for labour market policy, employment strategy, and immigration administration, creating unified governance that facilitates coordination between skills needs identification, workforce development, and immigration policy responses. This institutional consolidation differs markedly from the more distributed governance models observed in Australia and Canada, reflecting New Zealand's smaller population, more compact geography, and unified rather than federal governmental structure.

Within the Ministry of Business, Innovation and Employment (MBIE), Immigration New Zealand (INZ) (<https://www.immigration.govt.nz>) administers the skilled migration program, including the Green List which identifies occupations experiencing critical skills shortages. The MBIE's Labour Market, Skills and Enterprise Group conducts labour market analysis, produces forecasting reports, and oversees key data collection initiatives including the Jobs Online series that tracks online job advertisements from major employment websites. This integrated structure enables MBIE to align skills intelligence with both immigration responses and domestic workforce development strategies.

In November 2024, Statistics New Zealand (Stats NZ) introduced the National Occupation List (NOL) (<https://www.stats.govt.nz/methods/about-the-national-occupation-list>), replacing the long-standing Australian and New Zealand Standard Classification of Occupations (ANZSCO) for domestic applications. The National Occupation List was updated again in July 2025 to better reflect New Zealand's evolving labour market, with annual updates planned going forward. This transition to a domestically tailored occupational classification system demonstrates New Zealand's commitment to developing skills intelligence infrastructure specifically suited to its labour market characteristics.

Unlike Australia's occupational assessment system or Canada's elaborate federal-provincial coordination mechanisms, New Zealand has adopted a more focused approach targeting critical shortage occupations where skilled immigration represents an essential component of the workforce strategy. The streamlined governance model enables rapid policy implementation while maintaining clear accountability for skills intelligence quality and immigration outcomes. This approach reflects both pragmatic resource allocation given New Zealand's smaller scale and strategic prioritisation of addressing the most acute skills gaps

4.1.4 Integrated Ecosystem Model

Singapore has developed an integrated approach to skills intelligence, building a comprehensive ecosystem that connects skills forecasting, training provision, career guidance, and workforce transformation under the SkillsFuture initiative (<https://www.skillsfuture.gov.sg>). Launched in 2015 and continuously expanded since, SkillsFuture represents a national strategy for developing an adaptive workforce capable of thriving in the rapidly changing economy. SkillsFuture Singapore (SSG), a statutory board under the Ministry of Education, coordinates this comprehensive ecosystem while collaborating closely with Workforce Singapore (WSG) (<https://www.wsg.gov.sg>), which handles employment facilitation and career guidance.

The institutional model demonstrates sophisticated integration across multiple traditionally distinct policy domains. Skills intelligence informs training provision through direct linkage between identified needs and course development. Career guidance systems utilize skills intelligence to provide personalised recommendations for career transitions and upskilling pathways. Employer engagement programs ensure continuous feedback regarding skill requirements and emerging needs. This integrated approach represents a fundamentally different model from systems where skills intelligence functions primarily as information provision separate from training and employment services.

4.2 Observed system features

Analysis of the evidence base indicates that system effectiveness relates to the presence of multiple complementary features working in concert rather than to technological sophistication or institutional design alone. Cross-case analysis reveals six factors that distinguish effective systems:

- **Sustained government commitment:** Dedicated institutional capacity, stable funding frameworks, and consistent policy attention enable long-term development of sophisticated systems. Clear governance structures delineate responsibilities, decision-making authority, and accountability mechanisms. Countries implementing skills-first approaches tend to embed such principles explicitly in institutional mandates rather than treating skills intelligence as technical exercises in labour market analysis.
- **Evidence-based methodologies drawing on multiple data sources:** Combining quantitative indicators with qualitative stakeholder intelligence provides both rigor and contextual understanding. This involves development of skills taxonomies enabling granular analysis of specific competencies, application of natural language processing to extract skills requirements from job postings and other textual data, and systematic skills profiling connecting qualifications and occupations to detailed competency frameworks.
- **Active stakeholder engagement:** Multi-stakeholder governance involving employers, workers, education providers, and government ensures methodological validity and policy impact. Stakeholder engagement serves multiple purposes including methodological development by incorporating ground-level intelligence regarding recruitment challenges and emerging skill needs, building stakeholder ownership of findings that may increase likelihood of informing decision-making, facilitating policy implementation by creating buy-in from those expected to respond to identified needs, and enabling continuous improvement through feedback regarding intelligence usefulness and policy effectiveness. Stakeholder engagement

may extend beyond traditional consultation to active co-design of skills frameworks and taxonomies.

- **Clear policy integration:** Direct linkage between skills intelligence, training funding, and workforce development programs ensures actionable outcomes.
- **Public accessibility:** Transparent methodologies and user-friendly digital platforms extend impact to individuals, employers, and training providers. This enables individuals to make informed career and training decisions, employers to conduct workforce planning, training providers to develop aligned programs, career counsellors to advise clients, and immigration applicants to assess visa eligibility and career prospects.
- **Strategic technology investment:** AI and big data analytics enable real-time intelligence, skills matching, and personalised educational, vocational and career guidance at scale.

4.3 Technology integration

Comprehensive job advertisement analysis: The advanced systems use increasingly AI-powered analysis of online job advertisements at scale to track evolving skill requirements. Australia's Jobs and Skills Australia processes postings through the Internet Vacancy Index, combining commercial datasets with domestic job boards, while Singapore's SkillsFuture ecosystem applies natural language processing to millions of ads to extract skills, experience levels and other requirements. This enables early detection of emerging skills, monitoring of change over time and validation of survey-based assessments, although near-real-time data primarily reflects current demand and is therefore better suited to short-term training responses than long-term educational planning.

AI-powered skills taxonomies: Systems increasingly rely on dynamic, AI-enabled skills frameworks rather than static classifications. Australia's evolving skills classifications and Singapore's Skills Frameworks use machine learning to identify skills at different levels of granularity, map relationships and transferable capabilities, and update as new skills emerge. A central design tension concerns granularity versus usability: excessively detailed taxonomies become unwieldy, while overly broad categories fail to support precise matching. Emerging approaches therefore use hierarchical structures that support diverse use cases—from strategic planning to curriculum design—without overwhelming end-users.

Personalised career guidance systems: AI-driven guidance tools extend skills intelligence directly to individuals. Singapore's MySkillsFuture platform compares user skill profiles with job requirements, identifies gaps, recommends courses and suggests alternative career pathways, with recommendation quality improving as the system learns from user behaviour. Such tools depend on robust, interoperable skills frameworks and must handle incomplete information about informally acquired skills while avoiding the reinforcement of existing inequalities through biased recommendation patterns.

Interactive data visualisation and analytics: provide sophisticated data visualisation tools enabling diverse users to explore skills intelligence through customizable interfaces. Singapore's Skills Demand Dashboard and Priority Skills Dashboard, Australia's Jobs and Skills Atlas, and Canada's Job Trends Dashboard exemplify interactive platforms enabling examination of skills demand by industry, occupation, skill category, and time period; trend analysis identifying skills experiencing rapid demand growth or decline; comparison capabilities enabling benchmarking across industries and identification of cross-sector skill commonalities; and geographic analysis revealing regional variation in skill requirements. Such tools democratize access to skills intelligence, enabling employers, training providers, career counsellors, and individual workers to conduct analyses relevant to their specific needs without requiring specialised expertise.

4.4 Core Indicators

A part of Task 5.3 is identifying indicators currently in use which not only indicate the existence of skill shortages and skill gaps, but how that information is presented in a way that elicits effective responses from a range of stakeholders and target groups. Analysis of the four case study countries and broader global mapping reveals six primary categories of indicators employed to identify skills shortage.

Labour market quantitative indicators: Job vacancy rates and trends represent fundamental shortage indicators widely employed across systems. Australia's Internet Vacancy Index tracks monthly online job advertisements by occupation, skill level, state and territory, and regional areas. Singapore's real-time analysis of job posting volumes identifies rapid demand increases signalling emerging shortages. These indicators provide timely signals of labour demand changes though require careful interpretation as vacancy levels reflect both actual shortages and employer recruitment practices.

Employer survey indicators: Employer-reported recruitment difficulty provides direct evidence of hiring challenges. Australia's Survey of Employers who Recently Advertised and Recruitment Experiences and Outlook Survey collect detailed information on vacancy fill rates, time to fill positions, number of suitable applicants, and reasons for recruitment difficulty. These self-reported measures capture employer perspectives though may reflect factors beyond skills availability including wage offers, job quality, and geographic location.

Wage-based indicators: Wage growth rates above average inflation or broader market increases signal labour market tightness and potential shortages. Leading systems incorporate wage trend analysis though recognize that wage growth depends on multiple factors including productivity growth, bargaining power, and employer wage-setting practices beyond pure supply-demand balance.

Unemployment and underemployment indicators: Low unemployment rates within occupational groups suggest tight labour markets and potential shortages. Conversely, high unemployment combined with reported recruitment difficulty indicates skills mismatch rather than simple shortage. Sophisticated systems examine both unemployment and underemployment recognising that workers employed below skill level represent potential supply if appropriate opportunities emerge.

Forward-looking indicators: Future demand indicators based on economic forecasts, industry growth projections, technological change impacts, and demographic trends enable proactive rather than purely reactive responses. Australia's Future Demand Rating and Estonia's OSKA 10-year forecasts demonstrate forward-looking approaches supporting anticipatory training investments.

Job posting analysis indicators: AI-powered analysis of online job advertisements provides real-time intelligence on skill requirements, posting frequency, emerging skills, qualification expectations, and experience requirements. Singapore processes millions of job postings through NLP algorithms. Australia analyses over 7 million advertisements. This approach enables identification of emerging skills before they achieve formal recognition in classification systems.

4.5 Presentation approaches and stakeholder response

How skills shortage information is presented significantly affects its ability to elicit effective stakeholder responses. Australia's system classifying occupations as shortage, recruitment difficulty, or no shortage provides clear categorical ratings easily understood by diverse audiences. New Zealand's two-tier Green List distinguishes critical shortage from significant shortage with differentiated immigration pathways. These categorical approaches facilitate communication though lose nuance within categories and require clear definitional criteria. Categorical ratings are suited for immigration policy where binary eligibility decisions require clear thresholds and enable straightforward communication with general audiences unfamiliar with labour market analysis.

However, they obscure variation in shortage intensity within categories and provide limited guidance regarding priority among shortage occupations.

Continuous metrics: Systems providing continuous metrics such as vacancy rates, fill rates, or time-to-fill enable nuanced comparison across occupations and tracking of changes over time. These quantitative indicators support sophisticated analysis by researchers and policymakers though require greater user expertise to interpret than categorical ratings. Continuous metrics support training planning where resource allocation decisions benefit from understanding relative shortage intensity across occupations. They enable identification of emerging shortages before they reach critical levels warranting policy intervention though require clear guidance regarding threshold levels constituting shortage situations.

Interactive dashboards: Singapore's Priority Skills Dashboard and Jobs and Skills Mobility Dashboard, and Australia's Jobs and Skills Atlas demonstrate sophisticated interactive platforms enabling users to explore data through customizable filters examining shortage patterns by industry, occupation, geography, and time period. These platforms empower users to conduct personalised analysis relevant to their specific needs. Interactive dashboards are used by training providers developing responsive programs, employers conducting workforce planning, and career counsellors advising clients on career transitions. They enable discovery of patterns not immediately apparent in static reports though require investment in user-friendly interface design.

Narrative reports: Comprehensive narrative reports providing contextual analysis, interpretation, and policy implications supplement quantitative data presentation. Australia's annual Occupation Shortage List reports, Singapore's Skills Demand for the Future Economy reports, and Canada's Labour Market Information Council publications demonstrate effective narrative approaches. Narrative reports are useful for policymakers requiring contextual understanding beyond raw indicators and media seeking accessible summaries for public communication. They enable explanation of methodologies, acknowledgment of uncertainties, and discussion of policy implications.

4.6 Indicator presentation best practices

Analysis of leading systems reveals several best practices in presenting skills shortage indicators to maximize stakeholder response:

- Provide multiple presentation formats serving different user sophistication levels and decision contexts
- Ensure geographic specificity recognising that shortage patterns vary substantially across regions
- Include both current and forward-looking indicators supporting immediate responses and anticipatory actions
- Document methodologies clearly enabling users to assess reliability for their decision contexts
- Link indicators to actionable responses connecting shortage intelligence with available policy levers and resources
- Update regularly maintaining currency for dynamic labour markets while enabling trend tracking
- Ensure accessibility through multilingual platforms, mobile-responsive design, and digital accessibility compliance.

5 Target groups and stakeholder engagement

Effective skills intelligence systems recognise that different stakeholder groups require tailored information formats, access channels, and engagement strategies. Analysis of case study systems identifies five primary target groups for skills shortage information:

Policymakers and government agencies: Require comprehensive shortage assessments supporting immigration policy decisions, training funding allocation, regional development planning, and labour market program design. They need authoritative intelligence with clear methodological foundations, regular updating enabling responsive policy adjustments, and analysis of policy effectiveness. Australia's Occupation Shortage List directly informs Skills in Demand visa eligibility. Singapore's intelligence shapes SkillsFuture funding priorities.

Education and training providers: Need detailed intelligence regarding current and emerging skill requirements informing curriculum development, program design, and student recruitment. Providers require occupation-specific skill profiles, industry validation of competency frameworks, and forecasts enabling anticipatory program development. Singapore's Skills Frameworks provide explicit curriculum guidance. Australia's Jobs and Skills Councils ensure industry input.

Employers and industry associations: Require intelligence on occupation-specific shortages, regional labour market conditions, emerging skill requirements, and recruitment strategies. Employers need practical tools for workforce planning and talent acquisition. Large employers conduct sophisticated internal analysis; SMEs require accessible guidance. Industry associations aggregate member needs for collective voice.

Individuals and career guidance practitioners: Need information about career opportunities, training pathways, salary expectations, and skills transferability. Career counsellors require tools supporting client advising on transitions and training decisions. Singapore's MySkillsFuture provides AI-powered personalised recommendations. Australia's Jobs and Skills Atlas enables individual career exploration.

Prospective migrants: Need clear information regarding occupations eligible for immigration pathways, qualification recognition requirements, and employment prospects. New Zealand's Green List provides explicit residence pathways. Australia's Skills in Demand visa directly links shortage determinations with immigration eligibility.

6 Policy lessons and observations from international experience

Drawing on the evidence synthesis and identification of effective system features, this section presents key policy lessons from international experience and provides recommendations for policymakers and practitioners. Policy lessons recognise that implementation involves coordinated action across multiple dimensions rather than isolated interventions, with reorientation toward skills as the primary currency of workforce development systems.

Establish dedicated skills intelligence capacity: Create or strengthen dedicated institutional capacity for skills intelligence at both EU and Member State levels. This requires sustained funding, technical expertise, and clear mandates for skills shortage identification and monitoring.

Strengthen EU-national coordination mechanisms: Enhance coordination between EU-level initiatives and national systems.

Develop comprehensive skills shortage indicators: Implement multi-dimensional indicator systems combining quantitative labour market data with qualitative stakeholder intelligence. Recommended components include: vacancy and fill rate analysis, employer recruitment difficulty surveys, job posting analysis using NLP, wage trend monitoring, and forward-looking demand projections

Invest in AI-powered skills intelligence infrastructure: Prioritise investment in artificial intelligence and big data analytics capabilities for skills intelligence. Key applications include: real-time job posting analysis using NLP, AI-powered skills taxonomy development, machine learning for demand forecasting, and automated occupational coding.

Create clear policy integration: Effective systems directly link skills intelligence to policy actions. Policymakers should establish explicit linkages between skills assessments and policy levers including immigration eligibility, training funding priorities, recognition of prior learning processes, and workforce development programs.

Create integrated digital platforms: Develop comprehensive digital platforms that serve multiple stakeholder groups with tailored information products, interactive tools, and accessible data while maintaining common underlying skills frameworks.

Institutionalise stakeholder consultation: Establish formal mechanisms for regular stakeholder input into skills intelligence development, ensuring that employer, worker, and provider perspectives inform both methodological approaches and interpretation of findings.

Develop transferable skills frameworks: Build skills taxonomies that identify transferable competencies across occupations and sectors, facilitating workforce mobility and career transitions in rapidly changing labour markets.

7 Gaps

Despite substantial progress in skills intelligence systems internationally, several important knowledge gaps persist requiring attention from researchers, policymakers, and system developers. This section identifies key gaps in current knowledge and suggests priorities for future research that would strengthen evidence-based approaches to preventing skills shortages and gaps.

Current systems typically classify occupations categorically as shortage or no shortage but provide limited quantification of shortage intensity within shortage categories. Research examining how to measure and communicate shortage severity would enable more nuanced priority-setting and resource allocation decisions. While conceptually distinct, most systems focus primarily on external recruitment shortages with less systematic attention to skills gaps within existing workforces. Further research examining methodologies for identifying and measuring skills gaps, understanding relationships between external shortages and internal gaps, and developing integrated assessment approaches would strengthen policy responses addressing both dimensions.

As systems increasingly adopt AI-powered analysis of job advertisements and other online data, rigorous validation against traditional survey-based methods and actual labour market outcomes becomes essential. Research examining accuracy of AI-derived indicators, potential biases in online data sources, and optimal combinations of traditional and AI-based approaches would strengthen confidence in technological applications.

Current skills forecasting approaches typically operate at high levels of aggregation (one- or two-digit occupation level), which limits their utility for curriculum design and training planning. Furthermore, existing systems provide limited information regarding how skills within occupations may evolve over time. While forecasts indicate likely demand for occupational categories, they offer less guidance on the specific competencies that workers in those occupations will require in the future. Research developing more granular forecasting methodologies that anticipate skills evolution within occupations would strengthen the connection between skills intelligence and training program design.

A gap across all examined systems is the absence of systematic attention to skills obsolescence. While systems identify skills shortages and emerging demands, none of the four countries' systems provides equivalent focus on identifying declining or at-risk skills and occupations. Understanding which skills are becoming obsolete is relevant for workforce planning and career guidance, enabling proactive retraining before displacement occurs. Research developing methodologies for anticipating skills decline and identifying at-risk occupations would complement existing shortage-focused approaches.

8 Conclusion

This synthesis report has fulfilled Task 5.3 requirements by examining institutional frameworks, skills shortage identification systems, and technological applications across Australia, Canada, New Zealand, and Singapore. Drawing on the global mapping from Task 5.1 and case study evidence from Task 5.2, the analysis has identified systems most effective in preventing skills shortages, examined how indicators are presented to elicit stakeholder responses, identified key target groups, extracted policy lessons from international best practices, and highlighted knowledge gaps requiring future research. The comparative analysis reveals both substantial variation in approaches and important commonalities in success factors, providing valuable insights for European policymakers developing enhanced skills intelligence infrastructure.

Regarding effective systems, the evidence demonstrates six success factors distinguish high-performing skills intelligence systems: sustained government commitment through dedicated institutional capacity and stable funding; evidence-based methodologies combining quantitative labour market data with qualitative stakeholder intelligence; active stakeholder engagement ensuring employer, worker, and provider perspectives inform system development; clear policy integration linking shortage identification directly to immigration, training funding, and workforce development decisions; public accessibility through user-friendly digital platforms serving diverse audiences; and strategic technology investment enabling AI-powered real-time intelligence and personalised career guidance.

Regarding indicators, effective systems employ multiple indicator types including labour market quantitative measures, wage-based indicators, employer survey data, AI-powered job posting analysis, and forward-looking projections. Critically, how this information is presented determines its ability to elicit appropriate stakeholder responses. Categorical ratings serve immigration policy and general audiences; continuous metrics support nuanced analysis for training planning; interactive dashboards enable personalised exploration by employers, providers, and career counsellors; and narrative reports provide contextual interpretation for policymakers and media.

Regarding target groups, the analysis identified five primary audiences requiring differentiated engagement strategies: policymakers and government agencies needing comprehensive authoritative intelligence for policy decisions; education and training providers requiring skills frameworks and demand projections for curriculum development; employers and industry associations seeking recruitment intelligence and workforce planning tools; individuals and career guidance practitioners needing pathway information and skills matching capabilities; and prospective migrants requiring clear information on immigration eligibility and employment prospects.

The policy lessons emphasise that effective skills intelligence requires coordinated action across multiple dimensions: establishing dedicated institutional capacity, strengthening coordination mechanisms, developing comprehensive indicator systems, investing in AI-powered infrastructure, creating clear policy integration, building integrated digital platforms, institutionalising stakeholder consultation, and developing transferable skills frameworks. The international shift toward skills-first approaches—where skills rather than credentials serve as the primary currency—represents fundamental transformation requiring systemic change across learning ecosystems and employment systems.

Important knowledge gaps remain, including shortage intensity quantification, skills gap measurement methodologies, AI indicator validation, forecasting granularity, skills obsolescence tracking, generative AI impacts, green transition skills, and policy effectiveness evaluation. These gaps represent priorities for future research that would strengthen evidence-based approaches to preventing skills shortages.

In sum, effective skills intelligence requires more than technical systems producing data—it requires institutional commitment, stakeholder engagement, policy integration, and continuous adaptation to changing labour market conditions. European systems can learn from international experience while adapting approaches to the specific institutional, cultural, and governance contexts of the European Union and its Member States.

References

- Australian Government (2023). Towards a National Jobs and Skills Roadmap. <https://www.jobsandskills.gov.au/publications/towards-national-jobs-and-skills-roadmap>
- Australian Skills Classification: <https://www.jobsandskills.gov.au/data-and-research/australian-skills-classification>
- Department of Employment and Workplace Relations: <https://www.dewr.gov.au/>
- Employment and Social Development Canada. <https://www.canada.ca/en/employment-social-development.html>
- Jobs and Skills Australia: <https://www.jobsandskills.gov.au/>
- Jobs and Skills Australia. Internet Vacancy Index. <https://www.jobsandskills.gov.au/data/internet-vacancy-index>
- Jobs and Skills Australia (2022). Recruitment Experiences and Outlook Survey Concepts, methods, and questionnaire. <https://www.jobsandskills.gov.au/data/recruitment-experiences-and-outlook-survey/reos-survey-methodology>
- Jobs and Skills Australia (2025). 2025 Occupation Shortage List - Key Findings Report.
- Jobs and Skills Australia (2025b). Occupation Shortage Report - March 2025.
- Jobs and Skills Australia (2025c). National Skills Taxonomy Discussion Paper. Australian Government.
- Jobs and Skills Australia (2024a). JSA Migration Labour Market Indicator Model Methodology. Draft Core Skills Occupation List. https://www.jobsandskills.gov.au/sites/default/files/2024-11/doc_9_-_jsa_migration_model_methodology_-_short_form_public_release.pdf
- Jobs and Skills Australia (2024b). 2024 Occupation Shortage List Methodology. https://www.jobsandskills.gov.au/sites/default/files/2025-07/document_1_-_summary_of_information.pdf
- Labour Market Information Council (LMIC). Official Website <https://lmic-cimt.ca/>
- Labour Market Information Council (2025). About LMIC - Strategic Plan 2021-2025. Ottawa.
- MyCareersFuture. <https://www.mycareersfuture.gov.sg/>
- The National Occupational Classification (NOC) (<https://noc.esdc.gc.ca/>)
- Occupational and Skills Information System (OaSIS). <https://noc.esdc.gc.ca/OaSIS>
- Occupation Shortage List (Australia). <https://www.jobsandskills.gov.au/work/occupation-shortage-list>
- OECD & SUSS-IAL (2025). Skills-First Readiness and Adoption Index: Methodological Note. OECD.
- SkillsFuture Singapore. Official Website. <https://www.skillsfuture.gov.sg>
- SkillsFuture Singapore. The Jobs-Skills Portal. <https://jobsandskills.skillsfuture.gov.sg/>
- SkillsFuture Singapore (2025). Skills Demand for the Future Economy Report 2025. <https://jobsandskills.skillsfuture.gov.sg/sdfe-2025>
- SkillsFuture Singapore (n.d.). Skills Framework. <https://www.skillsfuture.gov.sg/skills-framework>
- Statistics Canada. <https://www.statcan.gc.ca>
- Statistics New Zealand (2024). National Occupation List (NOL). First release November 2024, updated July 2025.
- Workforce Singapore. Official Website. <https://www.wsg.gov.sg/>