Improving Indigenous employment or entrenching labour market segregation? Using Artificial Intelligence and online job ads to evaluate employers' Indigenous recruitment strategies

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Abstract

This study derives insight into changing demand for Indigenous workers by applying artificial intelligence to identify Indigenous-focused job postings. A natural language processing algorithm is used to classify a national database of online job ads according to whether they encourage Indigenous applicants, require Indigenous cultural capability, prioritize Indigenous candidates or are not Indigenous-focused. The analysis reveals significant growth in Indigenous-focused job postings but they are disproportionately concentrated in three sectors and one occupation group. In addition, although employers in sectors such as arts and recreation are advertising well-paid and high-skilled roles to Indigenous workers, there are other sectors where employers tend to advertise their more low-skill and low-wage roles to Indigenous workers. We also find that Indigenous-focused job postings are not well-aligned with Indigenous career pathways. Our research offers practical insights for Indigenous employment policy and our methodology can also be applied to evaluate employers' recruitment strategies for other target groups.

JEL Codes: J15, J21, J78
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Introduction

Government policy aimed at addressing inequities in Indigenous employment (Department of the Prime Minister and Cabinet, 2020; Hu *et al.*, 2019; Hunter, 1997; International Labour Organization, 2019) has been associated with improvements in labour market participation for Indigenous peoples[1] (Gray *et al.*, 2013; Steering Committee for the Review of Government Service Provision, 2020). There is also evidence that the employment of Indigenous peoples can deliver unique benefits for organisations (Ens *et al.*, 2016; Giblin, 1989; Scheyvens *et al.*, 2021). Nevertheless, Indigenous peoples still experience higher rates of unemployment, are more likely to be employed at the low-skilled end of the labour market and experience lower job retention than non-Indigenous people (Hunter and Gray, 2017; Lamb *et al.*, 2020).

Differences in employment outcomes for Indigenous peoples can be understood as a function of differences in opportunity structures resulting from labour market segmentation (Bosanquet and Doeringer, 1973; Harrison, 1972; Harrison and Sum, 1979; Leontaridi, 1998; Piore, 1972; Wachter, 1974). Segmentation theory recognises that the labour market is composed of non-competing segments. High-skilled, stable jobs that attract good wages and offer progression opportunities form the primary segment of the labour market. Low-skilled, unstable jobs, with substandard wages and limited training and development opportunities are found in the secondary labour market. Institutional barriers prevent vulnerable groups in the population from benefiting equally from education and training, with the result that their choices are mostly limited to the secondary labour market (Blakely, 1994; Harrison, 1972; Leontaridi, 1998). Their ability to move to the upper segment of the labour market is further constrained by the lack of training and development opportunities in the secondary segment of the labour market (Ashton, 1988; Felbo-Kolding *et al.*, 2019; Kenrick, 1981).

Labour market segmentation is influenced by factors such as social class, race and sex, which affect employment opportunities prior to entering the labour market through financial circumstances, attitudes, knowledge and access to schooling and formal training (Ryan, 1981; Valtonen, 2001). Within the labour market, segmentation is reinforced through biased recruitment, career development and promotion practices (Ryan, 1981). It is also influenced by employment services and government-funded training programs, which nudge the unemployed into low-skill training programs that essentially limit their options to the secondary sector (Ashton, 1988).

Indigenous employment is influenced by all these factors and more. The

1 For brevity, we use the terms "Indigenous peoples" and "Indigenous workers" throughout the manuscript to refer to Aboriginal peoples, Torres Strait Islander peoples and people who identify as both Aboriginal and Torres Strait Islander. The term "workers" is used in place of "peoples" when referring to people who are actively engaged in the labour market, as defined by the Australian Bureau of Statistics (2021c).

experience of colonisation has had traumatic effects on Indigenous Australians, who endured the loss of their lands, massacres and deliberate destruction of their culture and way of life. The ongoing effects of this trauma are visible in the disparities in their health and social outcomes (Griffiths *et al.*, 2016). Racism is still experienced by Indigenous peoples today (Paradies and Cunningham, 2009), perpetuated not only through prejudice and discrimination (Jones, 2000) but also through social norms, inherited disadvantage and internalised racism (Jones, 2000). Although Indigenous participation in higher education is improving, it remains below the rate of non-Indigenous Australians (Steering Committee for the Review of Government Service Provision, 2020). Under the Australian Government's Reconciliation Action Plan (RAP) program, employers are encouraged to commit to increasing the number of Indigenous Australians in their workforce. Reconciliation Action Plans have now been adopted by over two thousand Australian organisations (Reconciliation Australia, 2021). However, targets for Indigenous employment usually do not consider quality of employment, even though labour market segmentation represents another means through which disadvantage is perpetuated.

In this study, we used artificial intelligence (applied to online job postings) to investigate whether employers' Indigenous recruitment strategies are likely to entrench or address labour market segregation. A natural language processing (NLP) algorithm was trained to identify 'Indigenous focused' job postings. The algorithm classified job postings according to whether they specifically stated that Indigenous Australians (or Indigenous cultural capability) were required in the role, or that Indigenous Australians were encouraged to apply for the role. By differentiating Indigenous focused job postings from other job postings (which do not specifically encourage or require Indigenous Australians or Indigenous cultural capability) it is possible to investigate the quality and diversity of the roles for which employers seek Indigenous workers. In addition, the study investigated whether the location and qualification requirements of Indigenous focused job ads align with the locations and qualifications of Indigenous workers.

Our approach

Employers use job postings to describe the attributes they seek from job applicants. On the advice of Indigenous recruitment experts, we identified three ways that employers express demand for Indigenous workers in job postings. The strongest signals of demand for Indigenous workers are 'Identified' job postings. These positions require an exemption or intention against legislation because the position requires confirmation of Indigeneity and is only advertised to (or gives priority to) Indigenous peoples. The second type of job posting, which we call 'cultural capability' job postings, states that Indigenous cultural capability is a desirable or essential criteria to perform in the role. Finally, 'encouraging' job postings include a statement to the effect that Indigenous applicants are welcomed or encouraged. To understand the diversity and quality of the roles being advertised

to Indigenous workers, we compare the characteristics (industry of employment, occupation type, skill level and wage level) of these three types of 'Indigenous focused' job postings relative to other ('non Indigenous focused') postings. In addition, we compare the location and qualification requirements of Indigenous focused job postings with information about the location of and qualifications held by Indigenous workers. This analysis of the diversity, quality and alignment of Indigenous focused job postings reveals whether employers' recruitment strategies are likely to address or reinforce Indigenous labour market segmentation.

This research was Indigenous led. Leadership from Indigenous researchers and experts was provided through an internal Steering Committee (who defined the research objectives and supported interpretation of the data) and an external Advisory Group (who provided advice on maximising impact while respecting the complexity and sensitivity of research involving Indigenous data and career aspirations). Members of the project steering committee are also represented as authors of this research paper.

Materials and methods

Datasets

Online job postings

The national dataset of online job postings was provided by Adzuna Australia. Adzuna Australia aggregate online job postings from hundreds of sources, including job postings listed directly on the Adzuna Australia jobs board and other jobs boards, listings from some of Australia's major newspapers and job postings 'scraped' from employer websites sites. Job postings are classified according to the geographic location of the role being advertised, industry of employment (ANZSIC major division; Australian Bureau of Statistics, 2013), qualification level (Australian Standard Classification of Education; Australian Bureau of Statistics, 2001) and broad field of education (Australian Standard Classification of Education; Australian Bureau of Statistics, 2001). Duplicate postings are removed using an algorithm developed by Zhao *et al* (2021). The representativeness of the dataset has been evaluated in relation to Australian Bureau of Statistics labour force statistics and other commercially available job posting datasets and found to correspond well (Duenser and Mason, 2019; D. Evans *et al*., 2023).

The dataset of 10,561,471 job postings covered the period from January 2016 to December 2022. Skill levels were assigned to job postings using the skill level classification provided within the ANZSCO occupation taxonomy (Australian Bureau of Statistics, 2009), which is based on the level of qualification or years of experience required in the role. Skill levels range from 1 (requiring a Bachelor degree or higher or at least 5 years of experience) to 5 (requiring a Certificate I, secondary school education or a short period of on-the-job training). To improve interpretability, skill levels were reverse

coded for the analysis (so that a higher score represented a higher skill level) and treated as a continuous variable (rather than a categorical variable) in the analyses.
An NLP-based algorithm was used to identify three types of 'Indigenous focused job postings', using the following criteria, provided by the project Steering Committee:

> *Identified/priority job postings:* Only Aboriginal and/or Torres Strait Islander people can apply for the role, with evidence (Confirmation of Aboriginality (COA)) required. In some cases, the job posting may specify that non-Indigenous people may be considered for the role if no Indigenous people apply or just that Indigenous applicants will be given preference in the selection process. The posting states an exemption or intention against legislation (this includes Federal or State legislation) as an Equal Opportunity, Genuine Occupational requirement or Welfare measure.
>
> *Indigenous cultural capability required:* Evidence of being an Aboriginal and/or Torres Strait Islander person is not required. Non-Indigenous people can apply for the role but it is either essential or desirable to have cultural capability or experience working with Aboriginal and/or Torres Strait Islander peoples to perform in the role. Cultural capability is demonstrated understanding of Aboriginal and/or Torres Strait Islander cultural knowledge, skills and expertise, or the ability to work effectively with Aboriginal and/or Torres Strait Islander peoples.
>
> *Encouraging Indigenous applicants:* Aboriginal and/or Torres Strait Islander peoples are welcomed or encouraged to apply for the position. Non-Indigenous people can apply for the role and Aboriginal and/or Torres Strait Islander cultural capability is not an essential or desirable criterion for the role.

Job postings were classified as both Identified and cultural capability required if they met both definitions. The accepted measures for assessing the accuracy of a multi-class algorithm such as this one are precision, recall and F1 scores (Sokolova and Lapalme, 2009; Tsoumakas *et al.*, 2010). The measure of precision reflects how stringent the classifier is in detecting true positives (true positives as a proportion of true positives and false positives). The measure of recall reflects the classifier's ability to detect true positives when they occur (true positives as a proportion of true positives and false negatives). The F1 score takes into account the trade-off between precision and recall, providing a measure of overall performance. To provide a benchmark for the performance of the algorithm, precision, recall and F1 scores were calculated from ratings provided by multiple human raters. Table 1 shows the performance of the algorithm and Table 2 shows the same performance metrics for human experts. The algorithm out-performs the human raters in terms of precision but human raters achieve better recall statistics. The F1 scores suggest that the overall performance of the algorithm in classifying Indigenous focused job postings is just slightly lower than that of human experts.

Table 1. Precision, recall and F1 scores achieved by the algorithm (when compared with the human classified gold label dataset of Identified, cultural capability required, encouraging or not Indigenous focused job postings)

Type of job posting	Precision	Recall	F1 score
Identified	1.00	0.45	0.62
Cultural capability required	0.51	0.85	0.64
Encouraging	0.55	0.84	0.67
Not Indigenous focused	0.75	0.67	0.71

Table 2. Precision, recall and F1 scores achieved by comparing multiple human raters classifying job postings as Identified, cultural capability required, encouraging or not Indigenous focused

Type of job posting	Precision	Recall	F1 score
Identified	0.75	0.90	0.82
Cultural capability required	0.67	0.50	0.57
Encouraging	0.71	0.62	0.67
Not Indigenous focused	1.00	0.67	0.80

Wage level

Wage levels were assigned to job postings using weekly earnings data (specifically, the average weekly total cash earnings) for each ANZSCO four digit occupation. These weekly earnings data were obtained from the 21 May 2021 Survey of Employee Earnings and Hours (EEH) (Australian Bureau of Statistics, 2021a) which is based on a representative sample of approximately 52,000 Australian employees.

Location and qualifications of Indigenous workers

The 2021 Census of Population and Housing dataset (Australian Bureau of Statistics, 2021d) was used to generate counts of the number of Indigenous and non-Indigenous workers within each SA4 geographic region (based on their Place of Work)[2] and their highest formal qualifications (using the QALLP field and the QALFP fields from the Australian Standard Classification of Education to assess level and field of education).

2 Statistical Area 4 or SA4 geographic regions represent one of the standard spatial units used for publishing labour statistics (Australian Bureau of Statistics, 2018). The population of SA4 regions ranges from 100,000 to 500,000 persons and they are designed to represent the labour markets of the largest regional cities.

Census statistics for the working population reflect the number of respondents who were active in the labour force (working for an employer, working in own business or unemployed but looking for work) in the week before Census night (10 August 2021). Counts of workers broken down by field of education or level of education are lower than counts of workers broken down by SA4 location because some workers do not have a post-school formal qualification. The Australian Bureau of Statistics protects Census participants' privacy by introducing random (minor) perturbation of the data.

Results

Frequency and diversity of Indigenous focused job postings

Indigenous focused job postings represented approximately 13 per cent of all jobs posted between 2016 and 2022 (1 per cent represented Identified positions, 2 per cent required Indigenous cultural capability and 10 per cent encouraged Indigenous applicants). All three types of job postings showed a strong, increasing trend over time (see Figure 1). It is worth noting that this growth trend flattened somewhat between 2019 and 2020 which was when COVID-19 created a significant downturn in employment. This effect suggests that demand for Indigenous workers was disproportionately impacted by the pandemic, suggesting that Indigenous employment remains especially sensitive to labour market downturns (Hunter, 2010).

Figure 1. Timeline of Indigenous focused job postings

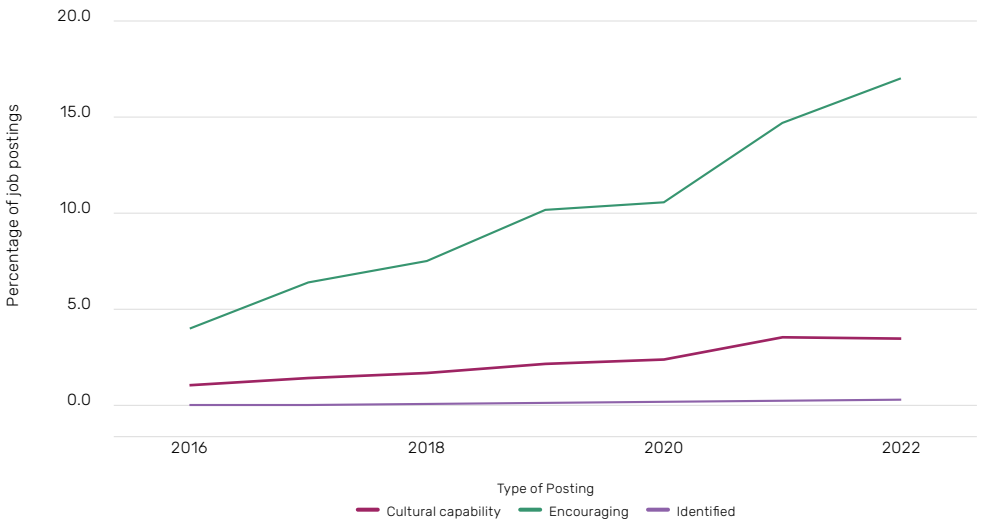


Figure 2 shows the same trends broken down by the industry division of the employer. It reveals that Indigenous focused job postings are concentrated in three sectors: public administration and safety, education and training, and health care and social assistance. Very few Indigenous focused job postings came from employers in other services, agriculture forestry and fishing, accommodation and food services, construction, transport postal and warehousing, financial and insurance services and manufacturing. Chi-square analyses (see Table 3) confirmed that the association between the industry division of the employer and the likelihood of a job posting being either Identified, requiring cultural capability or encouraging was statistically significant.

Figure 2. Industry divisions with a high and low percentage of Indigenous focused job postings

Table 3. Chi-square tests of independence for industry division and type of job posting

Type of job posting	df	X^2	p value
Identified vs. not Identified	18	24,940	0.000
Cultural capability required vs. not	18	214,862	0.000
Encouraging vs. not	18	587,225	0.000

In addition, certain occupational roles (in particular, community and personal service worker roles) were more likely to be Indigenous focused. Figure 3 visualises the proportion of Indigenous focused job postings over time, broken down by the type of occupation being advertised. Relatively few job postings for clerical and administrative workers, machinery operators and drivers, labourers and technicians and trades workers were Indigenous focused. Chi-square analyses (see Table 4) confirmed that the association between type of occupation and type of job posting was statistically significant.

Figure 3. Percentage of Indigenous focused job postings by year and major occupation group

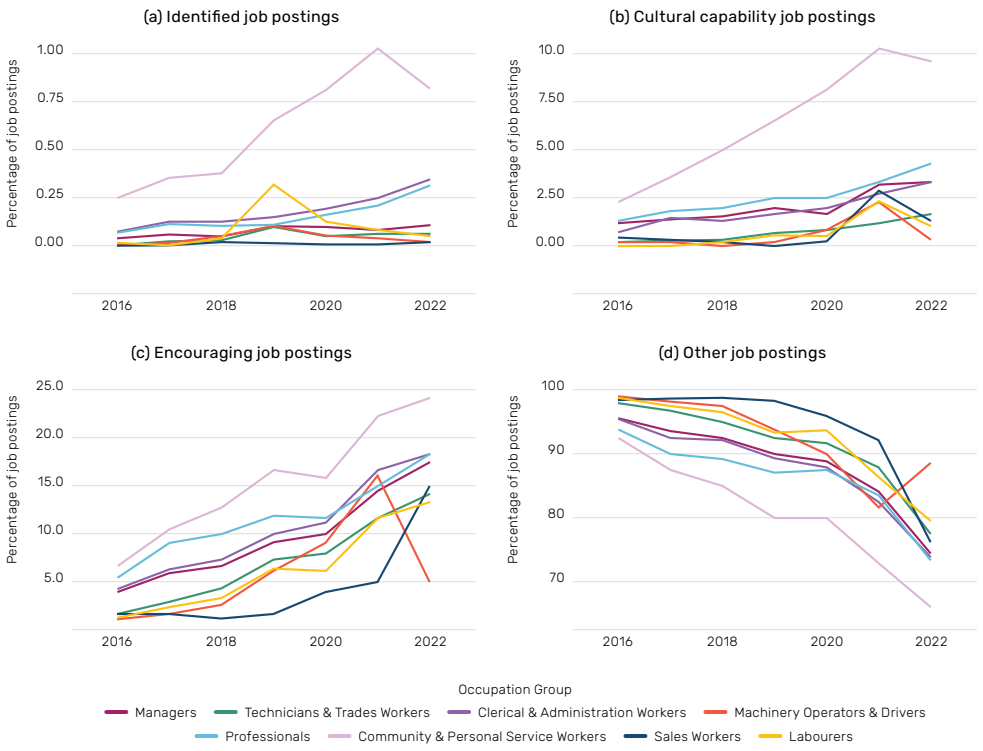


Table 4. Chi-square tests of independence for major occupation group and type of job posting

Type of job posting	df	X^2	p value
Identified vs. not Identified	7	16,009	0.000
Cultural capability required vs. not	7	111,129	0.000
Encouraging vs. not	7	127,074	0.000

Quality (skill and wage level) of Indigenous focused job postings

Having established that Indigenous focused job postings are not representative of job postings in general, the next step was to investigate the quality (skill level and salary level) of the roles being advertised to Indigenous job seekers. Since the likelihood of a job posting being Indigenous focused varies between industry divisions, a two-way Analysis of Variance was carried out, using both Industry division and type of job posting (Indigenous focused vs. not) as predictors of the skill and wage levels of the roles being advertised.

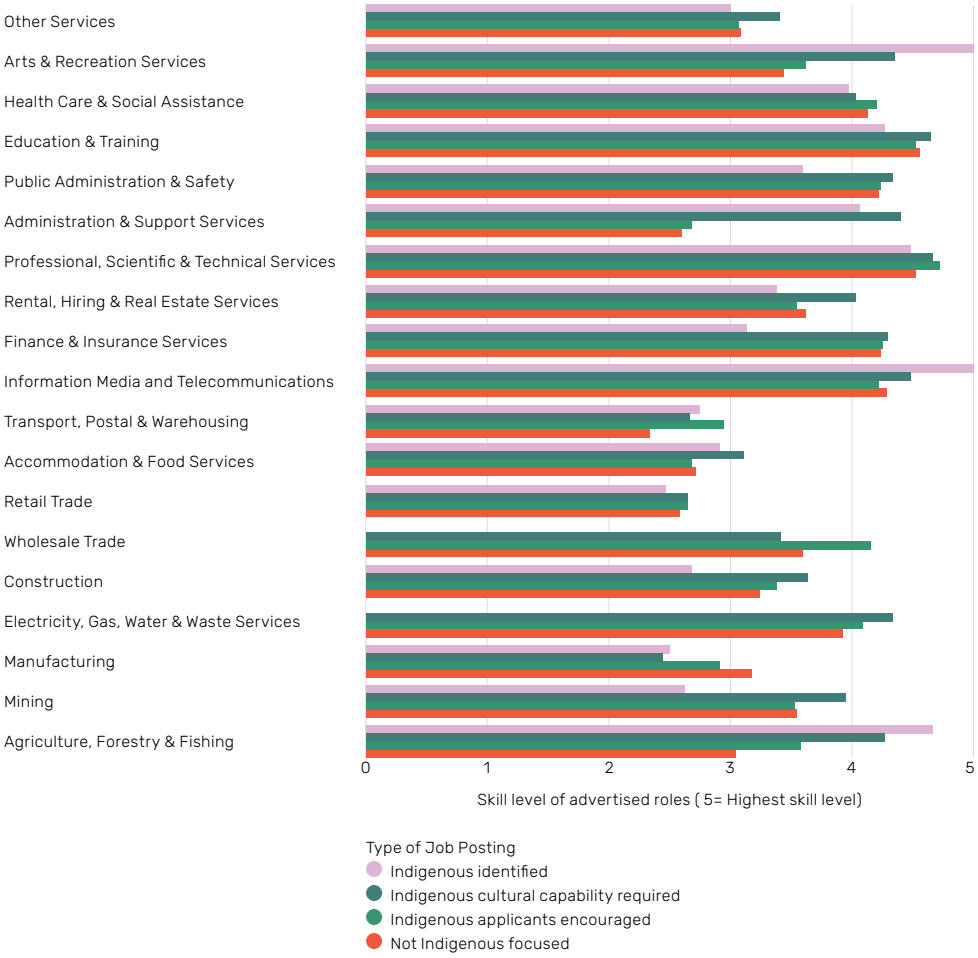
In the analysis predicting skill level, there was a significant two-way interaction, meaning that the relationship between type of job posting and skill level varied according to Industry division (see Table 5). Figure 4 visualises these effects. It shows variability in the average skill level of the roles being advertised in each industry division. For example, employers in the information, media and telecommunications divisions advertise more highly skilled roles (on average) than employers in retail trade. However, within each industry division there is additional variability in the skill level of Indigenous-focused job postings and non- Indigenous focused job postings. Identified job postings (represented by the lilac bar) tend to be for low-skill roles but in three industry divisions (information media and telecommunications, arts and recreation services and agriculture, forestry and fishing) this effect is reversed, with Identified positions being more high-skill on average than non-Indigenous focused job postings. Job postings requiring cultural capability (represented by the aqua bar) were more highly skilled than non-Indigenous focused (represented by the red bar) or encouraging job postings (represented by the green bar) except when posted by employers from the manufacturing industry division. Encouraging job postings are like non-Indigenous focused job postings in terms of their skill level, shown by the fact that the red and green bars tend to be similar in length within each Industry division.

Table 5. Comparing the skill level of Indigenous focused and other job postings across Industry Divisions

Source of variation	df	Sums of squares	F
Type of posting	3	143848	33763.29***
Industry division	18	5140412	201088.79***
Interaction	51	21114	291.52***
Error	10453701	14845937	

***p < .001

Figure 4. Skill level of Indigenous focused and other job postings



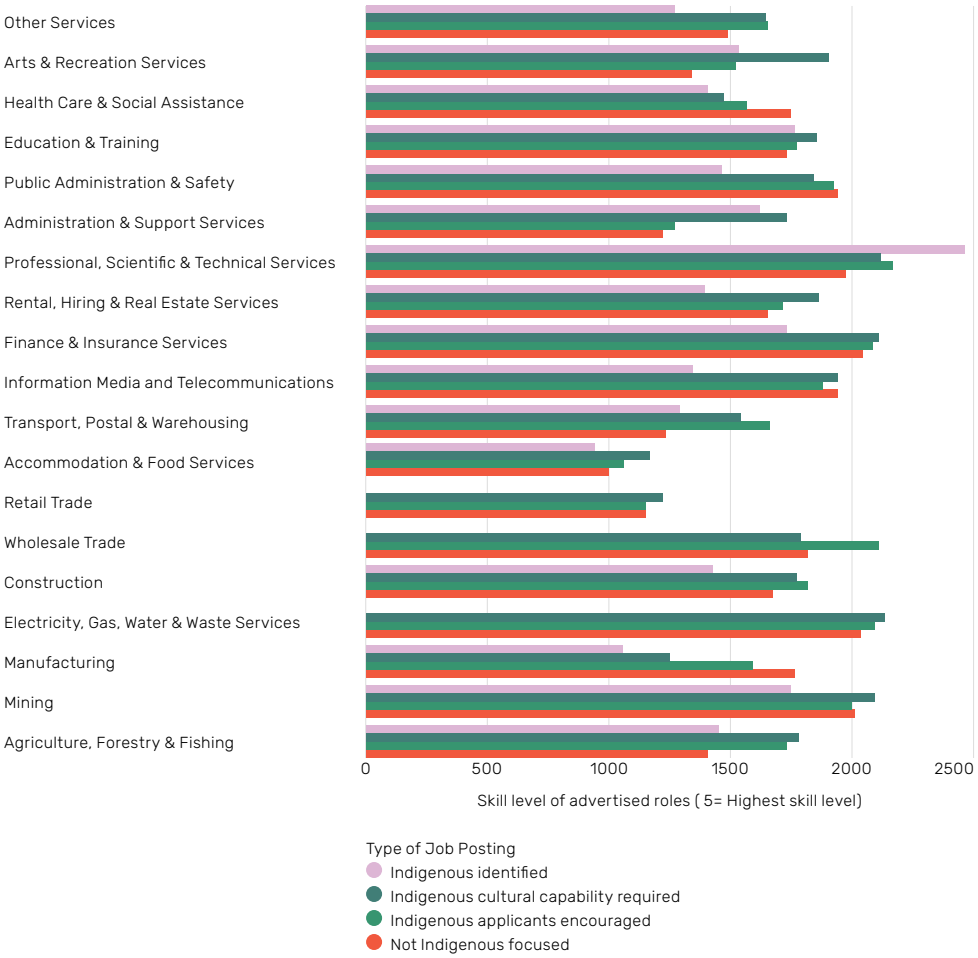
Since most job postings do not specify the salary offered in the role, the wage level associated with each job posting was calculated from weekly earnings data for occupations published by the Australian Bureau of Statistics (Australian Bureau of Statistics, 2021b). Again, there was a two-way interaction wherein both industry and type of job posting were associated with the average wage level of the roles being advertised (see Table 6). As shown in Figure 5, Identified job postings were usually for low wage occupations, except when they were posted by professional, scientific and technical services employers or administrative and support services employers. In other words, the Identified roles that employers create are for occupations that tend to attract low wages. The wages attached to roles that required cultural capability or encouraged Indigenous applications were mostly similar to the wages associated with non-Indigenous focused postings. However, the effect did vary according to industry division. For example, when employers in manufacturing and healthcare and social assistance advertise roles that require cultural capability, they tend to be in lower wage occupations than the other roles advertised by these employers.

Table 6. Comparing the average weekly earnings of Indigenous focused and other job postings across Industry Divisions

Source of variation	df	Sums of squares	F
Type of posting	3	3991100000	2585.67***
Industry division	18	1032300000000	111463.27***
Interaction	51	22810000000	869.27***
Error	10520669	5413100000000	

***p < .001

Figure 5. Wage level of Indigenous focused and other job postings

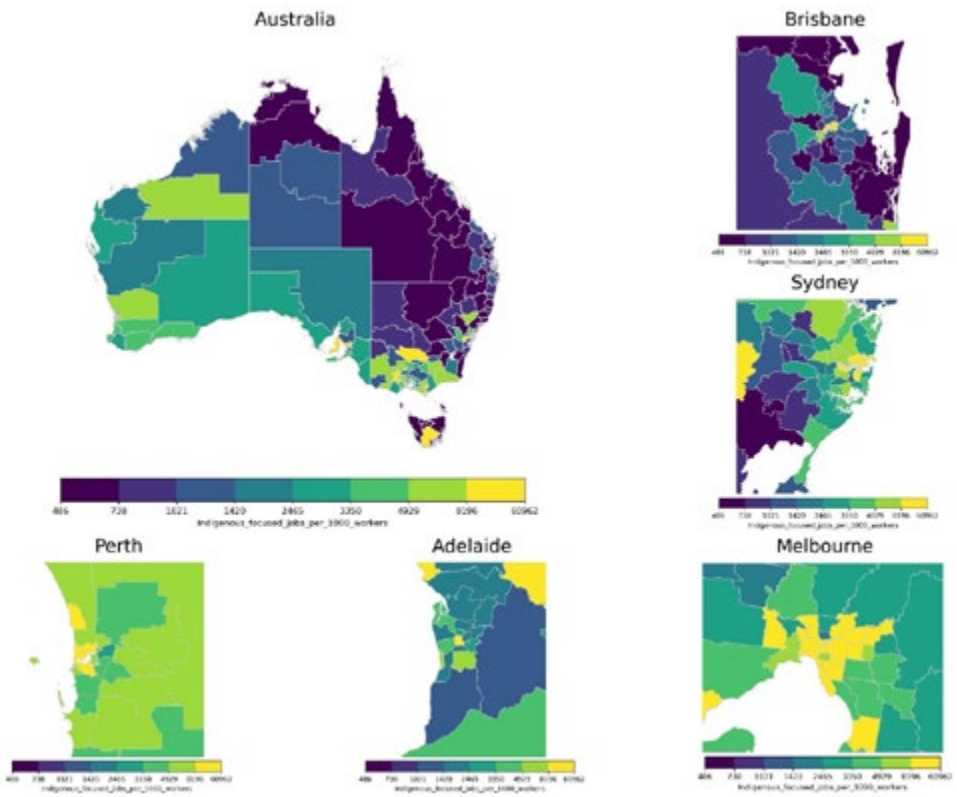


Alignment of Indigenous focused job postings

The analyses reveal some sectors where employers are using Indigenous-focused job postings to attract Indigenous workers to more high skill and salary roles. The impact of these efforts will depend on whether they are aligned with the career paths of Indigenous workers. Alignment is important given that Indigenous workers represent just over 2 per cent of the labour market and less than 1 per cent of workers with a Bachelor or higher degree (Australian Bureau of Statistics, 2021d).

In Figure 6, each region in Australia is colour coded based on the ratio of Indigenous focused job ads (between 2016 and 2022) per thousand Indigenous workers living in the region (at the time of the 2021 Census). The map shows that demand for Indigenous workers is concentrated in the capital cities (notably Sydney and Melbourne), but Indigenous workers live in regional and remote areas as well as the capital cities. In consequence, in one region of Australia there are only 39 Indigenous focused job postings per thousand Indigenous workers and at the other extreme, another region has 69,699 Indigenous focused job postings per thousand Indigenous workers.

Figure 6. Regional variability in the ratio of Indigenous focused job postings to Indigenous workers



To explore this issue in further detail, we calculated location and qualification quotients. Location quotients are a ratio of ratios that quantify how concentrated a particular industry, cluster, occupation, or demographic group is in a specific geographic region as compared to a reference area (e.g., the nation as a whole; Crawley *et al.*, 2013;

Miller *et al.*, 1991). Therefore, the location quotient for Indigenous focused job postings compares the proportion of job postings that are Indigenous focused in a particular region to the proportion of job postings that are Indigenous focused in the nation overall.

There are two, mathematically equivalent ways of calculating a location quotient:

$$\frac{(RIF/AIF)}{(R/A)} = \frac{(RIF/R)}{(AIF/A)}$$

RIF represents the number of Indigenous focused job postings in the region and AIF represents the number of Indigenous focused job postings in Australia. R is the total number of job postings in the region and A is the total number of job postings in Australia. The calculation is demonstrated with data from the Murray region of New South Wales. Out of the 22,384 job postings for the Murray region, 4,754 are Indigenous focused. This ratio is compared with the national ratio. Out of the 8,158,735 job postings in Australia, 865,863 are Indigenous focused. The two ratios are divided to produce the location quotient for Murray Region:

$$\frac{RIF/R}{AIF/A} = \frac{4{,}754/22{,}385}{865{,}863/8{,}158{,}735} = 2$$

A location quotient of less than one indicates that the region has 'less than its share' of Indigenous focused job postings relative to the rest of the nation. Conversely, a location quotient of more than one means that the region has 'more than its share' of Indigenous focused job postings. The location quotient of 2.00 for the Murray region indicates that the proportion of Indigenous focused job postings in this region is twice the proportion of Indigenous focused job postings for Australia as a whole.

To investigate whether the high demand for Indigenous workers in the Murray region is matched by a high proportion of Indigenous workers, a second location quotient is calculated, using employment data from the 2021 Census of Population and Housing. Out of the 53,408 workers in the Murray region of New South Wales, 1,372 identify as Indigenous. The total number of workers across all SA4 locations in Australia is 11,517,220, and of these, 246,988 identify as Indigenous. These figures can be used to calculate the Indigenous workers location quotient for the Murray region:

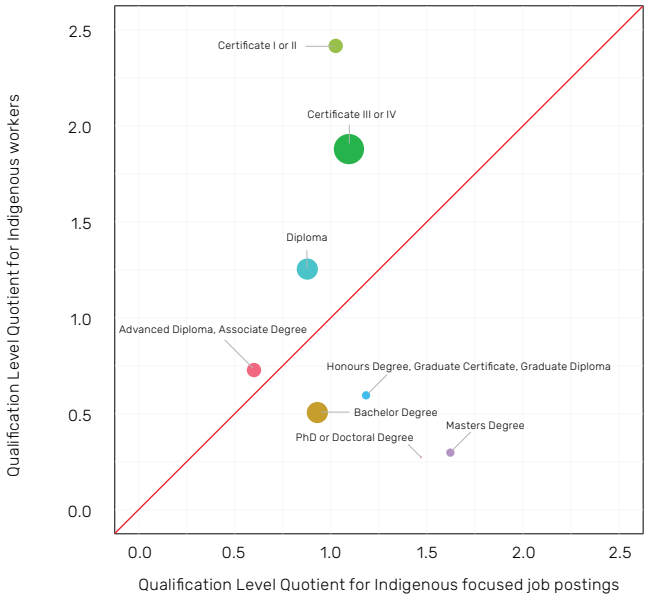
$$\frac{RIF/R}{AIF/A} = \frac{1{,}372/53{,}408}{246{,}988/11{,}517{,}220} = 1.2$$

The Indigenous workers location quotient of 1.2 means that the proportion of Indigenous workers in the Murray region is 1.2 times the proportion of Indigenous workers in Australia. Together, the two location quotients indicate that demand for Indigenous workers in the Murray region is twice as high than it is elsewhere in Australia but the proportion of Indigenous workers in the region is only 1.2 times higher than elsewhere in

Australia. Employers are therefore likely to find it challenging to recruit workers from the Murray region (relative to employers recruiting from other regions of Australia).

Comparing these demand- and supply-side location quotients (see Figure 7) reveals areas of misalignment in the Indigenous labour market. Each region of Australia is represented as a circle, with the size of the circle reflecting the size of the Indigenous workforce in the region. Regions that are far from the red diagonal line represent locations where demand for and supply of Indigenous workers is poorly aligned. For example, in the Queensland Outback there are two Indigenous workers for every Indigenous focused job posting; here, the supply of Indigenous workers is high relative to demand. Yet in the Western Australian Wheat Belt region there are more than four Indigenous job postings for each Indigenous worker. Employers seeking to recruit Indigenous workers for roles in the Western Australian Wheat Belt region will find it especially challenging.

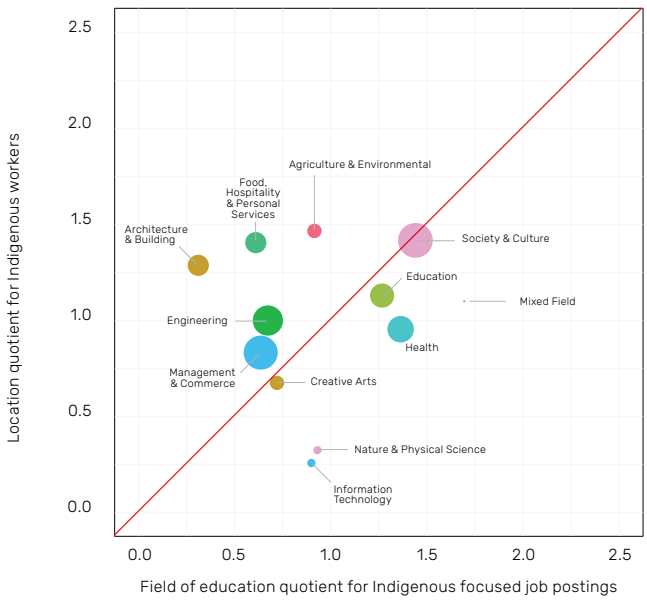
Figure 7. Alignment between demand for and supply of Indigenous workers based on location



This recruitment challenge will be magnified if the qualifications required in the roles are not aligned with the qualifications held by the Indigenous workers in the region. To investigate how qualification requirements contribute to labour market misalignment, the same formula is used to calculate field of education quotients. The Indigenous focused job postings quotients are based on job ads that specify a formal qualification in a specific field of education is required. A field of education will have a high Indigenous focused job postings quotient if the proportion of Indigenous focused job postings (relative to all job postings) is higher for job postings requiring qualifications in that field relative to job postings requiring qualifications in other fields. The corresponding Indigenous workers field of education quotient assesses whether the representation of Indigenous workers (within the pool of workers with qualifications in a specific field of education) is high or low relative to the representation of Indigenous workers across all fields of education. The figures for these analyses are captured from the 2021 Census of Population and housing.

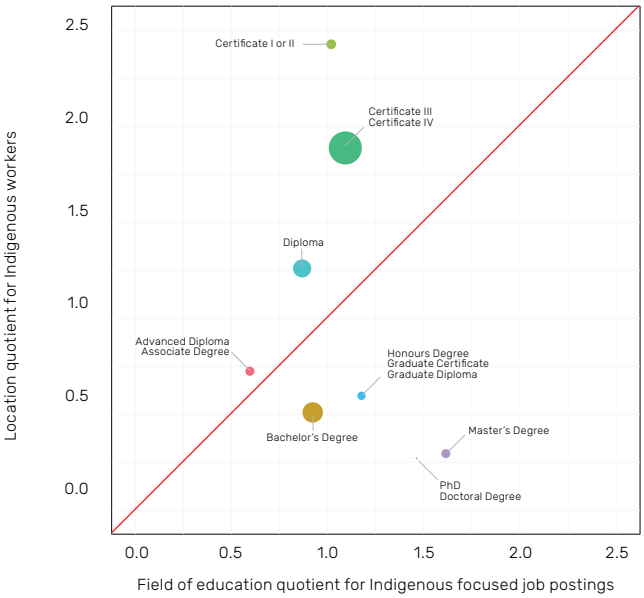
The two sets of field of education quotients are visualised in Figure 8. In this visualisation, the size of the circles reflects the number of Indigenous workers with qualifications in the relevant field. When the field of education is close to the red diagonal line, there is good alignment between demand for and supply of Indigenous workers in that field. The figure shows that demand for Indigenous workers in the fields of Information Technology and Natural and Physical Science is high relative to supply. Conversely, the supply of Indigenous workers with formal qualifications in Architecture and Building is high relative to demand.

Figure 8. Alignment between demand for and supply of Indigenous workers based on broad field of education



The same method can be used to compare the concentration of Indigenous workers and Indigenous focused job postings at different levels of formal education. The two sets of Qualification level Quotients are displayed in 9. In this figure, the size of the bubbles reflects the number of Indigenous workers with qualifications at that level. Figure 8 reveals that the challenge of attracting an Indigenous worker to fill an Indigenous-focused job posting is greatest when the role requires a Masters degree.

Figure 9. Alignment between demand for and supply of Indigenous workers based on level of qualification



Discussion

Using AI to analyse job postings reveals the lack of diversity in employment opportunities targeted towards Indigenous workers and opportunities to improve employers' Indigenous recruitment strategies. Despite a rapid increase in Indigenous focused job postings, demand is concentrated in three Industry divisions (public administration and safety, healthcare and social assistance and education and training) and one major occupation group (community and personal service workers). In some sectors (notably manufacturing, mining, construction), these employment opportunities

are concentrated in the secondary segment of the of the Australian labour market. However, there are a few sectors (arts and recreation, information, media and telecommunications, professional, scientific and technical services) where employers seek to attract Indigenous workers to high-skill and well-paid roles. The efforts of the latter employers are hindered by lack of alignment between the qualification and location requirements of Indigenous focused job postings and the actual locations and qualifications held by Indigenous workers.

This study was designed to provide insight into the extent to which employers' Indigenous recruitment efforts are likely to improve the quality of Indigenous employment. We find that efforts to recruit Indigenous workers (by posting Indigenous focused job ads) are strongest in the sectors with the highest proportion of public sector employment. We also observed a surge in advertised Identified positions in the South Australia (SA) health sector between the years 2021 and 2022 when there was an audit of institutional racism (Marrie and Bourke, 2020) and the release of the SA Rural Aboriginal Health Workforce Plan 2021-26 (South Australia Health, 2021). These patterns suggest that government targets aimed at improving the representation of Indigenous peoples in the workforce (e.g., Aboriginal Employment Unit, 2017; Australian Public Service Commission, 2019) are effective. However, it was employers in other sectors that were targeting Indigenous workers for their high-skill well paid roles. In addition, Identified job postings, which are designed to be filled by Indigenous peoples, tend to be for relatively low skill and low wage roles. Unless employers invest effort in upskilling Indigenous workers after they enter the organisation, these Identified positions will entrench existing differences in the skill level and earnings achieved by Indigenous workers.

The growth in other types of Indigenous-focused job postings (cultural capability and encouraging) is positive, in that it suggests employers have become more aware of the unique knowledge and capability offered by Indigenous peoples and the need to redress disadvantages experienced by Indigenous peoples. However, our findings suggest that they are not well aligned with the career pathways of Indigenous workers. Indigenous job seekers have the option to move to where a job is located and students can choose qualifications that align with demand in the labour market. Nevertheless, employment outcomes are poorer for Indigenous workers who live further away from labour markets (Biddle, 2010). If employers wish to improve the likelihood of attracting Indigenous workers to their organisation, they should consider how they might improve the alignment between the roles that they advertise to Indigenous workers and the career pathways chosen by Indigenous workers in the labour market.

Practical implications

The study suggests several strategies for addressing labour market segmentation. Geographic differences in the locations of Indigenous workers and employers seeking

to recruit these workers are a key source of misalignment in the labour market. Since nearly half of the Indigenous population live in predominantly rural regions, remote work arrangements represent a means through which employers in the cities could gain access to a larger pool of Indigenous workers. Remote work arrangements also have the potential to reduce the tension that can be experienced by Indigenous peoples who wish to progress their careers while maintaining their cultural identity and their connection to family, community and Country (Parkes *et al.*, 2015; Smith *et al.*, 2018). In addition, employers can improve their chances of attracting Indigenous workers by targeting Indigenous workers in fields such as architecture and building and agriculture and environment, where qualified Indigenous workers are well represented.

The research also reveals low engagement from Indigenous workers and employers in in STEM fields. The low number of Indigenous peoples with STEM qualifications is problematic because STEM qualified workers are in high demand (Leigh *et al.*, 2020; Qiyomiddin, 2024). Furthermore, there is likely to be increased demand for Indigenous workers in STEM organisations as the rights of Indigenous peoples to maintain, control, protect and develop their Indigenous Cultural and Intellectual Property becomes more widely recognised. To engage more Indigenous peoples with STEM careers, it is necessary to work with Indigenous communities at early stages of education since Indigenous students are under-represented in science subjects in high school (Cooper *et al.*, 2020). Students who have more contact with employers at school and University raise their career aspirations (Hughes *et al.*, 2016) achieve higher wages (Jackson and Bridgstock, 2020; Kashefpakdel and Percy, 2017; Percy and Mann, 2014), gain confidence and identify more ways of achieving their career goals (Mason *et al.*, 2022). STEM employers who are committed to improving the representation of Indigenous peoples in their field should be engaging with Indigenous students when they are still in school. STEM education could also be made more inclusive by giving coverage to Indigenous peoples' ways of building scientific knowledge and their deep understandings of weather, ecology, land management, medicine and astronomy (Christie, 1991; Green *et al.*, 2010; Norris and Hamacher, 2011; Oliver, 2013; Snively and Williams, 2008) in the science curriculum.

This research also provides valuable data to inform the education and employment decisions of Indigenous peoples (workers, students, carers, advisors). Educational outcomes are improved when Indigenous communities are empowered with information about the value of education (Dreise *et al.*, 2016). The data captured from job postings reveals the wide range of employers who seek Indigenous workers with high levels of formal education, providing evidence that educational investment will lead to employment (Dreise *et al.*, 2016).

Limitations

A limitation of this study is that it relies on job postings to identify where employers are seeking to attract Indigenous workers. It is possible that some employers who seek to attract Indigenous workers do not state this explicitly in their job postings. Moreover, the wording of job postings may not be a reliable indicator of cultural sensitivity and quality of employment. Establishing a business case, partnering with other organisations (e.g., specialist Indigenous employment services providers), investing in cultural competency training and supporting recruits with mentors are also recommended when seeking to attract and retain Indigenous workers (Generation One, 2013). Further research is needed to determine how many of the employers with Indigenous focused job postings provide a culturally safe environment, engage with Indigenous students in school and support the upskilling that is required to address the structural factors that lie behind continuing differences in opportunities for Indigenous Australians (Hunter, 1997; Karmel *et al.*, 2014; Stephens, 2010; Walter, 2015).

Directions for further research

Gaps in employment outcomes for Indigenous peoples relative to non-Indigenous peoples remain an issue around the world (Hu *et al.*, 2019; International Labour Organization, 2019). This study illustrates a novel method for investigating the extent to which employers' recruitment strategies are helping to increase the diversity and quality of employment opportunities for Indigenous peoples. The same method could be applied to monitor and evaluate employers' efforts to improve the representation of other diversity target groups and gain much needed insight into employers' engagement with these groups and the quality of the employment opportunities they provide. Moreover, big datasets of online job postings enable granular insights, making it possible to focus on opportunities in specific fields (e.g., public sector or private sector, STEM or non-STEM), geographic locations or occupations of interest.

A small but nevertheless important segment of the labour market that we did not focus on in this study is indigenous-owned businesses. Indigenous entrepreneurship represents an important means through which Indigenous peoples can create their own, culturally appropriate and high-quality career opportunities (Collins and Norman, 2018; Hunter, 2015b). The Australian government is supporting the growth of Indigenous businesses through preferential procurement policies, business grants and loan schemes (M. Evans and Polidano, 2022b). Indigenous-owned businesses achieve substantially higher rates of Indigenous employment than other Australian businesses across all of the industry divisions that they operate in (Eva *et al.*, 2024; Hunter, 2015a). The success of Indigenous-owned businesses in this regard has been attributed to both cultural and

geographic factors. Not only do Indigenous-owned businesses offer a culturally safe work environment, they are well-represented in the remote communities where Indigenous peoples live (Eva *et al.*, 2024). Further research exploring the relative importance of cultural and geographic factors for Indigenous workers' employment decisions would be desirable since it could inform non-Indigenous businesses' strategies for attracting and retaining Indigenous workers.

Finally, this study reveals the rapid growth in employers posting Indigenous focused job advertisements. There is currently no evidence as to whether Indigenous focused job postings are more likely to attract Indigenous applicants. In a focus group with Indigenous university students (carried out to inform our work in this space) we were told that jobs requiring Indigenous cultural capability are more desirable than Identified positions, since the latter can be associated with stigma. On the other hand, research carried out for the Australian Indigenous Employment Index (Minderoo Foundation, 2022) revealed that Indigenous employees had positive attitudes towards Identified roles. Systematic research is needed to determine whether the wording of job postings influences Indigenous job seekers, and if so, what information (e.g., statements encouraging Indigenous people to apply versus information about culturally sensitive workplace arrangements) is most useful for their decision-making.

Conclusion

The research reveals strong growth in employers seeking Indigenous workers through job postings. However, the diversity of these employment opportunities remains limited and the quality of the roles of being advertised varies according to the industry of employment. Importantly, the research reveals opportunities to strengthen the efforts of those employers who seek to engage Indigenous workers in high quality roles, by aligning their workforce strategies to reflect the geographic location and formal qualifications of Indigenous workers. Finally, the study illustrates a novel methodology that can be used to monitor progress in addressing labour market segmentation.

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