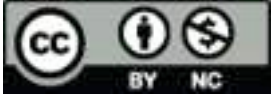




Reimagining the workforce: the Victorian rolling stock context

Literature review



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This report is one of a seven reports relating to the ‘Reimagining the workforce: building smart, sustainable, safe public transport’ research project. The complete suite of reports is as follows:

1. The Victorian rolling stock context. Literature review.
2. Community perceptions of careers working with rolling stock.
3. Organisational context assessment of inclusion and innovation in the Victorian rolling stock sector.
4. Training for a future rolling stock workforce.
5. The economics of rolling stock manufacturing, maintenance and operations for Victoria’s public transport sector.
6. Building smart, sustainable and safe public transport. Workshop context paper.
7. Reimagining the workforce for public transport: Interim action plan.

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Purpose

The purpose of this literature review is to provide the current industry context and outline a theoretical basis to support the research project Reimagining the workforce: building smart, sustainable, safe public transport. This project is funded by the Victorian Department of Transport and the Rail Manufacturing Cooperative Research Centre (RMCRC). The project aims to understand the current needs associated with the future public transport rolling stock workforce in Victoria, and in particular, the strengths, opportunities and challenges presented in overcoming the projected skills and capability crisis it currently faces and the need for innovation. It examines the different organisations who manufacture, maintain and operate rolling stock, and the influences that shape these, such as the procurement process, culture and the community.

The review is presented in five sections to provide an overview of the system in which both the issues outlined above exist in the Victorian public transport workforce. The aim of the review is to present a holistic overview of the local context, but it also draws on international literature to understand the deeper underlying issues.

Section 1: Introduction by Roger Jones, Celeste Young and Kumi Heenetigala

This section outlines the current industry composition and workforce within public transport with a focus on the Victorian context.

Section 2: Building innovative and inclusive organisational cultures by Celeste Young with contributions from Neil Parry

This section reviews the current literature relevant to organisational culture, innovation, and diversity and inclusion in the public transport sector workforce context. It examines the current status of the above issues and also examines the opportunities, barriers and complexities related to both retention and attraction of both the current and future workforce. Its focus is the Victorian and Australian context, but it touches on international literature in order to identify relevant studies that provide insight into the workforce.

Section 3: The community context by Daniel Ooi

The section summarises the existing body of work related to community perception of careers in rolling stock. This includes the extent to which the Australian and international community view careers in rolling stock as attractive, as well as the extent to which demographic changes among young job-seekers and changes in social and cultural values in relation to work, have changed the landscape for securing the future workforce in rolling stock. It also addresses the current understanding of the changing landscape of gender and cultural diversity of contemporary Australia in terms of career attraction, and ways in which understanding this might contribute to securing the future workforce in rolling stock.

Section 4: Skills gaps and training in the rail industry by Kumi Heenetigala

The Australian rail industry is currently undergoing significant expansion. Growth in population has led the government to commit over \$100 billion on rail investment in the next ten to fifteen years to meet the future demand of the expanding population for public transport throughout Australia. Increase in the number of large-scale projects requires expansion in the workforce in the rail industry. This requires identifying the skill shortage and training to meet the current and future needs of the rail workforce. This section will focus on skill shortage, the training requirements of the current and future workforce and availability of training to meet this shortage in Australia.

Section 5: The policy context by Celeste Young, Roger Jones and Neil Parry

This section covers the history of governance in Victoria, which has shaped the current industry structure. International trade policy and how it affects the public procurement of rolling stock is also examined.

Section 6: The economic context by Roger Jones and Sidney Lung

This section discusses the economics of procurement, first at the international scale, and then how it affects Victoria, addressing the procurement policies described in Section 1. The economic outlook internationally and in Victoria is then discussed. Finally, the economics of workforce and training issues is discussed with the aim of identifying the factors that lead to a sustainable workforce and industry.

Methodology

Google Scholar, Google Web, and the Victoria University databases were searched to identify academic and non-academic literature during August to October 2019. The authors of each section undertook word searches related to their research area, and selected documents for review based on relevance and suitability for the research currently being undertaken.

Executive summary

The focus of this literature review is the Victorian public transport rolling stock sector encompassing the design, manufacturing, maintenance and operations of trains, trams and light rail, and buses. This makes up a diverse industrial ecosystem of private and public organisations and stakeholders across government, business and the community. Most previous assessments have pursued specific interests, and to date there has been little that provides a system-wide overview of the sector's nature or scope.

Changing communities, organisational structures and the emergence of digital and cyber technologies (Industry 4.0) are transforming public transport. Increasing demand for rolling stock requires a skilled workforce able to adapt and respond to these changes in a way that builds resilience across the whole supply chain. The future workforce is central to this, so the sector needs to look beyond its current technological focus to the people needed to enable and sustain these changes.

Workforce issues have been present and recognised for some time, with a number of reports over the last 13 years finding:

- The need to improve organisational and workforce culture
- The need for cross-sectorial/organisational collaboration
- Issues with attraction and retention of employees
- Lack of a strong positive image of the sector
- The need to build a more diverse and innovative future workforce
- The need to build new capability and skills.

The BIS Oxford Economics 2018 report brought into sharp focus the need for the sector to focus on its workforce issues – particularly in relation to its ageing workforce and the impending loss of skilled labour through retirement. Achieving sustainable solutions to these issues provides a considerable challenge, as many of these issues are deeply entrenched and reinforced by long-standing cultural and structural aspects of rolling stock organisations and institutions. Addressing these will be a long-term prospect, requiring an understanding of where organisations have agency to act and what the most effective actions are likely to be.

The literature relating to rolling stock is diffuse. Data and analysis of the current state of the workforce and progress made to date, and the economics that underpin it, are patchy and/or non-existent. Regarding the community, there is limited literature that offers the insights needed to guide organisations in understanding who their potential future workforce may be, and how they can be most effectively recruited. It is also unclear as to what level of innovation or inclusion exists within the current supply chain, or the broader social and environmental benefits generated through procurement. As a result, it is not possible to ascertain the current composition of the workforce, where strengths and capabilities exist, or what the most effective economic and social levers are. Since 2006, specific recommendations in relation to workforce issues have been periodically raised and repeated, which suggests that deeper systemic issues are yet to be fully understood or addressed.

The evolution of the digital and cyber technologies and advanced manufacturing, is commonly referred to as the Fourth Industrial Revolution or Industry 4.0, which has increased global demand for those with science, technology, engineering and mathematics (STEM) skills. There is also a general shortage across industry of skilled trade employees, those with STEM skills and general digital literacy, particularly women (BIS Oxford Economics, 2018; PricewaterhouseCoopers [PwC], 2006). Many of the reports reviewed also suggest that the rolling stock sector exists within an inward and change-resistant culture, which can create barriers to workforce development and retention of younger employees, women, people from different cultural backgrounds, and those with non-standard skills and abilities.

Increasing demand and the potential for a more sophisticated approach to procurement, particularly local content and social procurement, offer substantial and immediate opportunities for sector renewal at a local level.

Key findings

Building innovative and inclusive organisational cultures

The lack of literature and data on workforce composition continues through to the existing specific people-based skills and capabilities needed to transition the current rolling stock workforce, and build and maintain a resilient future workforce. The literature contains a clear articulation of the problem and potential solutions, but little that provides practical support as to how to implement actions to achieve these outcomes that account for the different contexts and cultures across the rolling stock sector.

Knowledge gaps and needs include:

- Determine the current status of workforce progress in the industry
- Determine the prevailing decision making structures that shape organisational actions
- Develop a better understanding of the different types of organisational cultures to assist in developing practical solutions tailored to suit context-specific problems
- Identify similarities and differences in values and narratives across organisations in the rolling stock ecosystem that inform culture and decision making
- Understand current levels of inclusion within public transport organisations, and how inclusion manifests in practice
- Ascertain what organisational capabilities exist to enable transition, what is needed, and how these can be leveraged
- Establish the collaborative capability of the sector, and what collaborative models are possible within the current context.

The community context

The literature review of cultural values and career aspirations reveals a knowledge gap in terms of how to make careers in rolling stock more attractive. Central to this is the shifting attitudes of younger employees influencing the values that drive how they make career choices. While the existing literature on the work values of young people and theories of generational difference is useful, it is important to note that young people are highly segmented in other ways about work values – notably class, education, gender, geography, and cultural background. The literature on millennials tends to over-emphasise intra-age set difference above otherwise real and important inter-group differences. This is especially important considering the other forms of diversity of the potential applicant pool for rolling stock, that of gender and cultural diversity. The values of prospective job seekers have also changed due to greater cultural diversity. Increasing engagement of job seekers from non-Western cultural backgrounds necessitates:

- An increased understanding of the values of various diverse cultural groups in Australia in relation to prestige, career status, and occupational livelihood
- An increased understanding of the varying roles played by parents across different cultural minorities in Australia, in determining and influencing their children's career choices, especially with regard to STEM and rolling stock careers
- Understanding the varying importance of career attributes such as job security, social mobility, and flexibility for culturally diverse groups in Australia, and how the differing perception of these job attributes in relation to rolling stock careers influences attraction to the sector.

Skills and gaps in training in the rail industry

The literature review reinforced previous findings that specific training is needed to build a skilled workforce that is able to adopt new technologies and innovation. A number of training strategies have been identified and are currently being used by universities, RTOs and TAFEs to deliver courses, from certificates to degrees. Australia has also adopted the Australian Quality Training Framework to ensure consistent, high quality training and assessment for vocational education and training systems (VET). The TLI Transport and Logistics Training Package provides the nationally recognised VET, which covers the skills required for light rail and train, and the qualifications for occupations related to these. There is a lack of clarity of the specific training needs related to rolling stock, particularly in relation to delivery of training. It is worth noting that currently there are a number of organisations who are conducting in-house training.

Current needs are:

- To identify skills shortages related specifically to rolling stock, the type of training conducted and organisations that are conducting training
- To understand what future training needs are, particularly in relation to new technologies
- For training and education to attract and retain the workforce in the sector and to improve the understanding of the value of TAFE
- To address the current deficit of trainers and educators across the sector.

The Victorian policy context

The policy context for rolling stock in Victoria is primarily set by government procurement. It is diffuse, spanning multiple areas of policy and emergent in certain areas.

- Victoria's procurement policy provides incentives to increase diversity and inclusion and innovation within the workforce, and increase the participation of local businesses
- Demand-side procurement can be used to support innovation to increase social and environmental benefits, where these needs are not being met by normal market mechanisms
- Further work is needed to clarify how the different areas of policy across government connect and interact, and how these can be best leveraged to increase benefits to the local workforce and economy.

The economic context

Internationally, the rolling stock sector is experiencing rapid changes in technology, but is also highly competitive, and under pressure to deliver lower life-cycle costs for rolling stock, while improving their service delivery of passenger vehicles. The sector in Victoria is subject to the same pressures. International trade policy allows government a substantial role in procurement, specifically with SMEs, with the latest research suggesting that local procurement creates limited distortion of prices because volumes are too low. This allows governments a fair degree of leeway when designing procurement strategies and assessing value for money. Procurement agreements can be designed to:

- Deliver new technology, with the government as purchaser
- Support SMEs to innovate through technology transfer and to generate new intellectual property
- Deliver social and environmental outcomes as public good benefits by specifying employment, training and environmental conditions.

Quantified estimates of the economics of skills shortage and training in the rolling stock industry are hard to find in the economic literature. The following are areas of interest for further research:

- Assessment of the cost and benefit of providing training versus the opportunity cost of not providing the training
- The efficiency difference between private provision of training and public provision of training, and who pays for the training cost (private funding, public funding, trainee contribution and a share cost model)
- The economic benefit to trainer, trainee, the firm employing the skilled worker, and the local and national economy
- The cost and benefit of importing skilled workers by temporary visa compared with locally-trained skilled workers.



Introduction

Roger Jones, Celeste Young and Kumi Heetenigala

The changing landscape of public transport in Victoria

The public transport system in Victoria encompasses a vast array of transport modes including trains, trams and buses, and a variety of organisations. The supply chain also contains a diversity of organisations that vary in size and function and has close ties with manufacturing. The key functional areas are design and build, operations and maintenance.

The overarching context is changing and is opening up the potential for a 'new renaissance' in public transport. This has been driven by what is described as the fourth industrial revolution (Industry 4.0), which centres on 'cyber-physical systems' and the emergence of new digital technologies. Attracting and retaining an agile and skilled workforce who can adapt to change, is now an imperative for these organisations. This is far from straightforward, as it requires transformation across the public transport sector as a whole to achieve this. Organisations face a dichotomy as they will need to create a more 'innovation friendly' and inclusive culture that attracts and retains a diverse workforce. However, the sector itself is often characterised as an ageing, predominantly male workforce, which is resistant to change and innovation (PwC, 2006; BIS Oxford Economics, 2018).

Much of the work to date has focused on technological and economic futures. The Commonwealth Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE, 2012) developed *On Track to 2040: Preparing the Australian Rail Supply Industry for Challenges and Growth Roadmap* in consultation with industry stakeholders. It outlined 18 priority opportunities and their strategic pathways regarding future technologies across three themes for the rail sector: Power and Propulsion, Materials and Manufacturing, and Design, Modelling and Simulation. Realising this future and these opportunities requires collaboration and effective working partnerships 'between companies, government, and research and standards bodies to achieve outcomes' (PwC, 2006, p63).

The question this raises is how do organisations transition their current workforce to the workforce needed for the future, and what do they need to do this?

Industry workforce and structure

The public transport rolling stock industry sector is made up of three areas:

1. **Manufacturing of vehicles** – electric and diesel trains, trams and buses
2. **Vehicle maintenance** – different maintenance arrangements exist – some with the manufacturer, some with the operators
3. **Vehicle operations** – stabling, scheduling (not timetables) and driving.

Workforce

BIS Oxford Economics (2018) estimated that the rail industry in Australia has an overall estimated workforce of 107,205 with Victoria's workforce being 28,501. The workforce is comprised of managers, professionals, technicians and trades workers, community and personal service workers, clerical and administrative workers, sales workers, machinery operators, drivers and labourers (p17). In 2017, Deloitte Access Economics (2017) estimated 3,972 full-time equivalent (FTE) jobs nationally in rolling stock manufacture and 27,435 in passenger services (DAE, 2017, piii). They also forecast 19.4% growth in employment across the whole industry in the decade to 2027.

For the manufacturing and maintenance component, ACIL Tasman (2011) surveyed 142 firms to develop a national profile of the manufacturing and maintenance of equipment for railways in Australia. This covered businesses engaged primarily in the manufacture and maintenance of equipment to be used for railway and/or tramway track infrastructure and railway and/or tramway rolling stock (p vi). Nationally, the workforce totalled over 15,000 employees. Larger firms dominated the industry with 63% of workers, although 'small and medium sized firms made up over 90% of the firms in the industry' (p3).

Technical and trades workers make up the largest proportion of the workforce (53.4%), with sales being the smallest (1.5%) (Figure 1.1, overleaf).

The distribution of occupations in relation to firm size shows large firms dominate, containing the bulk of technical, trades and administration, and other whereas small firms had more employees in sales, science and research, machinery and driving than larger firms (Figure 1.2, overleaf). Although this represented only a small number of workers, it was considered by the ACIL Tasman authors to be suggestive of SMEs being 'an important core of research in the industry' (p8).

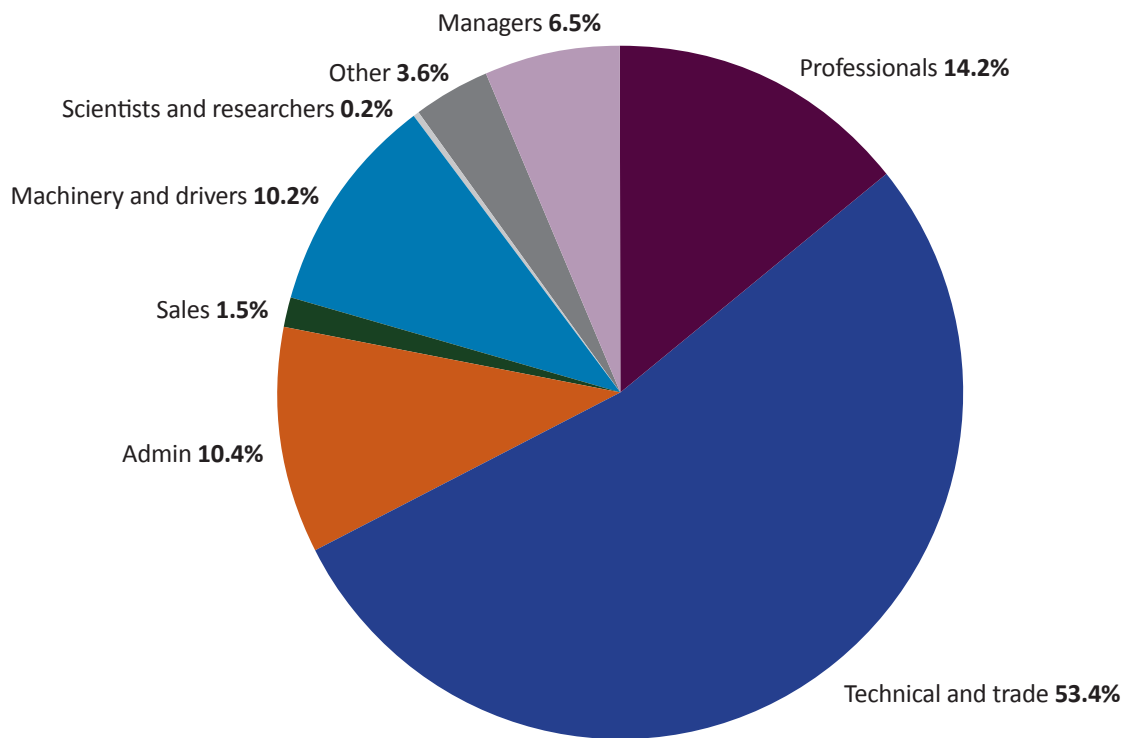


Figure 1.1 Workers by type (source: ACIL Tasman, 2011)

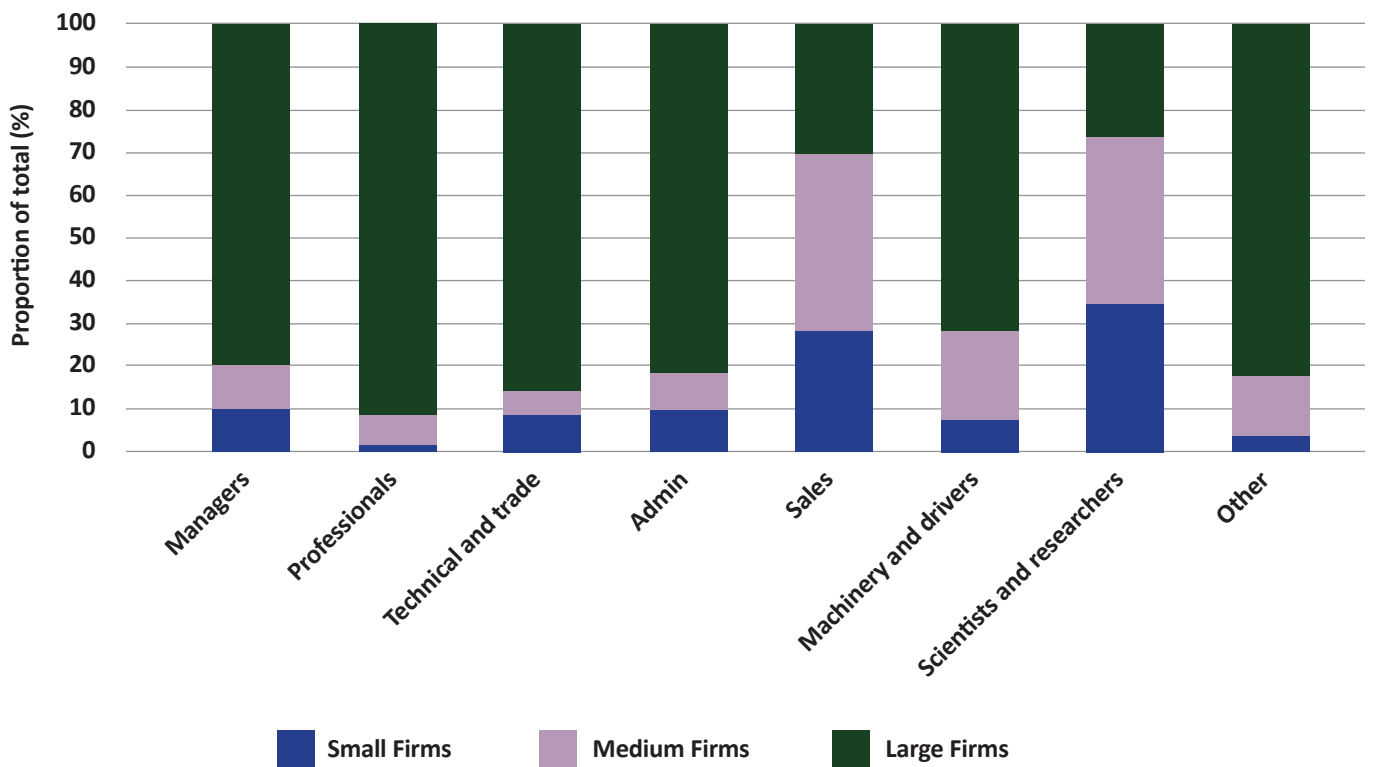


Figure 1.2 Proportion of workers by size (source: ACIL Tasman, 2011)

Other estimates are derived from the Australian Bureau of Statistics (ABS) Census data, which tend to preference rail. According to the Education and Training Committee (2010, p27):

‘An ABS report estimates that there were approximately 5,150 people employed in the Victorian rail sector in 2006. It was also noted by the Victorian Government, data for tram drivers, perway workers and people operating rail freight terminals has been included in other transport or building and construction industry data, rather than under the rail industry classifications.’

However, the Committee (2010, p27) states:

‘Analysis of websites and other information published by major rail organisations revealed at least 8,500 people directly employed in the Victorian rail industry. Metro Trains Melbourne has 3,562 employees, Yarra Trams has 1,987 employees and V/Line Passenger has 1,300 employees. Annual reports show that the Department of Transport, VicTrack and the two regulators (Essential Services Commission and Public Transport Safety Victoria) employ at least 900 people who are directly working in and supporting rail activities.’

They also state that ‘... according to the Australasian Railway Association, 1,000 people are employed in rolling stock manufacturing and maintenance in Victoria and another 5,000 to 10,000 are employed in their supply chain’. Furthermore, the Committee (2010, p28) noted a significant number of service industry workers supporting the rail industry:

‘The Australasian Railway Association, employs over 40,000 people directly in diverse occupations in over 150 rail organisations nationally. In its submission to the inquiry, the Association suggested that with the inclusion of people employed in the supply chain and service industries, the number of employees in the rail industry could be as high as 100,000. Therefore, while the rail industry has not been classified as a large employer, it is clearly an important contributor to the Australian economy.’

The Committee also reported that, according to the Commonwealth Department of Education, Employment and Workplace Relations, the rail industry employment nationally is expected to grow by 2.1% per annum by 2012–13, or the equivalent of 5,600 new jobs over that period, with continued growth beyond that time.

Current data from organisation websites and annual reports shows that Yarra Trams has over 2,200 employees including over 1,200 drivers, Public Transport Victoria (PTV) at 30 June 2018 had 504 employees, V/Line at the same time had 1,720 full-time and 244 part-time, including 400 drivers, with no data for Metro Melbourne.

For buses, the Bus Industry Confederation (BIC) 2010 Industry Survey estimated the Australian bus industry employed more than 50,000 people, with almost 10,000 employed in the bus manufacturing sector, encompassing tradesmen, technicians, and sales and administrative staff (BIC, 2010). For Victoria, the Currie and Delbosc (2009) survey of the industry in Victoria estimated 8,000 people in 2008/09 with 81% of those being employed as bus drivers, 7% in management and administration, 6% as maintenance workers and 7% as others.

Data from the ABS 2016 Census for major regions of Victoria (Table 1.1, overleaf), show in 2016, 859 people directly employed in rolling stock manufacture and repair, 8,985 in bus passenger services, 5,446 in rail passenger services, totalling 15,278 people. These are underestimates because they do not include the supply chain, bus manufacture and repair and possibly all of tram manufacture and repair. Nor do they include administrative staff or a number of service and professional staff involved in research and development, planning and operations. Compared to some of the earlier estimates, there is an indication the sector is growing.

Table 1.1 Data for four clearly identifiable industry employment categories from the ABS 2016 census

	Meib Inner	Meib Inner East	Meib Inner South	Meib NE	Meib NW	Meib Outer East	Meib SE	Meib West	No fixed address	Total
Rolling stock manufacture and repair	137	4	4	30	24	15	328	180	6	728
Regional and rural bus passenger	46	7	299	56	39	141	220	146	19	973
Urban bus and tram passenger	1,637	497	440	816	480	528	727	709	111	5,945
Rail passenger	3,456	117	205	196	143	163	254	211	111	4,856
Total	5,273	624	946	1,096	692	845	1,526	1,243	246	12,491

	Ballarat	Bendigo	Geelong	Hume	Latrobe – Gippsland	Mornington Pen	North West	Shepparton	Warrnambool and SW	Total
Rolling stock manufacture and repair	95	24	0	0	7	5	0	0	0	131
Regional and rural bus passenger	26	18	43	36	42	68	17	18	31	299
Urban bus and tram passenger	139	161	335	206	301	163	178	141	144	1,768
Rail passenger	103	102	130	72	81	26	33	19	24	590
Total	361	308	508	313	435	260	229	177	196	2,787

Industry

The structure of the manufacturing supply chain is complex, with different and sometimes competing definitions (Table 1.2). Not all the definitions in Table 1.2 are understood in the same way, and some of the lower tier companies are unaware of the classification.

Table 1.2 Different definitions of tiers applying to rolling stock manufacturing as understood by government and industry*

Tier	Vehicle structure definition	Business size definition (ATO/ABS)	Contract provision definition
Original equipment manufacturer	Whole vehicle manufacturer	Whole vehicle manufacturer	Whole vehicle manufacturer
Tier 1	System supplier	>\$100 million turnover or 200+ employees	Tier 1 supplier to the OEM
Tier 2	Component manufacturer	>\$100 million turnover or 200+ employees	Tier 2 supplier to Tier 1
Tier 3	Parts manufacturer	<\$100 million turnover or 20–199 employees	Tier 3 supplier to Tier 2
Tier 4+	Materials manufacturer	<\$10 million or <20 employees	Tier 4 supplier to Tier 3, etc.

* This mostly applies to trains and trams – the supply chain for buses is simpler.

For the purposes of this study, we are concentrating mainly on the SME component of the sector, rather than where they sit within the supply chain process. Although the manufacturing component gets the most attention, for direct employment, maintenance is more significant, and operations has similar employment to manufacturing.

Economically, manufacturing procured and sourced locally will have greater flow-on effects than operations, with maintenance somewhere in between.

Fleets, operations and maintenance

The following describes the origin of most operating rolling stock except buses and coaches, location of maintenance and operations and the organisations involved in those activities.

Trains

Metropolitan trains are managed by Metro Trains Melbourne, a consortium of Hong Kong's MTR Corporation (60%), Australia's John Holland Group (20%) and UGL Rail, a division of United Group Limited (20%). UGL also has a role in managing Melbourne's rail assets. Metro holds the operating franchise for metropolitan rail until 2024 (Public Transport Victoria, 2018). The asset manager for the order of 65 High Capacity Metro Trains (HCMT), Plenary, claims \$1 billion to local suppliers in Newport, Bendigo, Geelong and Dandenong, creating 1,100 skilled positions with at least 15% entry positions and 7% for those with some disability (DEDJTR, 2017a; Plenary, 2016).

Regional rail is managed by V/Line who have seen reductions in travel time to regional centres due to track upgrades, supported by investment in a fleet of VLocity trains. This has led to an increase in patronage and is supporting further investment in both infrastructure and rolling stock. Since 2013–14 patronage has increased from \$14.5 to \$20.8 million passenger journeys and outlays from government from \$436 million to \$839 million, which includes funding for infrastructure projects. Passenger subsidy in 2017–2018 was \$23 per person (Public Transport Victoria, 2018). Rolling stock is owned by VicTrack (through Rolling Stock Victoria), which in 2019 had a value of \$4.0 billion, with a further \$570 million under construction (VicTrack, 2019). The current fleet with planned purchases is shown in Table 1.3.

Table 1.3 Current and projected rolling stock with recent budget estimates as to cost

Type	Built	Builder	Number	Notes
Metro				
Comeng	1981–1988	Commonwealth Engineering	187	Refurbished 2000–2003 Alstom, 2017–2019 EDI-Rail Life Extension \$75 million
Siemens Nexas	2002–2006	Siemens	72	
X'Trapolis 100	2002–2004 2009–2019	Alstom Ballarat	106	Complete early 2020 \$15 million each
HCMT	2017–2023	Evolution Rail (Downer, CRRC and Plenary)	65	From 2017 to 2023, 65 trains + infrastructure \$2,176 million, 100 projected to 2025 (35 more)
V/Line				
Sprinter	1991	Goninan, Broadmeadows	21	
Vlocity	2005–2020	Bombardier Dandenong	76	12 on order, \$257 million for 21 (inc. infrastructure), \$280.4 million for 27 (inc. infrastructure), 225 carriages (2018)
Diesel	1985–1987 N Class	Clyde Engineering, Broadmeadows	25 (31 AR)	Carriages are N-set and H-set (133 in 2018)

Source: <http://vicsig.net> and government documents

Metropolitan trains are currently maintained at facilities in Epping, Craigieburn, Newport, Westall, Bayswater and Macaulay. Evolution Rail has built a maintenance facility in Pakenham East for the HCMT fleet. The regional rail fleet is maintained in West Melbourne, Ballarat East, Newport and Bendigo (Table 1.4) (DEDJTR, 2017b).

Table 1.4 Main depots where maintenance on urban and rural passenger rolling stock occurs

Depot	Trains	Operator	Notes
Urban			
Bayswater	X'trapolis	Metro	
Craigieburn	Comeng	Metro	
Epping	X'trapolis	Metro	
Newport	65 HCMTs from 2018	Evolution/Downer	Centre of Excellence for Rolling Stock. 175 manuf jobs, 60% local content, Evolution Rail Academy
Newport	Siemens/Nexas	Siemens	Next to EDI
Pakenham East	30 HCMTs	Evolution Rail	100 est maintenance jobs
Westall	Comeng	Metro	
Rural			
Bacchus Marsh	Mainly VLocity	VLine	Stabling commuter trains
Ballarat	Various	United Group	Maintenance urban and rural trains
Ballarat East	VLocity	Bombardier	
Bendigo	Various	Bendigo Rail Workshops	Metro, Bombardier are clients
Dynon/West Melbourne	VLocity and diesel locos	VLine/Bombardier	Stabling and workshops
Geelong	Various diesel	VLine	Stabling and servicing

Source: <http://vicsig.net> and government documents

Trams

Trams are operated by Yarra Trams, and the parent companies are Keolis and Downer. Keolis is a private French company, one of the world's largest passenger transport companies and Downer is a New Zealand/Australian company. One of Downer's historical acquisitions is the former ABB site in Dandenong. Yarra Trams operates over 450 trams on over 250 km of double track tramways and employs over 2,200 people.

Historically, trams were built in Melbourne, but between 2001 and 2008 trams were built overseas (mainly in France) and imported. Local procurement has seen manufacturing returning to Dandenong via Bombardier who took over the older ABB facility. The E2 Class trams are low-floor permitting wheelchair and pram access. The design is local and the accompanying internal communications capacity is being rolled out across the fleet. A new communications and control centre has been constructed allowing fleet movements to be tracked in real-time, improving punctuality and the capacity to avoid stoppages. Maintenance is shared by Bombardier and Yarra Trams, with the latter taking on the more routine tasks, and operations are dominated by Yarra Trams and contractors.

Infrastructure improvements to support low-floor and heavier trams include raised stops and bridge strengthening. Legacy effects of older stock that lack improvements seen in the W2 trams include about 60% of the fleet being high-floor, older trams lacking air conditioning and with braking problems. Planning is underway for 40 more E Class trams from those in Table 1.5 (overleaf) by 2022, with specifications still being determined (PTV, 2015). The next generation trams will follow from 2022 (PTV, 2015).

The tram fleet maintenance and stabling depots are summarised in Table 1.6 (overleaf). Bendigo Tramways is upgrading to become a premier facility in rejuvenating vintage rolling stock for trams and trains. Ballarat Tramway Museum is similar but on a smaller scale.

Table 1.5 Current rolling stock

Type	Built	Builder	Number	Notes
SW5	1939–1940	MMTB	3	Heritage trams
SW6	1939–1951	MMTB	15	Restaurant trams, museum pieces, Bendigo, NZ, Ballarat, six in limited service
W6	1951–1955	MMTB	4	Heritage trams
W7	1955–1956	MMTB-Ansair	4	Heritage trams
Z3	1979–1984	Comeng	111	
A1	1984–1985	Comeng	27	
A2	1985–1986	Comeng	42	
B2	1988–1994	Comeng/ABB	130	B-Class Tram Life Extension \$21 million
C	2001–2002	Alstom	36	Built overseas and imported
D1	2002–2003	Siemens	38	Built overseas and imported
D2	2003–2004	Siemens	21	Built overseas and imported
C2	2008	Alstom	5	Built overseas and imported
E	2011–2017	Bombardier	50	Dandenong
W8	2013–2018	MMTB-BTW	9	Rebuilt by Bendigo Tram Workshop
E2	2017–2020	Bombardier	29	Eleven more to come (E-Fleet total 90) order of 20 \$274 million (inc. infrastructure)

Source: <http://vicsig.net> and government documents

Table 1.6 Nine depots in Melbourne provide the running support for over 450 trams

Depot	Trams	Operator	Notes
Brunswick	B2 Class: 22, D2 Class: 21, Z3 Class: 8	Yarra Trams	Maintenance depot Bombardier doing brake refits
Camberwell	A2 Class: 13, B2 Class: 35	Yarra Trams	
East Preston	SW6 Class: 3, Z1 Class: 4	Yarra Trams	Storage, some refurbishment
Essendon	B2 Class: 44, Z3 Class: 29	Yarra Trams	Heavy maintenance, bogie rebuilds and wheelsets, advertising (Buspak)
Glenhuntly	A1 Class: 4, B2 Class: 26, Z3 Class: 19	Yarra Trams	
Kew	A2 Class: 26, C Class: 36	Yarra Trams	
Malvern	D1 Class: 38, Z3 Class: 55	Yarra Trams	
North Fitzroy	SW6 Class: 3, W6 Class: 1, W7 Class: 2	Victrack	Storage
Preston–Preston Workshops/ New Preston	B2 Class: 3, E Class: 43, E2 Class: 13	Yarra Trams	Major workshops
Southbank	A1 Class: 23, A2 Class: 3, C2 Class: 5, E Class: 7, E2 Class: 15, SW6 Class: 3, W8 Class: 8	Yarra Trams	

Source: <http://vicsig.net> and government documents

Buses

Victoria's bus services cost roughly \$1 billion per year. An auditor's report in 2015 recommended an overhaul of the franchise agreements in place to be able to re-tender at the end of contract, revise routes and timetables more freely, put in place stricter and clearer performance criteria and enforce these criteria with penalties if necessary (Victorian Auditor-General, 2015). Some of these changes have been included in recently signed contracts.

Four bus operators (Ventura, Sunbury Bus Service, Sita Buslines, and Cranbourne Transit) signed ten-year contracts subject to meeting performance targets. These commenced in July 2018.

Eight bus operators (CDC, Dysons, Northern Transit, Dineen Group, Tullamarine, Ryans, Moonee Valley and Moreland) opted for seven-year contracts subject to meeting performance targets. These commenced in August 2018.

Ventura is the largest public bus provider and runs almost 900 buses on 141 routes out of twelve depots. It is a family-run private company and purchases its fleet through locally assembled buses, mainly with imported chassis, having an agreement with Volgren to supply at least 21 buses per year.

Transdev runs about one-third of Melbourne's network under the Melbourne Metropolitan Bus Franchise. They have six depots (Doncaster, Heatherton, Keysborough, North Fitzroy, Sunshine West and Thomastown), roughly 1,100 staff and 500 vehicles servicing 47 routes. Their current contract has been extended to January 2021 to allow the government to put a full procurement process in place. 100 new buses have been ordered in 2019–20 for \$16 million to bolster the state-owned fleet servicing this franchise.

CDC (ComfortDelGro) buses' parent company is a multinational based out of Singapore and the world's largest land transport company. They are situated in Altona and run buses in Melbourne's west and north, and in Geelong on 55 routes. They are introducing 50 new hybrid buses into their fleet by 2022. The chassis is built in Sweden and the body in Dandenong.

Other metropolitan bus operators are: Broadmeadows Bus Service, Cranbourne Transit, Dysons, Kastoria Bus Lines, Martyrs Bus Service, Moonee Valley Bus Lines, Moreland Bus Lines, Panorama Coaches, Ryan Bros Bus Service, Sita Bus Lines, Sunbury Bus Service and Tullamarine Bus Lines (recently purchased by CDC). In addition, public bus services operate in many regional centres across Victoria.

The new contracts to operate Melbourne's bus networks include tougher performance targets for punctuality and delivery and passenger experience, bringing bus contracts into line with trains and trams. They emphasise real-time information aiming for passenger-focussed services. They also removed exclusivity arrangements, allowing for greater flexibility in changing and establishing new routes.

The original proposal for the new contracts was to give end-of-term access to staff, depots, fleet and intellectual property (IP), but a campaign by bus owners led to the new 7-year contracts without this requirement (Cotter, 2018). An opt-out clause was also said to be built into the 10-year contract. The essence of their protest was that buses were assets that they used to build business, maintain relationships with their communities and to provide ongoing work for their staff. They could not compete with multinationals who could offer a lower price, raising the risk of regulatory capture, where business put in a low bid then expected to be bailed out if they failed (Cotter, 2018). Local bus owners also argued that profit was invested locally, rather than going to overseas investors, a variation of the local content argument.

References

- ACIL Tasman. (2011). *Railway manufacturing industry: a profile of the railway manufacturing industry in Australia*, Department of Innovation, Industry, Science and Research, Canberra.
- BIC. (2010). *Industry Survey*. Bus Industry Confederation, Kingston.
- BIS Oxford Economics. (2018). *Australasian Railway Association skills capability study. Skills crisis: A call to action*. Australasian Railway Association.
- Cotter, F. (2018). Bus contracts backflip: Vic govt offers new seven-year option without assets acquisition. *Australian Bus & Coach*. Retrieved from <https://www.busnews.com.au/industry-news/1806/bus-contracts-backflip-vic-govt-offers-new-seven-year-option-without-assets-acquisition>
- Currie, G., and Delbosc, A. (2009). *2009 Victorian bus industry survey*. Institute of Transport Studies, Monash University, Melbourne.
- Deloitte Access Economics. (2017). *Value of rail: The contribution of rail in Australia*. Deloitte Access Economics, Canberra.
- Department of Economic Development, Jobs, Transport and Resources (DEDJTR). (2017a). Bigger trains for a better Melbourne. In *Evolution Rail and Government of Victoria* (Ed.): <https://transport.vic.gov.au/-/media/tfv-documents/high-capacity-metro-trains/jobs-and-investment-fact-sheet.pdf>
- DEDJTR. (2017b). *Victorian Government submission to the Senate Inquiry into the State of Australia's Rail Industry*. Melbourne.
- Department Industry, Innovation, Science, Research and Tertiary Education. (2012). *On Track for 2040: Preparing the Australian Rail Supply Industry for Challenges and Growth Roadmap*. Commonwealth Government of Australia, Canberra.
- Education and Training Committee. (2010). *Inquiry into Skills Shortages in the Rail Industry*.
- Plenary. (2016). High capacity metro trains Melbourne, Victoria, Australia. In *Plenary* (Ed.) Melbourne.
- PTV. (2015). *Trains, trams, jobs 2015–2025*. Public Transport Victoria, Melbourne.
- Public Transport Victoria. (2018). *Annual Report 2017–18*. Public Transport Development Authority, Melbourne.
- PwC. (2006). *The changing face of rail: A journey to the employer of choice*. Australasian Railway Association, Kingston.
- Victorian Auditor-General. (2015). *Tendering of metropolitan bus contracts*. Victorian Auditor-General's Office, Melbourne.
- VicTrack. (2019). *Annual Report 2018–19*, Victorian Government Department of Transport, Melbourne.



Building innovative and inclusive organisational cultures

Celeste Young with contributions from Neil Parry

Changing workforce needs

Workforce shortages are a long-term issue currently facing public transport, where there is a critical need to attract and retain a diverse and innovative workforce to ensure future sustainability of the industry. This issue sits within the larger context of technological, social and economic disruption, particularly in relation to manufacturing. This is changing not only the environment in which public transport workers operate, but also the work people do and how they work. A submission by Bombardier (2009) to the Inquiry into the State of Manufacturing in Victoria by the Economic Development and Infrastructure Committee of the Parliament of Victoria, state:

‘Manufacturing in 2009 is no longer the making of goods by manual labour in factories. Manufacturing is now based around supply chain clusters of R&D and design firms, suppliers of materials and components, marketing services, and wholesale and retail businesses. This ‘new manufacturing or production paradigm’ is driven by the globalisation of R&D, production and markets, the rapid integration of large emerging countries such as India and China, and the need for customer-focussed, environmentally sustainable products and services.’ (p9)

The Australian Centre for Social Innovation (TACSI) (2017) also observe that ‘there has been a shift in the overall structure of employment related to manufacturing – from a focus on unskilled work towards a much more skilled workforce’ (p14).

However little attention has been given to the ‘softer’ people-based skills that support the management and transition of the workforce in a dynamic environment. This is an extremely complex and challenging task. PwC (2018) raise the importance of an organisational focus on people within the workforce raising the need to ‘nurture agility, adaptability and re-skilling’ (p5). The Committee for Economic Development Australia (CEDA) (2014) also suggests that Australia ‘lags behind its global competitors on the human capital criterion’ (p9). To understand what is needed by the rolling stock sector, it is important to ascertain the organisational and cultural strengths within the sector, and the barriers to creating an inclusive learning workforce that can retain and attract the diverse and innovative workforce they wish to become.

Innovation

Due to the evolution of technology and the need for innovation, people and the work they do in all areas of public transport are now critical to the future sustainability of the sector as a whole. There are many different types of innovation that can be applied to this sector, for example social innovation, disruptive innovation and technological innovation. What type of innovation is needed is also determined by its specific function and context. These models of innovation apply in individual contexts, but as the transport sector is diffuse, the ability to effectively innovate is not just dependent on individual organisations or one type of innovation. Development, transfer and uptake of new knowledge requires systemic innovation which involves government, industry and the community. Davies et al. (2012) define systemic innovation as:

‘A set of interconnected innovations, where each is dependent on the other, with innovation both in the parts of the system and in the ways that they interact.’ (p4)

Characteristics of systemic innovation they identify include (p5):

- Innovation that develops following a crisis or period of upheaval
- New ideas, concepts and paradigms
- New laws and/or regulations across a broad area
- Coalitions for change of many actors and/or across more than one sector or scale
- Changed market metrics or measurement tools
- Changed power relationships and new types of power structures
- Widespread diffusion of technology and technology development
- New skills or roles across many actors new institutions.

The role of government

Government plays a pivotal role with innovation in the public transport sector through its policies, procurement process and support programs, presenting both challenges and opportunities. Edler and Fagerberg (2017, p12) reviewed policy in relation to innovation and found it to be a relatively new area of policy which has emerged since the 1990s. In relation to analysis of policy instruments in use (Figure 2.1, overleaf) they found the key focus being in areas such as R&D and technology, but noted ‘there were only a handful studies on the impact of public procurement’ (p13). They also state that there tends to be a lack of awareness of interactions between different policy instruments by policy makers and categorise how they can influence outcomes, indicating a need to build capability in this area.

Innovation policy instruments	Overall orientation		Goals						
	Supply	Demand	Increase R&D	Skills	Access to expertise	Improve systemic capability, complementarity	Enhance demand for innovation	Improve framework	Improve discourse
1 Fiscal incentives for R&D	●●●		●●●	●○○					
2 Direct support to firm R&D and innovation	●●●		●●●						
3 Policies for training and skills	●●●			●●●					
4 Entrepreneurship policy	●●●				●●●				
5 Technical services and advice	●●●				●●●				
6 Cluster policy	●●●					●●●			
7 Policies to support collaboration	●●●		●○○		●○○	●●●			
8 Innovation network policies	●●●					●●●			
9 Private demand for innovation		●●●					●●●		
10 Public procurement policies		●●●	●●○				●●●		
11 Pre-commercial procurement	●○○	●●●	●●○				●●●		
12 Innovation inducement prizes	●●○	●●○	●●○				●●○		
13 Standards	●●○	●●○					●○○	●●●	
14 Regulation	●●○	●●○					●○○	●●●	
15 Technology foresight	●●○	●●○							●●●

●●● = major relevance ●●○ = moderate relevance
 ●○○ = minor relevance to the overall orientation and stated innovation policy goals of the listed innovation policy instruments
 Source: Adapted from Gök, et al., 2016, p11.

Figure 2.1 Taxonomy of innovation policy instruments

Status of innovation in Australia

The Department of Industry, Innovation and Science’s (DIIS), *Australian Innovation Systems Report 2016*, provides updates on Australia’s innovation performance. Overall they found that ‘Large firms reported the largest increase in innovation-active businesses from 70.8% in 2007–08 to 77% in 2015–16’ (p9). Manufacturing reported the highest level of innovation-active firms at 58.3%.

High growth firms (HGF) are seen as increasingly important due to their relationship with innovation and their link to employment growth. The report found ‘employment in HGFs contributed about 46% of net positive employment growth from 2004–05 to 2011–12, despite representing only 9% of all firms with five or more employees’ (p28).

This report shows a strong increase from 2005–15 in relation to R&D and HGF in SMEs, from 69% in 2005 to 85% in 2015 (Figure 2.2, overleaf). The OECD (2018) also highlights that, ‘Innovation in small and medium sized enterprises (SMEs) is at the core of inclusive growth strategies: more innovative SMEs are more productive’ (p3). Successful strategies to support this from a policy level have been undertaken in Korea and the US, and are detailed in the economic section of this review.



Note: Years refer to financial years, thus 2005 represents 2004–05, 2010 represents 2009–10, and 2015 represents 2014–15.

Figure 2.2 R&D HGF proportion by firm size – 2005, 2010, 2015 (DIIS, 2017)

They also reported that Australia ranks in the bottom half of the OECD rankings in relation to collaboration, with only one in four firms reporting collaboration, and that this was found to be less between innovative firms and their suppliers. In relation to R&D-active firms as a proportion of innovation-active businesses, only one fifth reported collaboration. They suggest this indicates the ‘majority of R&D activities are in-house, not involving partnership with other organisations’ (p16). They also attributed a four percentage point growth increase in annual productivity to collaboration in innovation.

CEDA’s 2014 report, *Advanced Manufacturing Beyond the Production Line* reinforces this, characterising successful manufacturers in Australia as primarily being SMEs who were ‘export-focused, customer-driven, innovative and technologically-cognisant’ (p6). They were also found to have good management of global value chains and to position themselves in the innovation lifecycle from the beginning of process through to the post-sales stages of production.

Current barriers and needs for innovation in public transport

Innovation presents a number of challenges to the public transport sector. The Rural and Regional Affairs and Transport References Committee (2017) noted that ‘the low level of innovation being implemented across the industry continues to be both a concern and a key challenge for the rail manufacturing sector’ (p9). It also notes a ‘lack of certainty about future contracts, a lack of continuity and a lack of technical expertise have contributed to an understandable lack of confidence around investing in innovation and technology’ (RMCRC Submissions, 2017, p5).

The role of procurement in creating the right political environment is also raised by the BIS Oxford Economics (2018) review of rail industry capability and skills in which they state:

‘It is often the procurement process itself, with its focus on short-term price instead of longer term benefits, which is perhaps one of the greatest inhibitors of innovation in the rail industry.’ (p79)

The SEMMA’s Submission to the Senate Finance and Public Administration References Committee Inquiry into Commonwealth Procurement Procedures (2014) also raised specific issues in relation to SMEs stating:

‘SMEs are world leaders in their field but are difficult to identify and locate. Some find dealing with government too difficult and risky as the tender process can take considerable time and cost but also involve significant risk, not only with exposure of IP, etc., but also the ever present likelihood that the Government will cancel projects.’ (p3)

Other factors that act as barriers to innovation are raised by BIS Oxford Economics (2018) who found practices in the sector contribute to this, stating ‘recent industry soundings indicate that the rail industry usually relies on “tried and true” approaches which leave little room for innovation’ (p79). Conversely the *Australian Innovation System Report 2017* (DIIS, 2017) states that ‘the majority of Australian firms were domestic modifiers and their ability to successfully execute this relatively simple strategy is arguably a strength of Australia’s innovation system’ (p89). They also caution that focusing solely on modifying innovation may effect Australia’s international competitiveness in the longer term due to the lower degree of novelty in this process, indicating the need to build capability in different forms of innovation.

BIS Oxford Economics (2018) also raise that there is a need to adopt a more ‘innovation-friendly culture’ in organisations that accept and reward R&D, and promote new products, systems and methods. At an organisational level, this needs to be approached holistically across the organisation, not just exclusively in R&D departments (Teruel et al., 2015). However, PwC (2006) suggest the high level of regulation has resulted in a risk adverse culture that is ‘resistant to change’, and where there is ‘reluctance amongst operators to bear the risk of implementing innovations and changes in technology’ (p52).

Understanding the cultural ecosystem of public transport

Organisational culture

There are many formal and informal definitions applied in relation to organisational culture which include:

‘Organisational culture focuses on the beliefs, values and meanings used by members of an organisation to grasp how an organisation’s uniqueness originates and evolves and operates.’ (Shultz, 2015, p5)

‘... widely shared and strongly held values.’ (Chatman and Jehn, 1994, p524)

The more informal definitions include:

‘... rules of the game.’ (Schein, 2010, p15), or

‘... just the way we work together.’ (Coolican and Jackson, 2002, cited in Igo and Skitmore, 2006)

These definitions may be illustrative of how culture manifests as a ‘surface’ culture that is visible (formal rules, doctrine, dress code and organisational values), and an informal or ‘deep’ culture that is not visible (values, beliefs and ways of thinking) (Dadfar and Gustavsson, 1992, p84).

Schein (2004) describes organisational culture as an outcome of interactions between three components: basic assumptions (beliefs, perceptions thoughts and feelings, ultimate source of values and actions), espoused values and beliefs (philosophies, strategies, justifications) and artefacts (visible organisational structures and processes), as groups learn and work together over time:

‘Any social unit that has some kind of shared history will have evolved a culture, with the strength of that culture dependent on the length of its existence, the stability of the group’s membership, and the emotional intensity of the actual historical experiences they have shared.’ (Schein, 2004, p11)

How organisations evolve and function is the result of both internal and external influences, and the culture is formed through interactions between these systems. Harrison (2005) suggests organisations are open systems, and highlights the need to understand the different components both internally and externally of an organisation. He defines key aspects of this system as:

- **General environment** includes institutions and conditions that may have infrequent or long-term impacts on the organisation, including the economy, the legal systems, the state of research and technical knowledge, the community, the political system and national culture.
- **Environment** (task and general) includes all the external organisations and conditions that are directly related to an organisation’s main operations and its technologies, including suppliers, unions, customers, clients, regulators, competitors, markets for (service provision) and products, and the state of knowledge of the organisation’s technologies.
- **Purpose strategies, goals, objectives and plans** and the interest of key decision makers in the organisation.
- **Behaviour and process** includes the prevailing patterns of behaviour, relationships and interaction between individuals and groups.
- **Culture** includes shared norms, values, symbols and rituals relating to key aspects of organisational life.
- **Structure** includes enduring relationships, between individuals, groups and larger units, groupings of positions and in divisions, departments and other units. Structures also incorporate formal rules (the way things should be done), such as standard operating procedures and processes, established mechanisms for coordination, human resource mechanisms, and informal rules (the way things are done). (Young et al., 2018a, adapted from Harrison, 2005)

Organisational cultures and the role of values

Organisational cultures are multifaceted and often have an overarching culture which is made up of different subcultures. Martin (2001) discusses the different types of cultures that exist within organisations identifying three categories: integrated, differentiated and fragmented. They suggest that to understand organisational culture it needs to be viewed holistically from an 'integration perspective' which encompasses both 'differentiation and fragmentation perspectives' (p156). Schein (2004) also examines sub-cultures who form their own informal and formal rules, and categorises them into functional roles, for example, the operator, the engineer and the executive.

As the rolling stock sector in Victoria encompasses multiple organisations and functional areas, these cultures and subcultures are present across institutional, organisational and group levels, and can create tension and conflict as a result of the differing values they hold.

Values underpin the formation of culture, as they provide the basis of decision making informing the beliefs that determine what is most important and what motivates action (Schwartz, 2012). They are often used as a tool by organisations to determine the nature of workforces and how best to manage them. Values-based approaches are also increasingly being used in relation to organisational and societal transformation with the emergence of change management paradigms such as appreciative inquiry. This methodology has been used to facilitate strategic change through conversations that capture what is important to individuals to establish shared understanding and agreement of a desired future (Cooperrider and Whitney, 2001). Hall et al. (2007) also reinforce that values-based approaches can be a useful tool for bringing together multiple perspectives and reducing conflict.

Values in an organisations can develop as a result of processes and structures. The Ahmad study (2017) found efficient and productive systems in manufacturing require workers to embody certain shared values, in order to maximise output. Pakdil and Leonard (2015) found organisational culture can also become institutionalised and define specific values, such as the Toyota Production System, which consists of two principles: continuous improvement and respect for people. These values in turn shape narratives which influence personal and organisational identity, culture and decision making.

O'Reilly et al. (1991) raise the importance of aligning of organisational values with those of the individuals who work within the organisation. Their study examining the 'person to organisation fit' using 42 values-based competencies concluded: 'For an individual to be satisfied and attached to an organisation, the person may need both task competency and a value system congruent with the central values of the organisation' (O'Reilly et al., 1991, p511).

In terms of assessment of values, the competing values framework (CVF) is a well-known conceptual tool devised by Quinn and Rohrbaugh (1981), which identified three conflicting areas of values related to organisational focus:

- Wellbeing and development of people in the organisation versus the wellbeing and development of the organisation
- Organisational structure – stability versus flexibility
- Organisational means and ends – important processes (e.g., planning versus final outcomes, such as resources).

Quinn and Rohrbaugh (1983) refined this into four cultural categories: clan, hierarchy, market and adhocracy. Cameron and Quinn (1999) further developed the CVF into the organisational culture assessment instrument using the (CVF) as a basis to define cultural profiles using the above cultural categories and six key dimensions of organisational culture (summarised by Pakdil and Leonard, 2015):

- **Dominant characteristics** – teamwork, inclusion, creativity
- **Organisational leadership** – leadership style and approach that permeates the organisation
- **Management of employees** – how employees are treated
- **Organisational 'glue'** – bonding mechanisms
- **Strategic emphasis** – organisational strategy drivers
- **Criteria for success** – how is success defined and who gets rewarded.

This tool has been used extensively in organisations and academia related to understanding and management of organisational cultures.

Safety culture

One of the strongest influences on public transport culture is safety, and there is a large body of work that pertains to safety culture with multiple areas of focus. The most relevant to this review is the area that focuses on the organisational cultural overlay as a mechanism for influencing individual behaviour more broadly across organisations to create proactive learning risk cultures. The key cultural elements that support this (Figure 2.3) are also aligned with the elements needed for the creation of inclusive and innovative cultures that encompass social and technological risk.

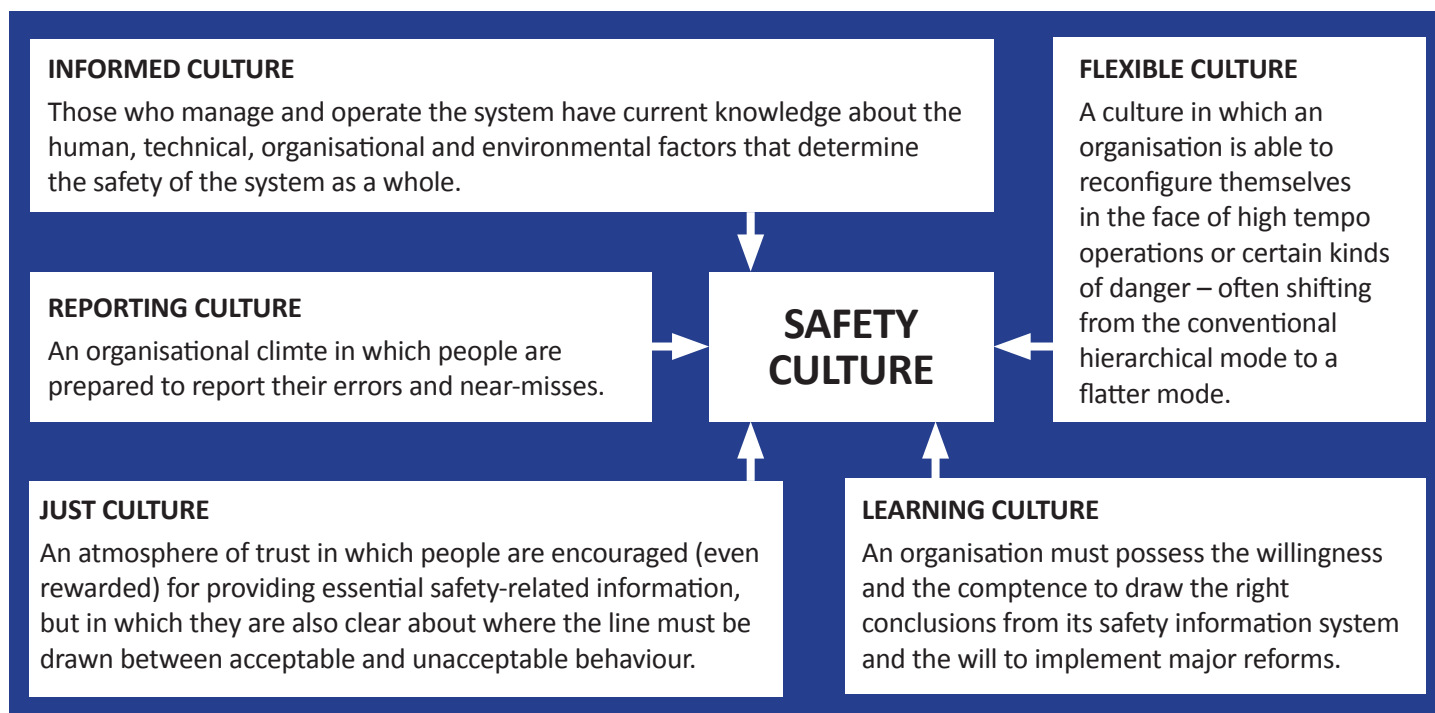


Figure 2.3 Components of safety culture and definitions (adapted from Reason, 1997; GAIN Working Group E, 2004)

These components are developed through a systemic approach to transformation that encompasses the environment that surrounds the workforce and the interactions of people within this. The establishment of clear boundaries, the development of trust and reporting are seen as critical first steps (Global Aviation Information Network [GAIN], (2004). However, James Reason highlights that ‘engineering a just culture is the all important early step that so much depends on’ (GAIN, 2004, pvi).

How risk information is conveyed and received is central to safety culture. Westrum (1993) provides an organisational typology in relation to risk culture that outlines three predominant cultures – pathological, bureaucratic and generative – that are determined by how an organisation processes information (Table 2.1).

Table 2.1 How organisations process information

Pathological	Bureaucratic	Generative
Information is hidden	Information may be ignored	Information is actively sought
Messengers are ‘shot’	Messengers are tolerated	Messengers are trained
Responsibilities are shirked	Responsibility is compartmentalised	Responsibilities are shared
Bridging is discouraged	Bridging is allowed but neglected	Bridging is rewarded
Failure is covered up	Organisation is just and merciful	Failure causes inquiry
New ideas are actively crushed	New ideas create problems	New ideas are welcomed

These were further built upon by Parker et al. (2006), who included two additional categories proposed by Reason (1997) – reactive and calculative – to develop an integrative model to support measuring of maturity in relation to safety culture (Parker et al., 2006).

The adaptation and use of this framework within the public transport sector is illustrated in Transport Safety Victoria's *Guidance of Safety Culture for Bus Drivers* (2016), which outlines five key areas of focus (p3):

- Management and leadership
- Just culture
- Information (flow and feedback)
- Learning culture
- Staff and stakeholder involvement.

In relation to safety culture, Mylett (2010) proposes that the theory of assumptions, values, beliefs and artefacts described by Schein (2004) are also part of the safety culture and plays a pivotal role in the rail industry in Australia. Risk subcultures in organisations can also form their own rules and values, which can override formal policy and procedures. For example, research of train drivers' shift patterns by Rainbird et al. (2010), found values of camaraderie and loyalty embodied by the train drivers towards one another (such as assisting other drivers with their workloads), could compromise their self-management of fatigue. Mylett (2010) also supports the notion of the need to address different subcultures suggesting a 'one-size-fits-all' portrayal of safety culture may create dissonance between the various sub-cultures that make up an organisation due to the different expressions of safety.

Glendon and Evans (2017) also discuss the existence of different risk sub-cultures related to work environment and its impact on safety communication finding:

'Train drivers, train guards and station staff perform their roles at a physical distance, sometimes remotely, from management supervision, and staff in these roles often work alone or with one or two other people. This may foster a sense of isolation from management and from the organization's communication mechanisms. Track maintenance staff and rolling stock maintenance staff tend to work under closer management supervision and in larger teams. As a result, they may feel more informed about management's commitment to safety and current information in the organization.' (p414)

Mental Health at Work (2015) also undertook a survey in Victoria involving 505 bus drivers examining the impact of the work environment on wellbeing. They describe bus driving job environments as characterised by working in isolation from other employees, sedentary and having to interact with sometimes difficult passengers. Their findings suggest their working environment had a substantial impact on wellbeing and led to 70% of the respondents feeling demotivated when facing workplace difficulties. These aspects can have profound effects on subculture and reduce its ability to deal with additional stressors such as change.

The McInerney (2005) inquiry into the Waterford incident in 2005 revealed particular characteristics of the organisation involved which may be indicative of culture more broadly in the industry at that time. Of particular note are (p22):

- Unwillingness to engage in critical self-examination of its safety performance or the effectiveness of its safety management
- A blame culture, and not a just culture, when dealing with incidents or accidents
- An insular and inward looking culture.

The role of organisational type in shaping culture

The organisations that make up the rolling stock supply chain are diverse, spanning large and small to medium enterprises (SMEs) who undertake designing and building, operating and maintenance of rolling stock. Organisational culture can also be informed by the size of an organisation resulting in cultural archetypes with specific values and assumptions. An Astrachan (1988) study examining a merger between a smaller local firm and a larger external organisation suggests that combining different cultural archetypes without the necessary understanding can result in poor outcomes. He identified two factors that could contribute to this, a lack of understanding of the local context and the opposing values and assumptions.

Ownership of companies can also shape cultural characteristics (Lowe, 2015; Astrachan, 1988). For example, Lowe (2015) examined how family firm size affects the extent to which bus and coach operators in Australia interact with and contribute to their community by evaluating the value of eight social determinants. The author makes the observation that 'bus operators display a level of local leadership that is valuable and significant' (p114). They conclude that:

'Small and medium family firm bus operators are more likely to interact with their communities on a per employee basis and that these, therefore, represent governance models that are more likely to contribute toward achieving outcomes in line with community and regional development initiatives.' (p135)

The culture that arises from different styles of ownership can also be a source of tension if it does not align with employee culture. Igo and Skitmore (2006) undertook a study to identify the current corporate culture of an Australian engineering consultancy to understand how the culture was perceived by both the internal and external environments. The results suggested the organisation had a dominant market-oriented culture, which did not reflect the desire of their employees. They concluded, 'the most appropriate form was found by those involved to be the employee-focused culture – indicating a misalignment between what employees thought was needed and what was being provided and a need to change' (p2).

Culture is also shaped by its demographic. Rail and areas of manufacturing are characterised by a predominantly male (and in the case of rail) ageing workforce. It is seen to have a strong culture, but the current need for greater diversity in its workforce to support innovation and growth and sustainability, means it will need to adjust to the broader needs to include workforce diversity and diversity of thought (BIS Oxford Economics, 2018; PwC, 2006; ARA, 2017).

The relationship between diversity and inclusion

For diversity to be effective, it requires effective inclusion and integration of diversity into organisations. Diversity has multiple meanings and can be applied to cultural, gender, disability, demographic and diversity of thought which is important for innovation. The definitions that are useful in an organisational context for diversity are:

'All the differences between people in how they identify in relation to factors including their age, caring responsibilities, cultural background, disability, gender, Indigenous background, sexual orientation, and socio-economic background (social identity); and their profession, education, work experiences, and organisational role (professional identity).' (Diversity Council of Australia, 2015, p8)

Inclusion is the mechanism which is central to creating workplaces and cultures where people feel valued and safe. Common definitions for inclusion are:

'Inclusion represents a person's ability to contribute fully and effectively to an organisation.' (Roberson, 2006)

'The degree to which an employee perceives that he or she is an esteemed member of the work group through experiencing treatment that satisfies his or her needs for belongingness and uniqueness.' (Shore et al., 2011)

Mor Barak (2015) describes the relationship between diversity and inclusion, as an evolving process – with the first stage being reactive, and the second stage proactive. The initial phase is seen through the physical representation of diversity in an organisation, which has also been referred to as 'surface diversity' (Singal, 2014; Mor Barak, 2015). The second stage is management of diversity which is inclusive, involving the less visible aspects that shape behaviour, which has also been referred to as 'deep diversity'.

Simply explained, diversity is what is seen from the organisational (top-down) perspective, whereas inclusion is the personal perspective of an individual's 'bottom-up' experience and response to diversity (Roberson, 2006).

The Diversity Council of Australia (2015) provides an evidence-based framework for inclusive leadership, and defines aspects that determine the formation of a personal identity as a basis for diversity (Figure 2.4, overleaf).

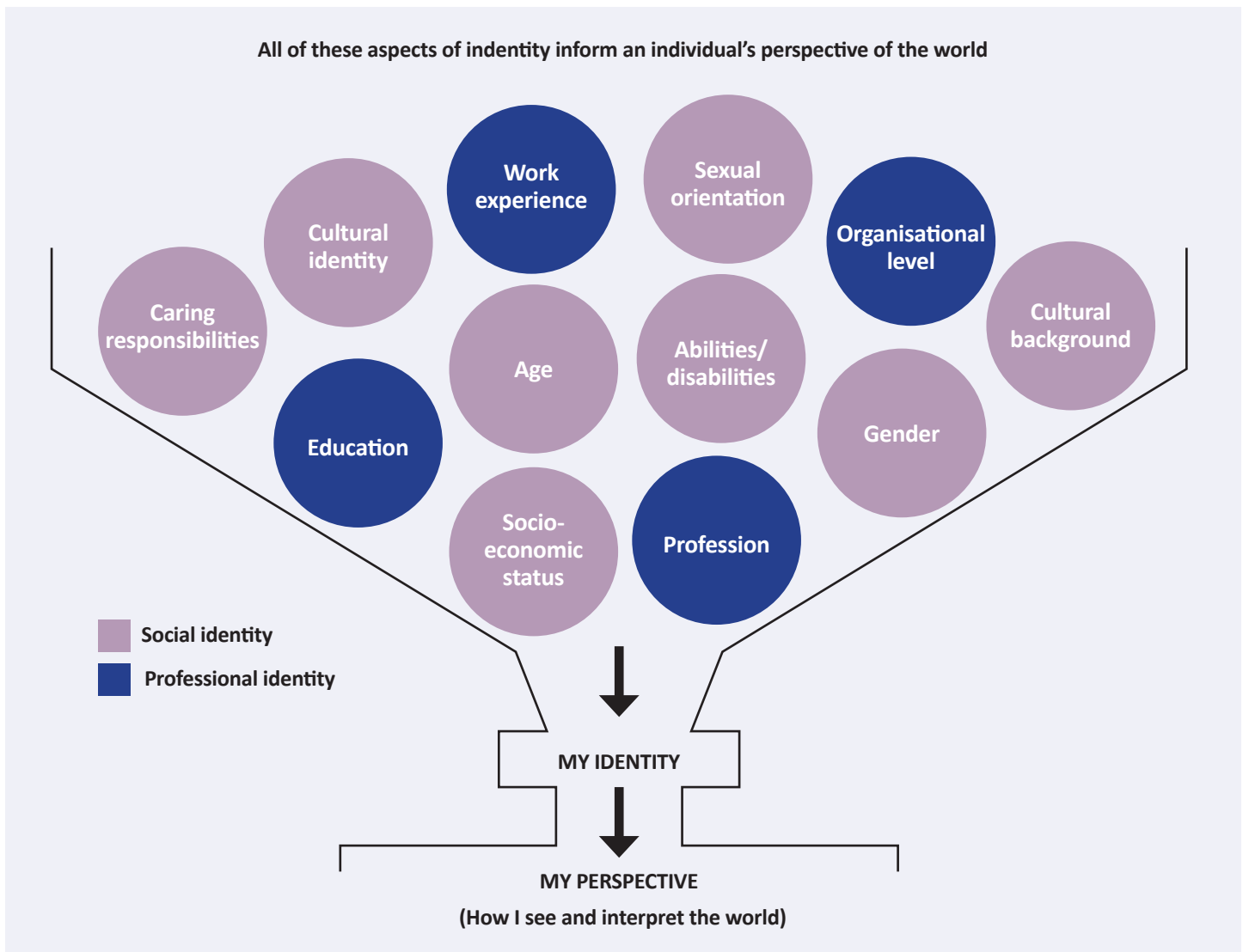


Figure 2.4 Aspects that can inform identity related to diversity (adapted from Diversity Council of Australia, 2015)

Brewer and Gardner (1996) examined the concept of belongingness which can create tension between an individual's need for uniqueness and individualism but also belong to and be validated by a group and the role of personal identity within this. Building upon this, Shore et al. (2011) developed a framework to support better analysis of belongingness and group interactions to uniqueness through defining how this is valued. This framework can be used as a basis for measuring the 'lived experience' of individuals in organisations to support evaluation of levels of inclusion (Figure 2.5).

	Low belongingness	High belongingness
Low value in uniqueness	<p style="text-align: center;">Exclusion</p> <p>Individual is not treated as an organisational insider with unique value in the work group, but there are other employees or groups who are insiders.</p>	<p style="text-align: center;">Assimilation</p> <p>Individual is treated as an insider in the work group when they conform to organisational/dominant culture norms and downplay uniqueness.</p>
High value in uniqueness	<p style="text-align: center;">Differentiation</p> <p>Individual is not treated as an organisational insider in the work group, but their unique characteristics are seen as valuable and required for group/organisation success.</p>	<p style="text-align: center;">Inclusion</p> <p>Individual is treated as an insider and also allowed/encouraged to retain uniqueness within the work group.</p>

Figure 2.5 Framework for inclusion (Shore et al., 2011)

Pless and Maak (2004) developed a framework that provides underpinning principals that form the basis for inclusion, identifying the following: reciprocal understanding, standpoint plurality and mutual enabling, trust and integrity (p129). They also provide key areas for implementation, which are:

- Raising awareness
- The development of a vision of inclusiveness
- The rethinking of key management concepts and principals
- Focus on the human relationship management systems that help implement change by translating inclusion principals into action via competencies and measurable behaviour, and fostering reinforcement, development, reinforcement and recognition of inclusive behaviour.

Young et al. (2018b) describe the relationship between diversity and inclusion as a process where diversity is introduced and becomes embedded in the organisation (Figure 2.6). The process was developed in collaboration with stakeholders in the emergency services by identifying specific responses to phases described as being commonly encountered by practitioners in the emergency services in Australia, and the combining and aligning of these with elements of evidence-based models. The key components identified and the correlating models used were:

- The changing of status quo – Satir model of change (Satir et al., 1991)
- The changing of identity – the four layers of diversity (Gardenswartz and Rowe, 2003) informed by Brewer and Gardner (1996)
- The management of grief – the five stages of grief (Kübler-Ross, 1993)
- Social innovation – stages in the innovation-decision process (Rogers, 2010).

There are numerous reports that discuss diversity in the rail and manufacturing workforce with a particular focus on women. There was little that could be found in relation to rail that pertained to inclusion.

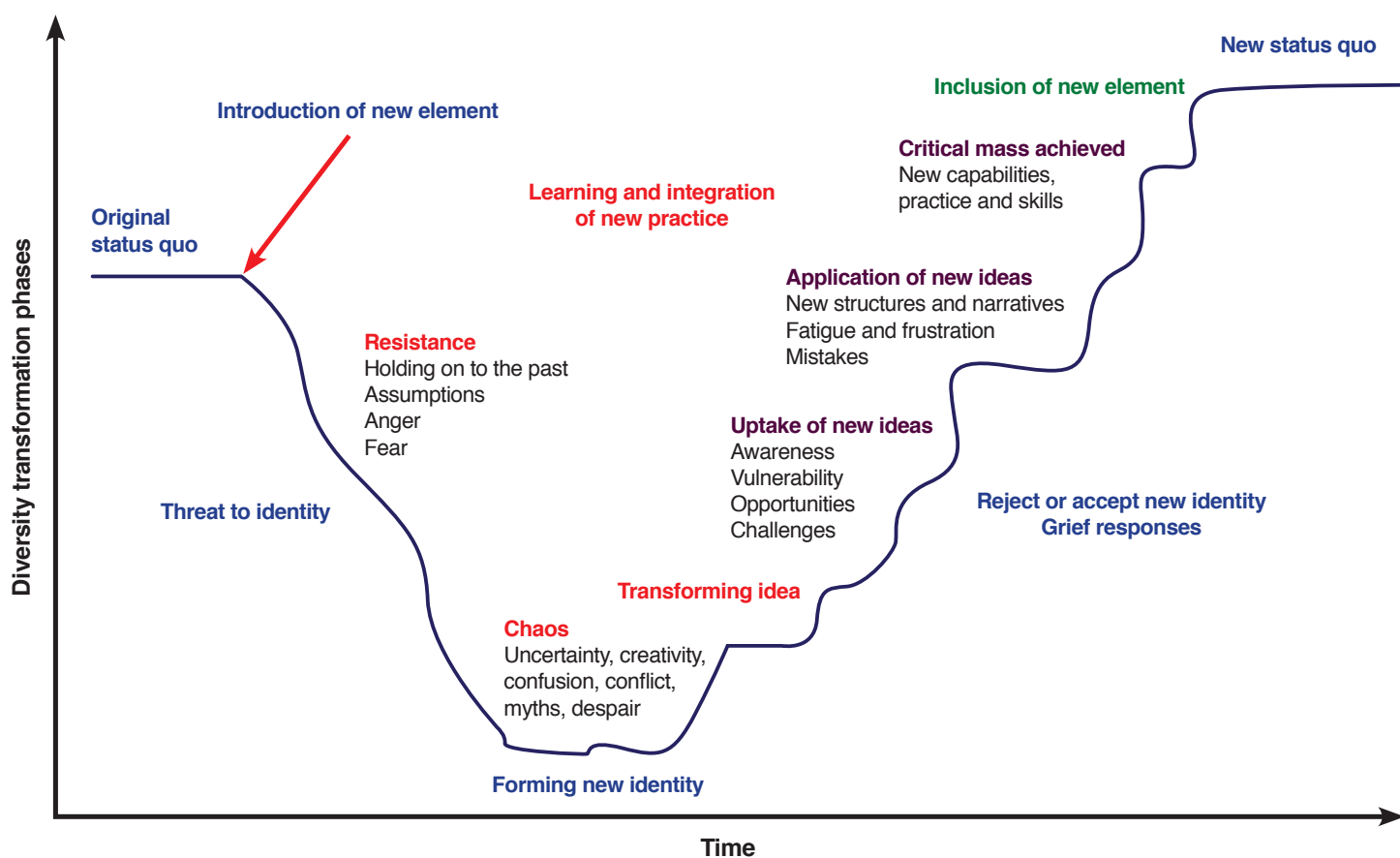


Figure 2.6 Phases of the diversity and inclusion transformation process (Young et al., 2018b, adapted from Satir et al., 1991; Kübler-Ross, 1993; Gardenswartz and Rowe, 2003; Rogers, 2010)

Why inclusion is important

Inclusion is important as it can help manage risks that may occur in a workforce, particularly during transitional phases when a workforce is becoming more diverse as a result of social and cultural change.

Inclusion is also particularly relevant to employee wellbeing and mitigating risk associated with diversity. It is a requirement within the *Occupational Health and Safety Act 2004* for all organisations to provide and maintain a physically and psychologically safe working environment (Worksafe, 2017). Shore et al. (2011) found that exclusion can result in, 'harmful cognitive, emotional, behavioral, and health outcomes'. Trener et al. (2012) also found emerging evidence that discrimination may also be associated with heart disease and stroke and engagement with smoking and substance abuse. The Hitlan et al. (2006) study also indicated exclusion is more detrimental to men compared to women in relation to psychological health.

Inclusion is also important to reducing the risks to organisational performance that can occur as a result of diversification of a workforce (Young and Jones, 2019). These risks include:

- Divisions across different cohorts and increased conflict (Pelled, 1996)
- Increased issues with communication and working together (Alagna et al., 1982)
- Increased intention to leave, turnover, job stress and burnout (Mor Borak et al., 2016)
- Poor organisational reputation which impacts on the attractiveness of organisations to potential jobs seekers (PwC, 2017)
- Poor management of implementation of change (Young and Jones, 2019).

Benefits of a diverse workforce

Increasing diversity, seen as critical by the sector to support future sustainability of the workforce, is discussed in multiple areas of the literature. McMahan et al. (1998) found diversity could result in creativity, innovation and improved problem-solving, resulting in a competitive advantage. Egan (2016) found it to provide an array of skills, knowledge, perspectives and backgrounds, while Mor Barak et al. (2016) undertook a comprehensive meta-analysis of service organisations globally worldwide and found job satisfaction, satisfaction with co-workers, organisational commitment, and job tenure.

Different types of diversity may also result in different types of outcomes. The Giffi et al. (2017) study on women in US manufacturing found gender diverse leadership improved financial performance. A study by Teruel et al. (2015) of intra-organisational structures in manufacturing and service firms found that the gender diversity had a greater positive impact on larger size R&D teams for carrying out product and organisational innovations, and on marketing and process innovation in micro and small businesses. A six-year longitudinal analysis on the impact of racial diversity on performance by Richard et al. (2007) found that there is stronger relationship between racial diversity and productivity in the manufacturing service industry firms.

The Daley et al (2003) report examines the key economic reforms for Australia, and identifies the considerable economic benefits associated with increasing participation of women in the workforce in Australia stating:

'Removing disincentives for women to enter the paid workforce would increase the size of the Australian economy by about \$25 billion per year.' (p35)

Maharaj and Rasmussen (2019 forthcoming) undertook a preliminary economic assessment of community benefits associated with Fire and Rescue NSW's (FRNSW) five-year program – Indigenous Fire and Rescue Employment Strategy (IFARES). The program was found to have an estimated \$8 million benefit to the community, with a cost-benefit ratio of 20, and a range of invaluable intangible benefits, such as building community pride and strengthening social cohesion.

The ARA *Women in Rail Strategy* (2017) also lists improved financial performance, reduced staff turnover costs, national productivity and competitiveness, minimised legal risks and costs, and corporate knowledge benefits (p5). A gender-diverse workforce can also provide insight into the needs of male and female customers and can facilitate effective interaction with male and female customers (Ali et al, 2017). However, simply increasing diversity does not guarantee these benefits. Young et al (2018a) found that in order for diversity to be effective and result in benefits, it needs to be integrated into organisations through effective inclusion and the levels of diversity sustained.

Barriers and enablers

PwC (2006) predict that 'over the next decade female participation in the workforce is expected to rise' (p25). They also state:

'The current focus in both the rail and manufacturing sector is to increase the participation of women in the workforce. Conversely, as women are currently largely un-represented in the rail industry, it will be a significant challenge for the industry to learn how to attract and retain them.' (p56)

Specific barriers in relation to gendered responses are a common theme in many reports. Williams and O'Reilly's (1998) extensive literature review into diversity over the last 40 years identifies the following gender-based responses to inclusion of women (p105):

- Higher levels of gender stereotyping in males dominated groups (Guttek, 1992)
- Hostility towards women in predominantly male organisations, but that women were less likely to isolate men when they were in the minority (Fairhurst and Snavely, 1983)
- Women were less well integrated into male dominated groups (Ibarra, 1992)
- When in the minority, men can be less satisfied and have 'more negative outcomes psychologically' (Tsui et al., 1992).

The ARA strategy (2017) to increase the participation of women in the rail workforce also identified the following barriers (pp. 4–5):

- Industry perceptions
- Lack of awareness of rail career opportunities
- Efforts perceived as tokenism
- Low representation of females in STEM subjects
- Legacy cultures
- HR rather than business issue
- Timing of current networking events
- Lack of female role model visibility in the industry.

The Pakula et al. study (2017) examines the issue of the structural and systemic barriers affecting participation and retention of women in trades in Canada and British Columbia in relation to women. They discuss the systemic nature of barriers, which range from a macro level through to the individual and the need for systemic approaches to address these through enabling factors (Figure 2.7, overleaf). They also examined how these worked across the career spectrum of women's careers and the different experiences of women at these different stages. They found 'a strong and broad staffing structure is absolutely critical to make sure that adequate human resources are dedicated to all program domains' (p10).

Clarke et al.'s (2017) study into organisational policy and practice in relation to women in the construction industry also reinforces the need for systemic approaches. They also found that it was 'important for initiatives to be developed in participation with employees and in parallel with appropriate recruitment, training, employment and working conditions' (p9) for them to be successful.

Women, however, are a diverse cohort, and it is important to consider the intersectionality with other areas of diversity such as age, race or disability which may create different needs (Shore et al., 2011). This is also discussed in relation to the Crossrail project that focused on changes to employment, access to key services (including training and work) and disabled access resulting in substantial increases in participation of women (Clarke et al., 2017, p9).

In terms of younger women, an international PwC online survey in 2015 across 75 countries of 10,105 respondents, aged between 20 and 35 focused on millennials. PwC (2015) found a change in the expectations and aspirations of this cohort and concluded that this was a 'new era of female talent' who are aware of and look for diversity in organisations:

'The female millennial is more career confident and career ambitious than the generations that have gone before her. To be successful and capitalise on the stellar traits of the female millennial, employers must commit to an inclusive culture, talent processes, policies and programmes that lean into the confidence and ambition of the female millennial. Forming talent strategies tailored for this talent segment will be a vital step to achieving the long-term aims and ambitions of an individual organisation.' (p6)

They also found that, contrary to the assumption that most women leave the workforce due to family commitments, 'women are much more likely to have left an organisation because of a lack of career progression, learning and development and pay' (p16).



Figure 2.7 Challenges, barriers and enabling factors (Pakula, 2017)

In relation to millennials more generally, a PwC (2017) *The Workforce of the Future* survey of 10,000 workers across six countries, found an increase in workers wanting to work for organisations with a 'powerful social conscience' from 65% in 2014 to 70% in 2017. Millennials (22–37), who are a key target employee cohort for the rail industry, rated most highly in this area with 76%.

Levels of diversity in the rail workforce

Diversity in the rail sector is currently seen in terms of gender and demographic diversity. There are three surveys that have been undertaken in relation to diversity in the rail sector. The ARA's *Workforce Development Report* (2014) provides an overarching view of diversity, whereas the Workplace Gender Equality Gender (WGEA) 2018 data set in relation to rail and transport and the ARA *Gender Diversity Report* (2018) focus on representation of women. The data collected across the reports vary, but can be used to paint an indicative picture of representation of women in the rail industry between 2014 and 2017.

Representation of women has increased since 2013 from 14% in 2014 (ARA, 2014) to between 20% (WGEA, 2018) and 21% (ARA, 2018) (Table 2.2, overleaf). Currently this equates to 17% of the workforce, which is still low in relation to the average of 47% of representation of women in the overall Australian workforce (ABS, 2018).

Table 2.2 Gender diversity

	Reports		
	ARA Workforce Development (2014)	ARA Gender Diversity Report (2018)	WGEA 2018 reporting data (2016/17) – rail transport
No organisation	21	26	10
Workforce representation	44,404	28,000	37,026
Representation women by number	7,383	5,880	7,405
Representation of women as a percentage	17%	20%	21%

Consistent across all three reports is the under-representation of women in managerial positions and over-representation in part-time positions. There are discrepancies between the reporting of gender equality policies and strategies by ARA members and those for the WGEA 2017/2018 reporting data. For example, ARA (2018) reveals 42% of employers have a retention gender equality or strategy, while WGEA data reveals 80% for the same. The reason for this is not clear.

In relation to occupation, representation of women was found to be lowest in operational roles (ARA, 2014) (Figure 2.8).

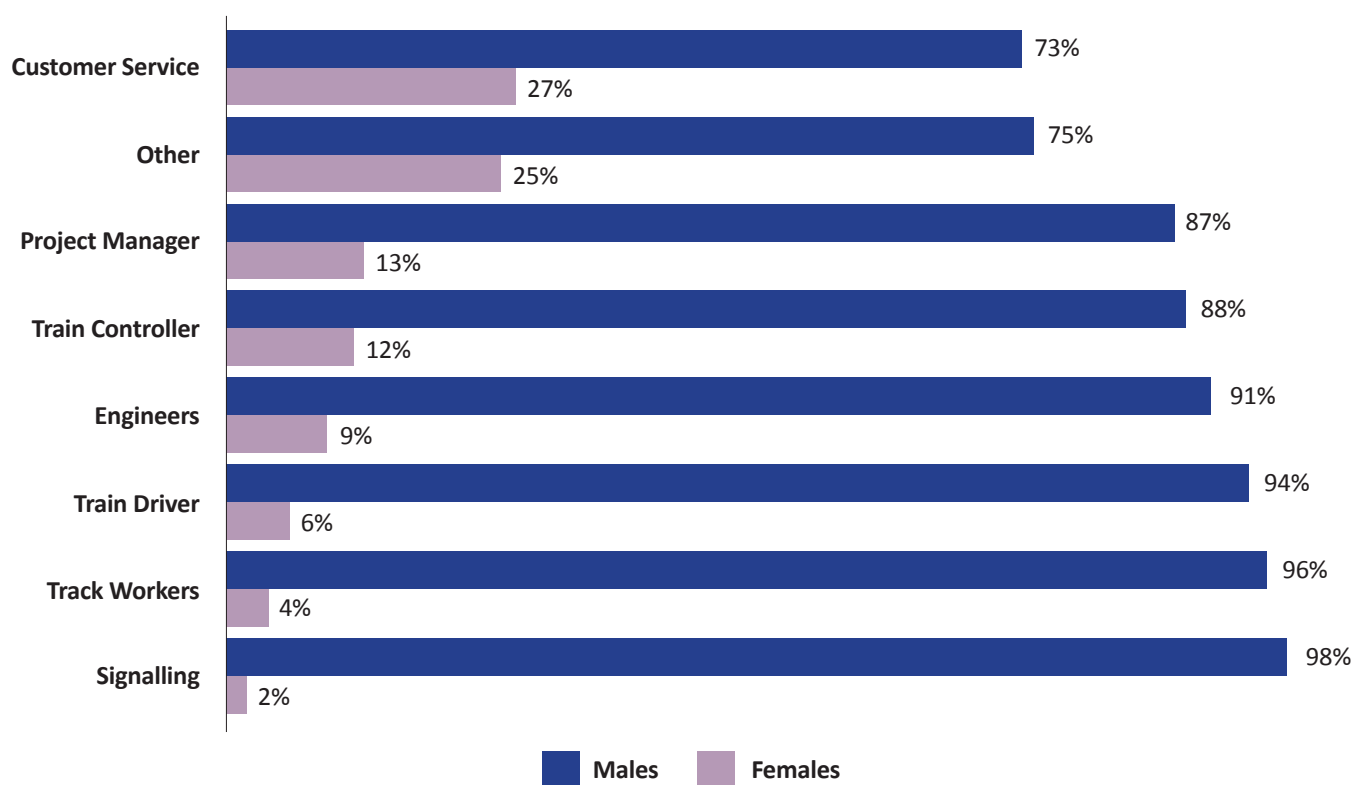


Figure 2.8 Gender by occupation (ARA, 2014)

ARA (2018) also found gender imbalance across all the rail sectors for full-time rail employees, ranging from an average of 14% of females employed in full-time positions in freight and manufacturing organisations, to an average of 23% of females employed in full-time positions in consultancy firms. Women also occupied more part-time than full-time or casual positions than men, with 66% in manufacturing/supply and 77% in infrastructure/maintenance. 60% of the 24% of non-managerial positions were clerical and administrative positions.

Low representation of women is a global issue generally but more acute in the rail sector in Australia. This is also the case in the UK, with the *Women in Rail Industry Survey* report finding 16.4% of women employed in the overall rail sector, with 12% of women in the supply chain in a manufacturing roles and 10% working as engineers (Women in Rail, 2015).

In relation to other diversity categories, ARA (2014) shows representation of Indigenous (1.73%) and disabled (2.96%) workers are below national averages, and cultural diversity is 10.35%. There were no further surveys that could be found to chart progression related to these areas. It was noted in the report that data collection was difficult across these areas and primarily collected when people were recruited.

Demographic representation in the workforce overall found 52% of the workforce to be over the age of 45, with the under 25s being the most under-represented group at 4%. In terms of specific demographics related to occupation, Figure 2.9 (overleaf) shows the 25–35 year-old demographic the highest in engineering and signalling occupations.

There was, however, no publicly available data found that could provide an overview of the current workforce size or composition for rolling stock in Victoria. There were also no publicly available measurements found for diversity or inclusion for the bus sector workforce. Data in relation to the rail workforce was raised as an issue in the PwC (2006) report *The Changing Face of Rail*, which stated, 'Currently, there is limited reliable data to direct effective industry or organisational workforce planning' (p5).

Although there is data emerging, there is little continuity or consistency between data sets in relation to diversity and inclusion in the workforce, and there is a need for further work in this area.

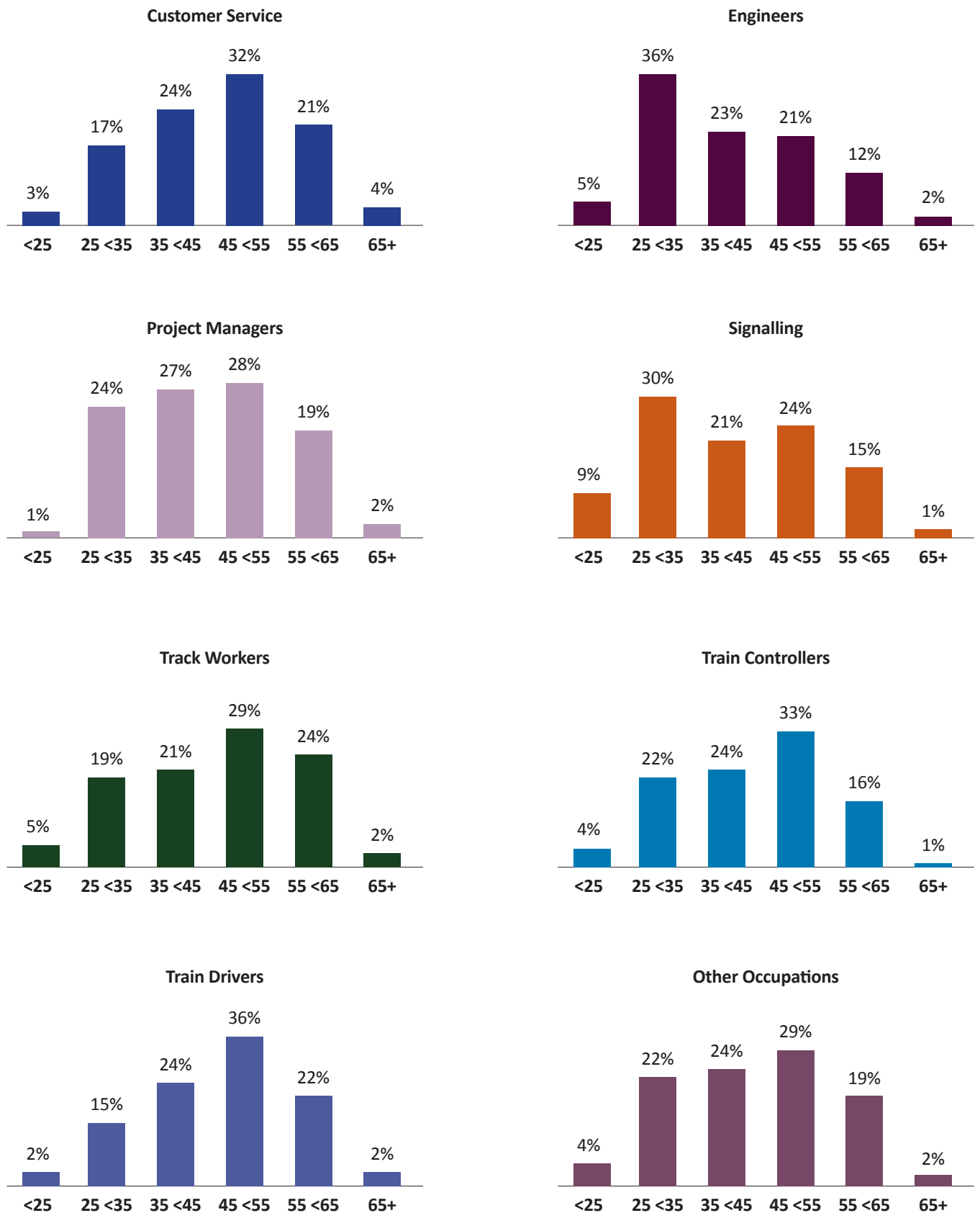


Figure 2.9 Demographic distribution in the rail industry relating to occupation (ARA, 2014)

Building and retaining a future workforce

There are a number of challenges facing the industry, the most common themes being the poor image and the culture of the transport sector and manufacturing. These are seen as long-standing issues that influence attraction and retention of employees, particularly women and younger people (PwC, 2006; TACSI, 2017; BIS Oxford Economics, 2018; CEDA, 2014).

The current workforce is characterised by PwC study (2006) participants describing the community as seeing rail as: ‘blue-collar, bureaucratic, public sector, unionised, not “sexy” and “male-dominated”’ (p6). BIS Oxford Economics (2018) also found similar negative perceptions within participants of their study. It is also suggested these perceptions and the narratives that arise about this in the transport sector as a whole are being reinforced by poor representation of the industry in the media (BIS Oxford Economics, 2018; TACSI, 2017; PwC, 2006). Some areas of the industry may be also seen to be less attractive than others, with one interviewee suggesting that maintenance had an ‘image problem’, indicating that it was seen as ‘lower order’ (BIS Oxford Economics, 2018).

Further discussion relating to attraction to the workforce and perceptions of the workforce can be found in the community section on pages 43–56 of this report.

The sourcing of community perceptions of rail from predominantly industry members rather than the community themselves provides an inwardly focused conversation. This may inadvertently reinforce the above notions through creating a narrative that is then projected back to the community. There are also indications the lack of knowledge about who the community is and their motivations, is also seen to lead to misconceptions within industry as to how to best engage with desired cohorts (TACSI, 2017).

However, there are a number of other factors seen to influence this agenda. The TACSI (2017) report into participation in the employment market in the contradictory environment of high job vacancy and high unemployment in South East Melbourne, raises legacy narratives and lack of knowledge of the current industry as barriers. This is illustrated by the Stanford and Swann survey (2017), which found 71% of the public surveyed in relation to their knowledge of the manufacturing industry thought that employment in manufacturing had decreased although there has been growth in the sector. This is not a uniquely Australian phenomenon, with the National Academies of Sciences, Engineering and Medicine’s (NASEM) (2015) extensive study of the rail industry in America finding rail had some features that were attractive, but ‘the larger public is not aware of these attractive features’ (p9).

The current lack of women engineers available in the employment pool sits within a global context of the current technological revolution (Industry 4.0) with ‘the demand for engineers – any engineers – far outweighing the supply’ (Women in Rail, 2015, p13). Kaspura (2017) also attributes the lack of supply in Australia to the ‘boom and bust nature of the industry’ since 2000 and a reliance on skilled migration to fill this gap. Other issues related to STEM skills and women are discussed in the Section 3 of this report.

TACSI (2017) also outline deeper systemic barriers that impact the ability of those from disadvantaged background to participate in employment. They raise that the current job seeking services focus on outputs rather than outcomes and that they are complex, fragmented and difficult for job seekers to navigate. They also found there was a need for organisation and job agencies to provide tailored support to address the unique needs and career pathways of this cohort to enable participation in the workforce.

The use of job agencies is also raised as a potential future issue in the *Standing Committee on Employment, Workplace Relations and Education 2007 Inquiry into Workforce Challenges in the Transport Industry* report that stated:

‘... that while it can serve as a useful temporary solution to unforeseen worker shortages, it may also reduce the sense of urgency employers and industry groups should have to develop longer term attraction and retention strategies.’ (p23)

The transferability of technology skills and attractiveness of jobs outside of rail may also be contributing factors that result in a job being seen as a stepping-stone to other jobs rather than a destination in itself. There are also indications of concern related to employees transferring to another industry creating a deficit:

‘Because as we’ve become more technological it also means that skills become so much more transferable. Google comes along and says, “Hey, I have a very nice job for you which is very creative”, and she’s, “Oh, fantastic. It sounds like the dream job.” They go. Now you’ve lost a rail professional.’ (BIS Oxford Economics, p39)

Transferability of skills, however, is seen as important for sustainability of the workforce in this sector. Challenges due to the fragmented nature of the industry and the lack of harmonisation across the sector in relation to training-related standards and competencies are a common theme (BIS Oxford, 2018; PwC, 2006). The Australian Human Rights Commission (2013) also stress the importance of the experience of candidates during the interview process as ‘a key determinant’ as to whether a candidate will choose to accept the job or not. They raise the need to train staff so that they are able identify experience and skills in candidates from non-traditional backgrounds that are applicable to different work contexts.

Leading organisations train their recruitment teams to consider how candidates with a diverse range of experiences may be able to transfer their skills to non-traditional roles. They value applicants who have mastered skills in other industries, shown ability to learn quickly and shown significant growth in the previous career path (Australian Human Rights Commission, 2013, p25).

NASEM also suggest in relation to millennials and Generation X in America, that there was a need to engage more effectively with social media (p9), indicating a need to build skills throughout the sector in relation to this.

Retaining particularly women and younger employees is also a common theme. An Australian study by Sharma et al. (2019) found the retention rate of women engineers to be 13.1%, with the majority leaving the workforce between ages of 20 and 30, compared to 1.4% men. They identified a number of barriers related to cultural influence, unconscious bias, myths and stereotyping and concluded ‘... apart from cultural, pay gap and other societal factors, it’s more about engineering culture which force women to leave the profession’ (p675). Findings from the survey conducted by PwC (2006) also found women were much less likely to intend to stay in the rail industry in the longer term than men. In terms of age demographics, those under 25 and between 36–45 were the least likely to stay longer term, and those over 55 the most likely to stay.

The high turnover among younger workers was primarily attributed to the apparent disconnect between the image of the rail industry and the reality of experience. PwC (2006) raise the dilemma facing rail organisations with the need to maintain the current workforce, as well as attract a diverse and skilled workforce, finding ‘... the strong culture that is very attractive to the existing workforce, is quite unattractive to the emerging workforce that rail requires for the future’ (p3). They also stated that it has ‘the propensity to cause new entrants to either assimilate into the culture or leave the organisation’ (p71).

Responses to the survey contained in this report as to whether participants would recommend the industry based on job conditions (Figure 2.10, overleaf) and the predominance of the values of safety and co-workers may be reinforcing this culture through attraction of those of similar mindsets by the current workforce. The responses related to dissatisfaction where people would not recommend the industry showed work/life balance, leadership and recognition to be the most highly rated reasons.

The PwC (2006) survey also found there was a lack of perceived ability of the industry to deliver in key areas that would improve employee satisfaction (Figure 2.11, overleaf), which reinforces the need for building industry capability. The survey also indicates that there are current capabilities that can be built upon, such as flexibility and variety to support the creation of environments that support growth and diversification of its workforce.

There are some programs focused in the area of capability building including:

- Australian Industry Group (AIG) Entrepreneurs Program which supports the building of organisational capability in the rolling stock supply chain (AIG n.d)
- RISSB Horizons Program (2019) that supports innovation and young leaders in the rail sector
- ARA Young Professionals initiative which provides a suite of programs that support the development of young professionals in the industry, including a Young Leaders Program mentorship programs (ARA n.d).

In relation to women, the ARA Women’s Strategy (2017) outlines a number of activities to be rolled out across the sector related to attraction and recruitment of women (ARA,2017, p9):

Attraction

- Branding and promotion of rail
- Unbiased gender recruitment
- Advocacy in educational institutions.

Retention

- Develop organisation-specific or industry-wide coaching and mentoring program
- Organisational culture and leadership
- Improved networks
- Develop a national framework.

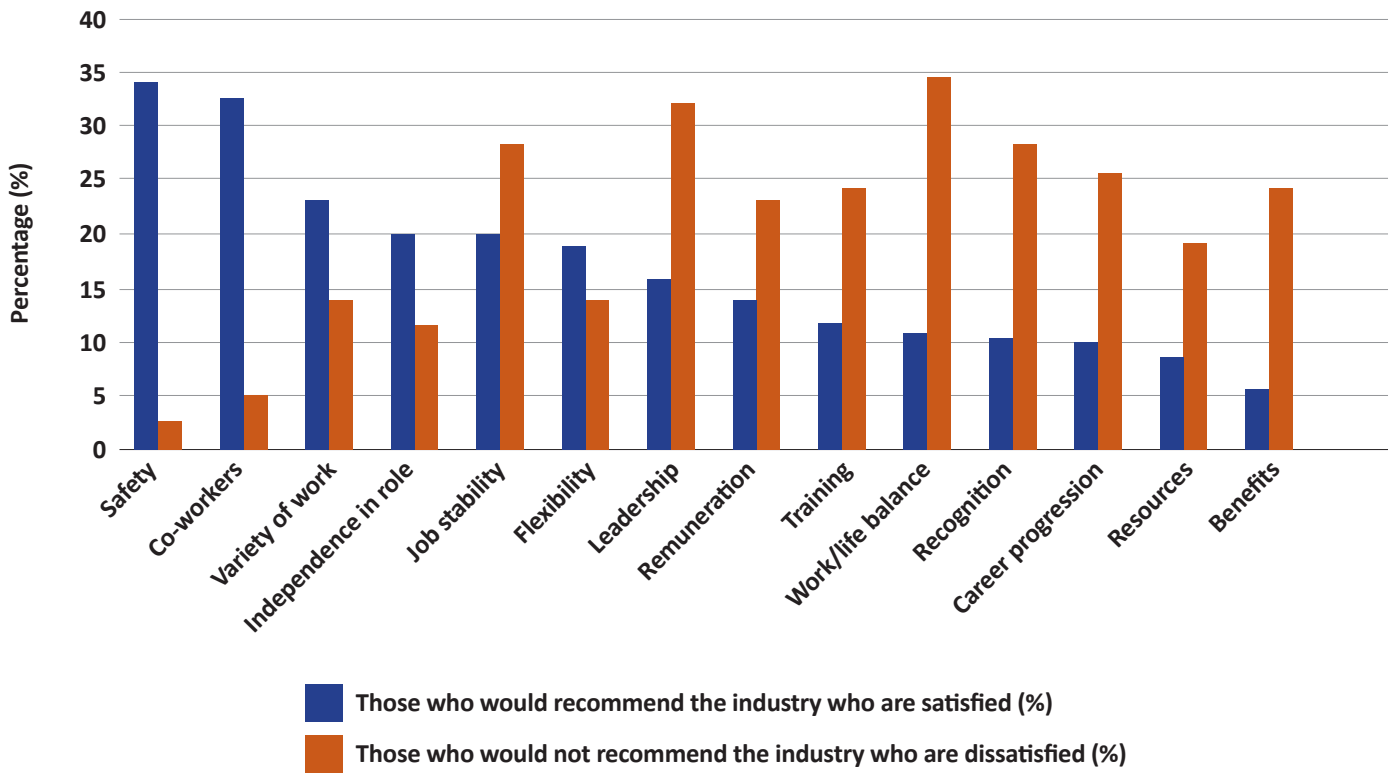


Figure 2.10 Job conditions (PwC, 2006)

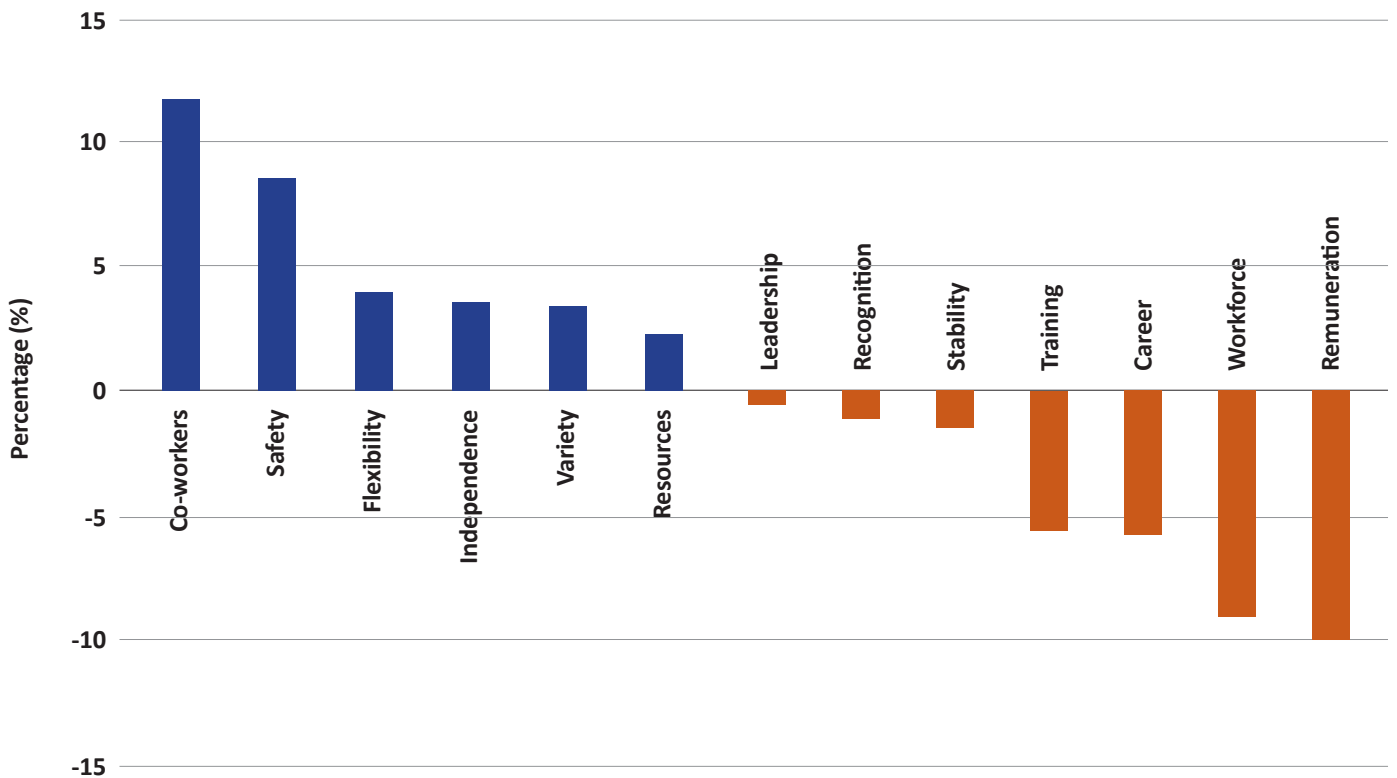


Figure 2.11 Over delivering/under-delivering (normalised difference between importance of job conditions and the rail industry's ability to deliver)

Leadership and management are seen as crucial areas for capability and skills development in a number of reports. However, the nature of skills and capabilities needed to transition the workforce and maintain the future workforce, were found to be not clearly defined.

There is a gap in relation to cultural diversity or disability in the rail sector, and there is a need for further research in this area. There is also a distinct lack of literature that explores the intersectionality between different diverse categories.

The way forward

PwC (2006) identified four focus areas and made a number of recommendations, which are summarised below (p6):

Attraction and retention

- Gain agreement on which audiences the industry should target
- Ensure alignment of branding (promise) with the experience (reality)
- Undertake small tailored campaigns rather than a 'big-bang' approach.

Skilling rail

- Establish clear guidance on minimum training requirements
- Expand the perception of 'capability development'
- Consider other models of capability development
- Commence workforce planning in a coordinated way that establishes the current and future needs of operators.

Workplace relations

- Establish mechanisms that allow the industry stakeholders to come together to begin to discuss and debate issues which are larger than any one operator can address individually.

Data collection

- ARA to act as a 'Research Clearing House'.

Reports undertaken in the years following the PwC (2006) study tend to either echo or restate these recommendations. This suggests that the key issue with the industry is not what to do but how to do this, indicating the need to understand and address deeper issues which impact organisational and sectorial ability to enact these recommendations.

In summary, challenges related to building workforce capability and maintaining employees in general is a systemic, multi-faceted issue that has been present for some time, and which requires a collaborative systemic and strategic approach to achieve effective outcomes. In relation to diversity, the attraction and retention of women and young people is an acknowledged issue. There are common themes, related to the need to change industry culture and public perceptions and also multiple recommendations that align over the period of 2006–2019. Although there have been strategies developed, it is not clear how well these are manifesting across the industry. There is also little indication of diversity in other areas such as disability, people from culturally and linguistically diverse (CALD) backgrounds, or Aboriginal and Torres Strait Islander people.

With the exception of representation of women in rail, there is a considerable gap in relation to analysis of measurement of progress of recommendations and who is or should be measuring them.

Summary

The public transport system in which rolling stock exists is complex, with the dominant forces being rail and manufacturing. The relationship of industry being a provider to government of both assets and services, adds additional complexity. The literature is diffuse, and data and analysis of the current state of the diversity and inclusion in the workforce or progress made to date is patchy and in places non-existent. It is also not clear what level of innovation exists within the current supply chain or where this exists. As a result, it is not possible to ascertain the current composition of the workforce or where strengths currently exist.

There is a clear articulation of the problem and potential solutions, but little that provides support in relation to practical implementation of how to achieve these outcomes in the different contexts and cultures across the rolling stock sector.

There is consistency in the issues pertaining to workforce in rail and manufacturing which include:

- The need to improve the culture
- The need for cross-sectorial/organisational collaboration
- Issues with attraction and retention
- The need to build a diverse and innovative future workforce
- The need to build capability and skills in the current workforce.

There is substantial duplication of a number of recommendations since 2006 in relation to the above issues, which suggests that deeper systemic issues are yet to fully understood or addressed.

Other issues found during the review were:

- A lack of information in relation to the current workforce composition of the rolling stock sector in Victoria
- There is little formal monitoring of progress of either recommendations of reports produced between 2006–2018 or the strategic pathways outlined in the On Track for 2040 Roadmap (DIISRTE, 2012)
- The literature is fragmented pertaining to specific areas of industry or type of business and there is little holistic overview provided of the complexity or diversity of organisations that make up the rolling stock ecosystem
- There is a substantial lack of literature pertaining to the specific people-based skills and capabilities needed to transition the current rolling stock workforce or build and maintain the future workforce. It is not clear what level of these capabilities currently exists in areas of the rolling stock supply chain.

Further research is needed to:

- Determine the current status of progress in the industry and also to determine the prevalent decision-making factors that shape organisational actions
- Develop a better understanding of different types of organisational cultures in the sector to assist the development of practical solutions which are tailored to suit context specific problems
- Identify differences and alignment in values and narratives across organisations in the rolling stock ecosystem that inform both culture and decision making
- Understand how inclusion manifests in practice and their current levels in public transport organisations
- Ascertain what organisational capabilities exist to enable transition, what is needed and how these can be leveraged in the rolling stock sector
- Establish the collaborative capability of the sector and what model of collaboration is possible within the current context.

Conclusion

The rolling stock workforce is at the heart of the public transport ecosystem and its evolution is now critical. The current technological revolution opens up the opportunity for this sector to reinvent itself. However, the fragmented and complex nature of the sector and the culture of the industry, present substantial challenges. There is a critical need to build capability, skills and collaboration across the sector to enable progress. The public transport sector aspires to become ‘an employer of choice’ (PwC, 2006). To do this, it will need to broaden its focus beyond technology to people and embrace the inherent complexity within this.

References

- Ahmad, S. (2017). Culture and lean manufacturing: Towards a holistic framework. *Journal of Business and Management* 1(1), 1–5.
- AIG (n.d) AIG Entrepreneur's Program, <https://www.aigroup.com.au/business-services/governmentprograms/entrepreneursprogramme>. Accessed 15 September 2019.
- Alagna, S., Reddy, D., and Collins, D. (1982). Perceptions of functioning in mixed-sex and male medical training groups. *Journal of Medical Education*, 57, 801–803.
- Ali, M., et al. (2011). The gender diversity–performance relationship in services and manufacturing organizations. *The International Journal of Human Resource Management*, 22(7), 1464–1485.
- Astrachan, J. (1988). Family firm and community culture. *Family Business Review*, 1(2), 165–189. SAGE.
- Australasian Railway Association (ARA) (n.d). *Young Professionals*. <https://ara.net.au/young-professionals> accessed 20 September 2019.
- ARA. (2018). *Gender diversity report of the Australasian rail workforce*.
- ARA. (2017). *Women in rail strategy: Improving rail's gender diversity*.
- ARA. (2014). *Workforce development report. Rail workforce data 2014*.
- Australian Bureau of Statistics Data. (2018). *Labour force, Australia, July 2018*, Cat. no. 6202.0. <http://www.abs.gov.au/auststats/abs@.nsf/mf/6202.0>. Accessed 16 September 2019.
- Australian Human Rights Commission. (2013). *Women in male dominated industries: A tool kit of strategies*.
- AIG (n.d) AIG entrepreneur's Program. <https://www.aigroup.com.au/business-services/governmentprograms/entrepreneursprogramme>. Accessed 15 September 2019.
- Bombardier. (2009). *Submission*, Inquiry into the State of Manufacturing in Victoria by the Economic Development and Infrastructure Committee of the Parliament of Victoria.
- Brewer, M., and Gardner, W. (1996). Who is this “we”? Levels of collective identity and self representations. *Journal of Personality and Social Psychology*, 71, 83–93.
- BIS Oxford Economics. (2018). *Australasian Railway Association skills capability study, skill crisis: A call to action*. Australasian Railway Association.
- Cameron, K., and Quinn, R. (2011). *Diagnosing and changing organisational culture: Based on the competing values framework*. AddisonWesley Publishing, Reading.
- Chatman, J. A., and Jehn, K. A. (1994). Assessing the relationship between industry characteristics and organizational culture: How different can you be? *The Academy of Management Journal*, 37(3), 522–553.
- Clarke, L., Michielsens, E., and Snijders, S. (2017). Misplaced gender diversity policies and practices in the British construction industry: Developing an inclusive and transforming strategy. In *Valuing People in Construction*, 130–150. Routledge.
- Committee for Economic Development Australia (CEDA). (2014). *Report – advanced manufacturing beyond the production line Commonwealth of Australia (2017)*, Department of the Prime Minister and Cabinet, National Innovation and Science Agenda, Australian Government, Canberra.
- Coolican, M.J., and Jackson, J. L. (2002). *Integrating culture with strategy*. www.leadervalues.com
- Cooper, R., and Quinn R. (1993). Implications of the competing values framework for management information systems. *Human Resource Management* 32(1), 175–201.
- Cooperrider, D., and Whitney, D. (2001). A positive revolution in change. In Cooperrider, D., Sorenson, P., Whitney, D., and Yeager, T. (eds.). *Appreciative Inquiry: An Emerging Direction for Organization Development*, 9–29. Stipes, Champaign.
- Dadfar, H., and Gustavsson, P. (1992). Competition by effective management of cultural diversity: the case of international construction projects. *International Studies of Management and Organization*, 22(4), 81–92.
- Davies, A., Mulgan, G. Norman, Pulford. W. (2012). *Social Innovation*. Social Innovation Europe.
- Daley, J., McGannon, C., and Ginnivan, L. (2012). *Game-changers: Economic reform priorities for Australia*. Grattan Institute, Melbourne.
- Department of Innovation and Industry and Science Australia, Office of the Chief Economist. (2016). *Performance review of the Australian innovation, science and research system*. Commonwealth of Australia, Canberra.
- Department Industry, Innovation, Science, Research and Tertiary Education. (2012). *On track for 2040: Preparing the Australian rail supply industry for challenges and growth roadmap*. Commonwealth Government of Australia, Canberra.
- Diversity Council of Australia. (2015). *Building diversity: An evidence-based model of inclusive leadership*.

- Edler, J., and Fagerberg, J. (1 January, 2017). Innovation policy: what, why, and how. *Oxford Review of Economic Policy*, 33(1), 2–23. <https://doi.org/10.1093/oxrep/grx001> provide a taxonomy of innovation policy instruments
- Egan, T. (2016). Creativity in the context of team diversity: Team leader perspectives. *Advances in Developing Human Resources*, 7(2), 207–225.
- Fairhurst, G., and Snaveley, B. (1983). Majority and token minority group relationships: Power acquisition and communication. *The Academy of Management Review*, 8(2), 292–300.
- Gardenswartz, L., and Rowe, A. (2003). *Diverse teams at work: Capitalizing on the power of diversity*. Society for Human Resource Management, Alexandria.
- Giffi, C., Huelsman, T., Drew-Rodriguez, M., and McClelland, K. (2017). *Women in manufacturing: stepping up to make an impact that matters*. Deloitte Development LLC.
- Glendon, I., and Evans, B. (2017). *Safety climate in Australian railways, people and rail systems: Human factors at the heart of the railway*, 409–416. CRC Press, Taylor and Wiley.
- Global Aviation Information Network (GAIN) Working Group E. (2004). *A roadmap to a just culture, enhancing the safety environment*.
- Gök, A., Cunningham, P., and Shapira, P. (2016), Introduction: Making Sense of Innovation Policy. In Edler, J., Cunningham, P., Gök, A., and Shapira, P., (eds), *Handbook of Innovation Policy Impact*, 1–17. Edward Elgar, Cheltenham.
- Gutek, B. (1992). Understanding sexual harassment at work. *Notre Dame Journal of Law, Ethics and Public Policy*, 6(2), 335–358.
- Hall, D., and Davis, R. (2007). Engaging multiple perspectives: A value-based decision-making model. *Decision Support Systems*, 43(4), 1588–1604.
- Harrison, M. (2005). *Diagnosing organizations: methods, models, and processes*. Sage.
- Hitlan, R., Clifton, R., and DeSoto, M. (2006). Perceived exclusion in the workplace: The moderating effects of gender on work-related attitudes and physical health. *North American Journal of Psychology*, 8(2), 217–235. (Accessed 8 Oct 2019.)
- Ibarra, H. (1992). Homophily and differential returns: Sex differences in network structure and access in an advertising firm. *Administrative Science Quarterly*, 37(3), 422–447.
- Igo, T., and Skitmore, M. (2006). Diagnosing the organizational culture of an Australian engineering consultancy using the competing values framework. *Construction Innovation*, 6, 121–139.
- Kaspura, A. (2017). *Engineers Make Things Happen*. Institution of Engineers, Australia.
- Kübler-Ross, E., and Kessler, D. (2014). *On grief and grieving: finding the meaning of grief through the five stages of loss*. Simon and Schuster.
- Lowe, C. (February, 2015). Does size matter? How firm size affects social externalities and community and regional development. *Sociology Study*, 5(2), 114–136. David Publishing Company, USA.
- Maharaj, N., and Rasmussen, B. (2019 Forthcoming). *The economic benefits of the Indigenous Fire and Rescue Employment Strategy (IFARES) program: Fire and Rescue NSW*. BNHCRC, Melbourne.
- Martin, J. (2001). *Organizational culture: mapping the terrain*. Sage.
- McMahan, G., et al. (1998). Strategic human resource management: Employee involvement, diversity, and international issues. *Human Resource Management Review*, 8(3), 193–214.
- McInerney, P. (2005). *Final report of the Special Commission of Inquiry into the Waterfall rail accident*. Government of New South Wales, Sydney.
- Mental Health at Work. (2015). *Creating safe, mentally healthy and resilient and supportive environments in the bus industry*.
- Mor Barak, M. (2015). Inclusion is the key to diversity management, but what is inclusion? Human Service Organizations: Management. *Leadership & Governance*, 39(2), 83–88.
- Mor Barak, M., Lizano, E., Kim, A., Duan, L., Rhee, M., and Brimhall, K. (2016). The promise of diversity management for climate of inclusion: A state-of-the-art review and meta-analysis. *Human Service Organisations: Management Leadership and Governance*, 40(4). Taylor and Francis.
- Mylett, T. (2010). Safety culture: Conceptual considerations and research method. *International Journal of Employment Studies*, 18, 1–33.
- National Academies of Sciences, Engineering and Medicine. (2015). *A guide to building and retaining workforce capacity for the rail road industry*. The National Academies Press, Washington, D. C.
- OECD. (2018). *Promoting innovation in established SMEs*, 2018 Ministerial Conference Policy Note. OECD Social Innovation Europe, Systemic Innovation. Social Innovation Europe.

- O'Reilly, C., Chatman, J., and Caldwell, D. (1991). People and organizational culture: a profile comparison approach to assessing person-organization fit. *Academy of Management Journal*, 34(3), 487–516.
- Pakdil, F., and Leonard, K. (2015). The effect of organizational culture on implementing and sustaining lean processes. *Journal of Manufacturing Technology Management*, 26(5), 725–743.
- Pakula, B., Nguyen, C., and Leonard, D. (2017). *Enhancing the retention and advancement of women in trade in British Columbia*, SkillPlan. Burnaby.
- Parker, D., Lawrie, L., and Hudson, P. (2006). A framework for understanding the development of organisational safety culture. *Safety Science*, 44, 551–562. Elsevier.
- Parliament of Victoria Education and Training Committee. (2010). *Inquiry into skills shortages in the rail industry*. Parliament of Victoria.
- Pelled, L. (1996). Demographic diversity, conflict, and work group outcomes: An intervening process theory. *Organization Science*, 7(6), 615–631.
- Pless, N., and Maak, T. (2004). Building an inclusive diversity culture: Principles, processes and practice. *Journal of Business Ethics*, 54(2), 129–147.
- Price Waterhouse Coopers (PwC). (2018). *Workforce of the future: Views of 10,000 workers*.
- PwC. (2017). *Opening up on diversity: Getting to grips with reputational risk*.
- PwC. (2015). *The female millennial: A new era of talent*.
- PwC. (2006). *The changing face of rail – a journey to the employer of choice*. Australasian Railway Association, Kingston.
- Quinn, R., and Rohrbaugh, J. (June, 1981). A competing values approach to organisational effectiveness. *Public Productivity Report*, 122–140.
- Quinn, R., and Rohrbaugh, J. (1983). A spatial model of effectiveness criteria: Towards a competing values approach to organisational analysis. *Management Science*, 29(3), 363–77.
- Rail Manufacturing Cooperative Research Centre. (2017). *Senate Rural and Regional Affairs and Transport References Committee Inquiry into Australia's Rail Industry Submission*.
- Rural and Regional Affairs and Transport References Committee. (2017). *The Australian Rail Industry*. Commonwealth of Australia.
- Rail Industry Safety and Standards Board (RISSB). (2019). *Rail Submission Productivity Commission Issues Paper, National Transport Regulatory Reform*.
- Rainbird, S., et al. (2010). *The impact of organisational culture on fatigue management: The case of camaraderie amongst metropolitan train drivers*. 7th Annual Meeting of the Australasian Chronobiology Society (ACS).
- Reason, J. (1997). *Managing the risks of organisational accidents*. Ashgate Farnham, UK.
- Richard, O., Murthi, B., and Ismail, K. (2007). The impact of racial diversity on intermediate and long-term performance: The moderating role of environmental context. *Strategic Management Journal*, 28(12), 1213–1233.
- Roberson, Q. (2006). Disentangling the meanings of diversity and inclusion in organizations. *Group and Organization Management*, 31(2), 212–236.
- Rogers, E. (2003). *Diffusion of innovations*, 5th Edn. Free Press, New York.
- Satir, V., and Banmen, J. (1991). *The Satir model: family therapy and beyond*. Science and Behavior Books.
- Schein, E. (1995). The role of the founder in creating organizational culture. *Family Business Review*, 8(3), 221–238.
- Schein, E. (2004). *Organizational culture and leadership*. The Jossey-Bass business and management series, 3rd Ed. John Wiley and Sons, USA.
- Schein, E. H. (2010). *Organizational culture and leadership (Vol. 2)*. John Wiley & Sons.
- Schultz, M. (2012). *On studying organizational cultures: Diagnosis and understanding (Vol. 58)*. Walter de Gruyter, Berlin.
- Schwartz, S. (2012). An overview of the Schwartz theory of basic values. In *Psychology and Culture*, 2(1), 11.
- Sharma, J., et al. (2019). Vertical segregation: Issues and challenges of women engineers in Australia. *Procedia Manufacturing*, 30, 671–676.
- Shore, L., Randel, A., Chung, B., Dean, M., Holcombe, K., and Singh, E. (2011). Inclusion and diversity in work groups: A review and model for future research, *Journal of Management*, Santiago.
- Singal, M. (2014). The business case for diversity management in the hospitality industry. *International Journal of Hospitality Management*, 40, 10–19.
- Stanford, J., and Swann, T. (June, 2017). *Manufacturing: A moment of opportunity*, Briefing paper for the National Manufacturing Summit by Centre for Future Work at the Australia Institute.

- Teruel, M., Parra, M., and Segarra, A. (2015). *Gender diversity and innovation in manufacturing and service firms*. Technical report, Departament d'Economia-CREIP, Facultat d'Economia i Empresa.
- The Australian Centre for Social Innovation. (2017). *Addressing disadvantage in southern Melbourne*.
- Transport Safety Victoria. (September, 2016). *Guidance – safety culture*.
- Trenerry, B., Franklin, H. and Paradies, Y. (2012). *Preventing race-based discrimination and supporting cultural diversity in the workplace: an evidence review*, Victorian Health Promotion Foundation, Melbourne, at: https://www.vichealth.vic.gov.au/~media/resourcecentre/publicationsandresources/economic%20participation/2012%20workplace/chw_discrim_full_web_final.ashx
- Tsui, A., Egan, T., and O'Reilly, C. (1992). Being different: Relational demography and organizational attachment. *Administrative Science Quarterly*, 37(4), 549–579. doi:10.2307/2393472.
- Van Maanen, J. and Schein, E. (1977). *Toward a theory of organizational socialization*. Massachusetts Institute of Technology.
- Westrum, R. (1993). Cultures with requisite imagination. In Wise, J., Stager, P., and Hopkin, J. (Eds). *Verification and Validation in Complex Man–Machine Systems*. Springer, New York.
- Williams, K., and O'Reilly, C. (1998). *Demography and diversity in organizations: A Review of 40 Years of Research*, JAI Press.
- Women in Rail. (2015). *Women in rail: Industry survey*. London. <http://womeninrail.org/wp-content/uploads/2014/04/WR-Industry-Survey-Report-December-2015.pdf>
- Women Equality Gender Association. (2018). *Data set*. <https://data.wgea.gov.au/industries/287.xlsx>. Accessed 21 September 2019.
- Worksafe Victoria. (2017). *A guide book for employers. Preventing and managing work related stress*. Victorian Workcover Authority.
- Young, C., et al. (2018a). *Diversity and inclusion: Building strength and capability literature review*, Bushfire and Natural Hazards CRC (BNHCRC), Melbourne.
- Young, C., Jones, R. N., and Kumnick, M. (2018b). *The long road: Building effective diversity and inclusion in emergency management organisations. Case study synthesis and draft framework*. BNHCRC, Melbourne.
- Young, C., and Jones, R. N. (2019). *Risky business: Why diversity and inclusion matter. Into the future: Building skills and capabilities for a diverse and inclusive workforce, workshop synthesis and key research findings*. BNHCRC, Melbourne.



The community context

Daniel Ooi

Community perceptions of careers in rolling stock

Over a decade after the *Changing Face of Rail* report (PwC, 2006), the literature on the community perception of rail careers, and rolling stock careers in Australia more broadly, remains limited. The key problems identified by that report, based on a survey tool with limited responses (p21), from the perspective of community perceptions, were identified as (p11):

- Current employees believe the community perspective of the rail industry is negative
- The general public are believed to develop their perception of the industry through negative media and personal consumer experience of trains (mostly passenger)
- The general public has a very low level of understanding of the industry or the career opportunities that are available
- There is a difference between how the industry is perceived from outside the industry and the reality of working in the industry
- The stereotypical image of the rail industry as being slow and resistant to change is unlikely to change without an element of rejuvenation in either the workforce, or technology, rail products and services
- The employee survey points to a significant issue that people in the 18–25 year-old group and those in their middle career years are least likely to recommend the industry as an employment option for family and friends.

It should be noted that these perceptions were gained from employees within the sector and from representatives of member organisations, rather than the general community at large, and thus may reflect industry perceptions rather than those of the community. More work is needed to establish if these views are the same as those of the broader community. Since the publication of the above-mentioned report, it is not clear if the situation has changed, and the literature review herein summarises the extant and available work related to exploring the following questions related to careers in rolling stock and the community:

- To what extent does the Australian community view careers in rolling stock as attractive, and what aspects of these careers present a barrier to attraction for various segments of the community?
- To what extent have demographic changes amongst young jobseekers, and changes in social and cultural values in relation to work, changed the landscape for securing the future workforce in rolling stock?
- How can we understand the changing landscape of gender and cultural diversity of contemporary Australia in terms of career attraction, in ways that might contribute to securing the future workforce in rolling stock?

Virtually all the research thus far aimed at understanding attraction to careers in rolling stock in Australia has focused on a single cohort (engineering students, and their lecturers/teachers in both universities and TAFE colleges), regarding a specific sector (rail careers).

The 'Attraction and Image Project' (2009–2011) funded by the Cooperative Research Centre (CRC) for Rail Innovation examined knowledge and perceptions of rail careers across Australia. Based on 34 interviews conducted with engineering teachers, academics, and industry members, seven focus groups with engineering students and teachers, and a survey of 350+ engineering and trades students, the project (Wallace and Sheldon, 2014) concluded that the primary issues of public perception amongst engineering graduates were:

- Perception of rail as traditional and not innovative
- Low awareness of career opportunities
- Low brand awareness
- Lack of information on rail careers
- Career paths not portable and dynamic.

The engineering students surveyed generally indicated a low level of knowledge of rail careers, nominating drivers, security guards, and track workers as typical rail careers (Wallace et al., 2010). Most students had no rail-specific content in their university or TAFE courses, either in the form of curriculum topics, or industry-linked activities. In the same report, it suggested that a lack of knowledge of the rail industry on the part of academics, teachers, and career counsellors resulted in a lower profile of rail amongst possible career options for engineering students (Wallace et al., 2010). It was noted that the recruitment consultants interviewed regarded it as more difficult to attract candidates to public rail than to the private engineering companies, due to widespread negative perceptions, in which private engineering consultancies were described by participants as high status and high-tech, in contrast to public rail which was not (p11). One other closely related factor noted by Wallace et al. (2010) in their discussions with the recruitment consultants was the enduring image of the rail sector as dominated by bureaucratic public entities.

Additionally, some of the students regarded maintenance jobs within rail as unattractive due to the perception of routineness. Students noted: 'It's OK when you're older, but now I'm not interested in routine maintenance', and 'Maintenance is not interesting when you're young.' (Wallace et al., 2010, p15).

While student perceptions were generally negative and often based on commuter experience, current rail apprentices were generally positive, reporting their pre-employment perceptions to have been informed by family members, close friends, and acquaintances (Wallace et al., 2010).

Another 2006 study into the perceptions of rail careers by engineering graduates in Australia concluded that the lack of specific information available meant that individuals filled in the knowledge gap using their own personal experiences. It stated that ‘many respondents did not know much about rail specifically, so when asked for their perceptions of rail, they used past experience and general perception about what railways are like to build a point-of-view about rail’ (Ramia-Topp, 2006, cited in Waterhouse and Kerr, 2008, p45). This concurs with the assertion of the *Changing Face of Rail* report of the importance of personal consumer experiences of trains in shaping perceptions of careers in the sector.

In a survey of 407 engineering students from around Australia, Wallace et al. (2011, p8) asked what attributes final-year engineering students found most desirable in a career. Based on seven-point Likert-type items, their findings are shown in Table 3.1.

Table 3.1 Survey responses of job characteristics found desirable in a sample of 407 engineering students in Australia

General job benefits	Mean score	Importance rank
Development benefits (self-development)	4.07	1st
Economic benefits (compensation)	4.03	2nd
Interest benefits (interesting work)	3.93	3rd
Social benefits (collegial work environment)	3.80	4th
Culture benefits (management culture)	3.68	5th
Application benefits (benefits to society)	3.65	6th
Travel benefits	3.50	7th
Prestige benefits	2.99	8th

Mean score scale: 5= very important to 1= not important at all. Source: Wallace et al., 2011.

It can be seen from Table 3.1, that the issue of ‘public image’, in terms of rolling stock careers, cannot be reduced to a simple positive/negative dichotomy. Rather, there needs to be an appreciation for the ways in which community perceptions of each career property is distinct and can either be in accord with the occupational reality or be misinformed.

In the report on megatrends and scenarios in employment in Australia, researchers from CSIRO (Hajkowicz et al., 2016, p14) identified several key issues, at least two of which apply to the transport sector. The first is stemming the decline in Science, Technology, Engineering, and Mathematics (STEM) capabilities (point 4) and the second is the importance of challenging community perceptions and norms about job types (point 6).

A literature review undertaken by Waterhouse and Kerr (2008) into future workforce values for the CRC for Rail Innovation, identified four different groups for targeting in securing rail futures. These were generated based on the authors’ understandings of the existing literature and were recommended to be: women, older workers, migrant groups, and indigenous Australians. In the same report, they note two research gaps in community perceptions of the rail industry (p4):

- An understanding of these target employment groups’ pre-employment perceptions of corporate reputation
- A misalignment between the perceptions created as a result of the marketing of rail industry and the reality upon entry into the industry – experience does not meet the promise.

More research on these sectors of the population needs to be conducted, in order to understand the processes and sources of information underlying their perceptions of careers in rolling stock.

The literature of community perceptions of careers in the public transport sector overseas can help us understand the Australian context, by providing both an alternative against which to compare variables, policies, and programs.

The Transport Infrastructure Skills Strategy report by the UK Department of Transport (2016) noted that young children in that context are both knowledgeable about public transport careers, and understand its social importance (p80):

‘Ask any 6-year-old what management consultancy is, what a law firm or power plant does and compare this to asking them about transport. Even very young children know what transport is and they are often passionate about it – be it planes, trains, boats or roads with cars, bikes and buses. All children have experience of making journeys

on at least some modes of transport and imaginative play often focuses on transport – from pretending to be a train or bus driver to creating journeys to a hospital, supermarket or even a castle. Our sector starts from a strong position; children understand the basic concept of what we do, that we make journeys happen and that we help people get where they want to go. However, as children get older perceptions of transport, and engineering in particular, appear to be less positive.’

In the United States, Cronin et al. (2013) note that ‘the effect the public transportation industry’s image has on the success of efforts to build a sustainable public transportation workforce cannot be overstated’. They cite several positive public perceptions facing the industry improved workforce attraction:

- Transit systems branding themselves as ‘green’ employers, for example Via Mobility Services in Colorado using hybrid vehicles and green graphics to create a positive image of the organisation. They highlight the green credentials of public transport and point out that public transport reduces America’s carbon emissions by 37 million metric tons per year (s3, p17).
- Emphasis on community impact and social consciousness, such as the American Public Transport Associations’ blue-ribbon panel on youth outreach to help introduce a new generation to transit careers (s3, p10).
- Improvements in management to create a shared culture of success (s3, p10).
- Cronin et al. (2013) cite major negative current perceptions facing the industry that have erected barriers to workforce attraction.
- Inaccurate perceptions of the mission of public transport. Although it may be viewed positively as servicing the poorer and disabled segments of the community (the report notes that a survey by one transit agency revealed that regular patrons of the transit system were likely to perceive users as like themselves), some patrons regarded contact with these segments as making them less likely to apply for transport jobs. This was especially true for those who do not use the public transit system regularly.
- False impressions of job difficulty, in terms of physical difficulty and mental stress.
- Misperceptions of the gender and cultural barriers.
- Unawareness of career path opportunities.

It should be noted that these citations in the Cronin et al. (2013) report were based on information provided by transit authorities. In other words, they are industry perceptions of what they believe their community perceives, rather than independent studies drawn directly from community respondents.

Some key knowledge gaps emerging from the above literature review on community perception of careers in rolling stock are:

- There is little-to-no research on community perceptions of careers in buses, trams, and light rail. Virtually all the existing literature is on rail.
- There is scant literature on broader community perceptions of careers in rolling stock. Most studies focus on engineering students, however, changes in the last decade to workforce composition and career values would suggest it is critical to recruit more broadly.
- A knowledge gap exists in our understanding of whether more information about, or experiences of, public transport will necessarily in and of itself improve community attraction to careers in the sector. It has not been determined whether patronage of, and knowledge of, transport services correlates positively or negatively with job attractiveness. The relationship between service patronage, information salience, and perception is not always a straightforward correlation. For example, the meat processing sector in Australia has faced similar difficulties to with attraction and retention, based on public perception of the trade as ‘dirty work’, however Jerrard et al. (2008) demonstrate that more information about the sector does not necessarily result in better public perceptions.
- Furthermore, there is not enough detailed research as to what forms of knowledge and engagement would be most needed. While it is clear from the literature that there is a need for greater public engagement and promotion about public transport careers, it is not clear what specific kinds of knowledge would be necessary, and how it should be framed. For this, it is necessary to conduct in-depth interviews with potential applicants in order to understand what values, motivations, and cognitive processes lead them to not seek public transport careers.
- Have there been generational changes in the last ten years, especially with ‘digital natives’ occupying a greater space in the emergent workforce?
- Are there opportunities to improve community perception of public transport careers related to the growing awareness of climate change, and the need for innovative green public transport solutions as part of mitigating this?
- Has there been a response to the changing ethno-cultural profile of Australia’s workforce in the past ten years? The high proportion of international students in engineering courses in Australia are an underutilised source of talent (Wallace et al., 2010, p17). This is truer today than ten years ago, and clearly needs to be addressed.

How does the community come to make decisions about careers in rolling stock?

The literature reviewed in the section above indicates that attraction to career pathways in rolling stock is limited by (often incorrect) negative images about the attributes of such a career. However, public image and perceived rewards are not the only factors shaping career attraction. The Social Cognitive Career Theory (SCCT) model of Lent et al. (1994) argues that career attraction (and later performance and persistence) is the result of not only outcome expectations (what one perceives they will get from the job, such as remuneration, personal satisfaction, and learning opportunities), but also self-efficacy beliefs, how well a prospective applicant believes they will perform a job, and whether they will succeed at this. A career might offer the most attractive conditions and benefits, but if a prospective employee does not perceive themselves able to perform well in the field of work, they will not be attracted. There is evidence that this model is useful in understanding how individuals choose careers in science and engineering (Byers-Winston et al., 2010; Fouad and Santana, 2016), as well as across international contexts, as in the meta-analysis of 37 studies across Europe and Asia conducted by Sheu and Borden (2017).

According to the SCCT model, two variables make up career behaviour, and these are person variables and environmental variables. Person variables include self-efficacy beliefs and outcome expectations. Environmental variables affect both person variables, but since the former are filtered through the latter, different people respond to the same environmental variables differently (Lent et al., 1994). This model implies the need for multi-faceted approaches, if lack of self-efficacy (belief one is unsuited to the job) is an important part of why people are not applying for careers. For an individual to be attracted to a career in rolling stock, it is necessary for applicants to have some experience of success in the types of processes they will be undertaking (Figure 3.1).

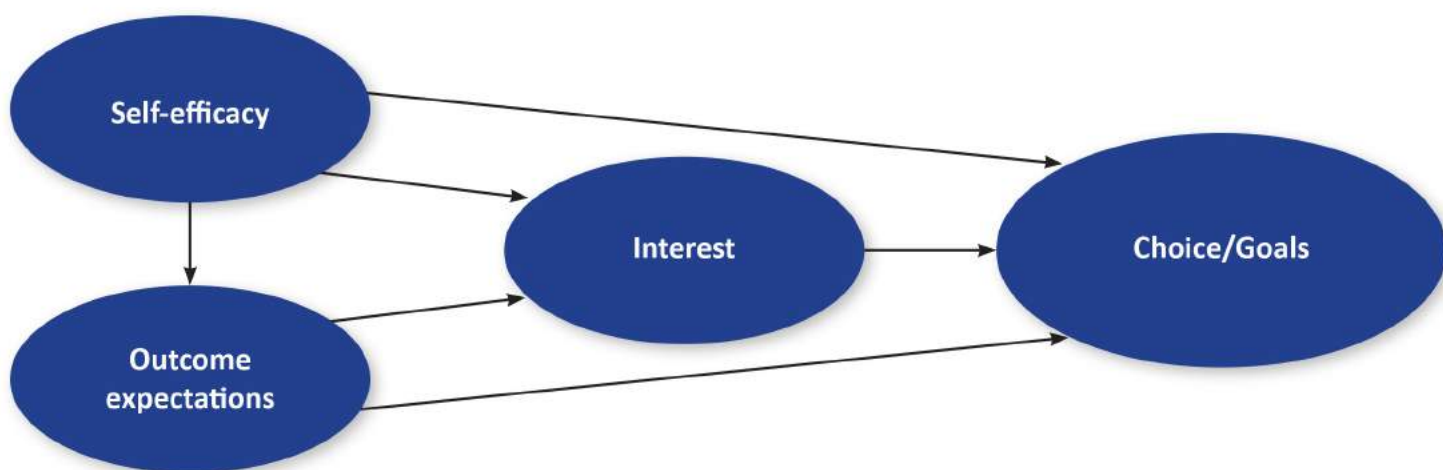


Figure 3.1 Simplified SCCT model indicating importance of both expected outcomes and self-efficacy beliefs in shaping career interest and career choice (adapted from Lent et al., 1994)

In a review of the use of the SCCT model to engineering, the US National Academy of Engineering (2018, p83) note the important features of the theory for thinking through the factors underlying career selection:

- Self-efficacy beliefs (task-specific confidence through direct experience)
- Outcome expectation (expected and perceived rewards, satisfaction, and remuneration)
- Individual differences (gender, ethnicity, health, personality)
- Limiting contextual factors (home and school environment)
- Prior learning experiences
- Encouragement from others (social persuasion)
- Excitement and image.

The SCCT model helps to reframe the question around community perceptions of transport career opportunities, by going beyond the simple question of ‘what does a career in rolling stock offer me?’, to consider the importance of ‘will I be good at a job in transport?’ In other words, SCCT argues for the importance of individuals as viewing themselves as competent at performing tasks as a precursor to a career involving that task being attractive. In order for this self-efficacy to develop, there must be direct exposure to this. The extent to which SCCT applies to career attraction in rolling stock in Australia needs to be tested empirically and comes directly out of this body of literature.

Another important factor is the perceived orientation of peers and an individual's community to careers in rolling stock. Bregman and Killen (1999) interviewed 72 young people (evenly divided by gender and age groups of 16, 19, and 22 years old) and found both parental influences and personal growth (learning and self-improvement opportunities) were strong drivers of career choice, while social-conventional factors were not.

In what has been labelled a variant of Festinger's (1989) Social Comparison Theory, Collier (1994) argues that prospective candidates for the future workforce also tend to evaluate their suitability for careers based on those with similar abilities and beliefs, stating that:

'The group serves as a powerful anchor that limits the level of aspiration, particularly when the group is cut off from other groups ... people tend to use others who are similar or have similar levels of ability as a source of social comparison.' (p83)

Another important factor in the decision-making process around transport careers for young people is parental support. Ferry et al. (2000) collected data on 791 undergraduate students in STEM courses at two universities and found a significant correlation between the level of parental encouragement and learning experiences in math and sciences, and thus self-efficacy beliefs to pursue these fields. The implication of this is that any analysis of the role of perception should include consideration of the level of support given to the career choice from parents as well.

The UK *Transport Infrastructure Skills Strategy* (UK Department for Transport, 2016, p79) noted the key factors in that context which influenced young people's attractions to transport careers, and these factor and their relationships are illustrated in Figure 3.2.



Figure 3.2 Main influences on young people in career decision making (reproduced from UK *Transport Infrastructure Skills Strategy*, UK Department for Transport, 2016, p79)

This literature indicates a research gap in our understanding of the social comparisons used to assess self-suitability for rolling stock careers. It is necessary to identify stereotypes held by the community about those who enter the various careers in rolling stock, and to what extent do potential applications identify themselves as like these stereotypes?

This parental influence is clear in the childhood socialisation of a segment of the rolling stock workforce, who develop an interest in trains at a young age. The PwC (2006, pp. 39–40) report concluded that there were two major segments comprising the industry in Australia. Firstly, a cohort of those who joined the rail workforce due to an attraction to drive trains, including a childhood love for trains or a dream to drive trains, a family history with the industry, or a strong sense of community service with rail. Secondly, a cohort drawn to properties of the job rather than rail itself, such as good remuneration, good opportunities, or job security.

In both these cohorts, peer and parental modelling play a significant role, either in the cultivation of the importance of rolling stock, or for the latter, in word-of-mouth perceptions about opportunities in the sector.

Structural barriers may also play a major role in stopping potential applicants pursuing careers in rolling stock, even if they view the jobs available as attractive. A report on social disadvantage and unemployment in the Southern Melbourne region authored by The Australian Centre for Social Innovation (TACSI) (2017) provides an example of how high unemployment rates of a region (for example, Dandenong, at 20.9%), can sometimes coincide with high job vacancies. This contradiction highlights a situation in which job vacancies are available, but young people are disengaged from school and employment, thus both unemployment and job availability remain high. In the report (TACSI, 2017), interviews with jobseekers revealed frequently mentioned structural barriers to work for individuals to be (p4):

- A lack of available transport
- Complex personal situations
- A lack of skills
- Visa restrictions.

These factors, along with others that were ascribed by the report as limiting jobseekers ability to seek employment, are illustrated in Figure 3.3.

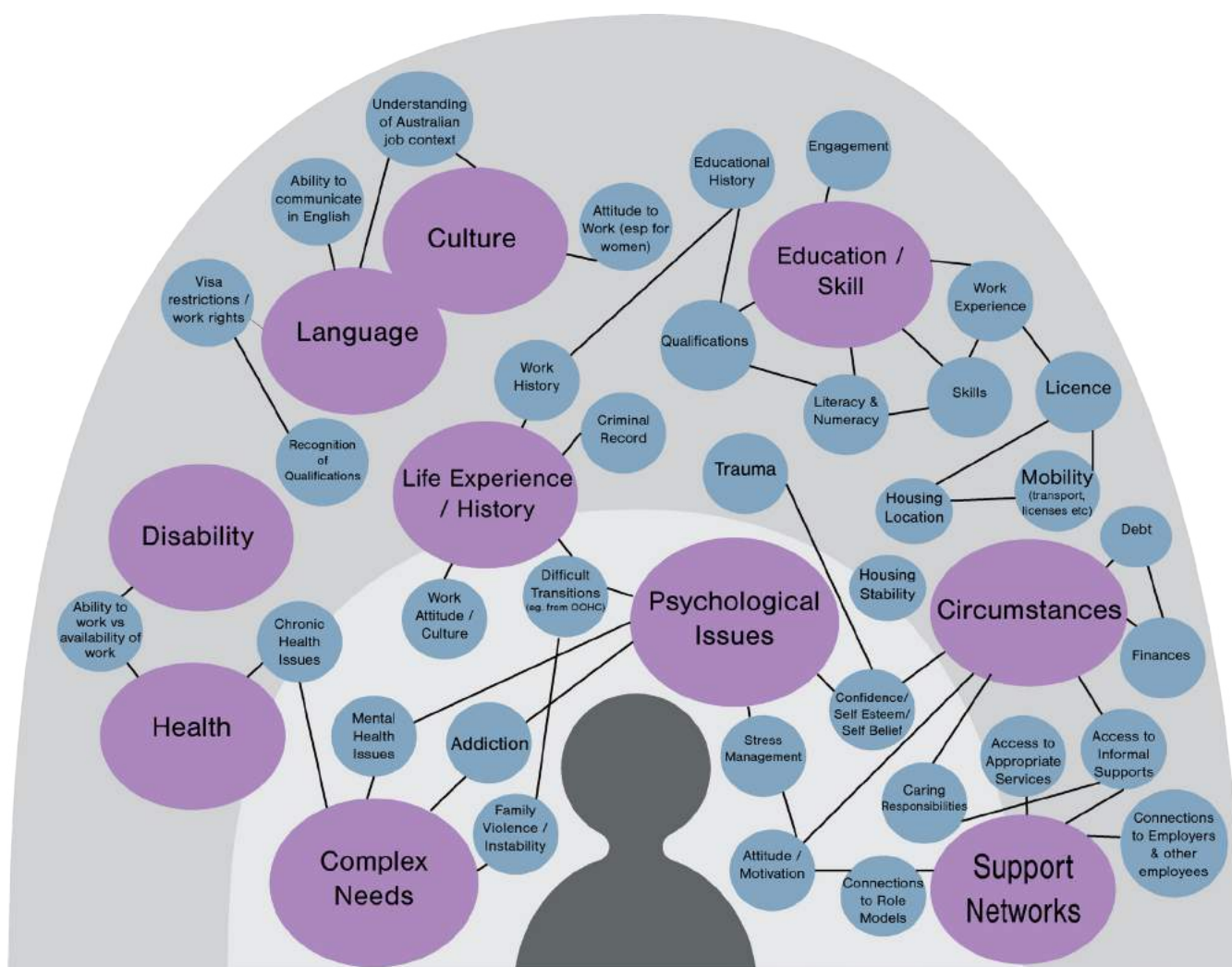


Figure 3.3 Structural barriers preventing young people gaining employment (reproduced from TACSI report, 2017, p19)

These factors contrast with the perspectives of employers revealed in the stakeholder interviews, which mainly revolved around the assumption that the jobseekers simply did not want to work. That same report cited that the public perception of the ‘death of manufacturing’ had a negative effect on potential jobseekers in terms of attraction.

From this literature, an important research gap is the need to determine the **specific structural barriers** faced by potential applicants for rolling stock jobs, in addition to factors of attraction previously mentioned, as well as the degree to which perceptions of the decline in manufacturing careers has contributed to individuals not becoming attracted to the sector.

Young people, career values and aspirations

The successful attraction and integration of young people is essential for the securing of the future workforce in rolling stock, and addressing the significant threat posed by an ageing employee profile. But what work values are held by young people, and how does this accord with the values of the existing rolling stock workforce?

Howe and Strauss' (2000) assertion that the rise of a 'millennial' youth cohort (sometimes referred to as Generation Y, born 1981–1996), is transforming work cultures, has been highly influential in popular discourse of work values and career attraction, including transport careers (for example, Goodyer and Kaur, 2017). To what extent is this popular conception supported by the academic literature?

A review by Twenge (2010) of studies on work values and generational differences concluded that in most studies, 'Gen X' (defined as those born from 1965–1981) and 'Gen Y' (defined by Twenge as those born 1982–1999) value leisure more highly and rate work as less important to their lives, than their older colleagues from the 'Baby Boomer' (born 1946–1964) and 'Silent Generation' (born 1925–1945). Remuneration was a more important consideration to these two generational groups, but the review concluded that there were no differences in altruism as a motivating factor. Table 3.2 summarises the empirical evidence for generational differences in work value.

Table 3.2 Summary of empirical evidence for generational differences in work values

Work value or trait	Findings
Work centrality	Silent > Boomer > GenX > GenY
Work ethic	Silent > Boomer > GenX > GenY
Leisure values	GenY > GenX > Boomers
Altruistic values (helping, volunteering)	No differences
Intrinsic values (meaning, using talents)	No differences
Extrinsic values (money, status)	GenX > GenY > Boomers
Affiliation or social values	Time-lag: Boomers > GenX > GenY Cross-sectional: GenY > GenX > Boomers
Job satisfaction and intention to leave	GenY > GenX in job satisfaction Conflicting results for intention to leave
Individualistic traits and attitudes	GenY > GenX > Boomers > Silent

Source: Twenge, 2010

Debevec et al. (2013) have argued that a newer younger cohort of millennials has been shaped by spending its formative years in the global financial crisis of 2008 and the years after the 9/11 terrorist attacks of 2001. They focus on 'cohorts' shaped by significant events, rather than on fixed-length 'generations', which come to define social values for that group. They associate the millennial cohort as ambitious, entrepreneurial, and valuing diversity (p22). Comparing a cohort of 'Older Millennials' (n=266) and 'Younger Millennials' (n=467), they examined the factor loading on a number of items, and found differences in a number of properties (thrift, environmental consciousness, and patriotism). Similarly, Cugin (2012), in a multi-country study of one thousand respondents sampled from across Australia, America, China, Singapore, and Germany, concluded there were significant generational differences in work values.

The broader attempts to stereotype 'millennials' have been critiqued by Harrington et al. (2015) as over-generalising. They have argued that the samples used in most studies cited as empirical evidence tend to be taken from US college students, typically with double the national mean income. Harrington et al. (2015, pp. 3–4) have more carefully argued that what this cohort has in common are a more limited set of traits:

- The increasing role of technology in their lives
- Delays in traditional 'adult commitments'
- Changing gender roles
- Changing nature of careers
- Changing expectations about work.

Similarly, Parry and Urwin (2011), in their review of empirical evidence of generational work values, have suggested that perhaps ‘age’ and ‘generation’ have been falsely conflated. Rather than a significantly different age set, the values ascribed to newer generations are simply those ascribed to youth more broadly (regardless of generation). In terms of the substantive research question at hand, the distinction is not that significant, as it is both the generational values, and those work values of young people at this time which are under examination.

In terms of the Australian context, Benson and Brown (2011) found significant differences between ‘Baby Boomer’ and ‘Generation X’ cohorts in a large survey (n=3,335) of employees of an Australia public sector organisation. They found a higher level of ‘job satisfaction’ and lower ‘willingness to quit’ amongst the older cohort.

A study by Busch et al. (2008) examined a sample of 75 Australia workers in the information technology sector, to generate a model of the different work values held by Australians in three age-based cohorts (Generation Y, Generation X, and Baby Boomers). They came to the model illustrated in Figure 3.4.

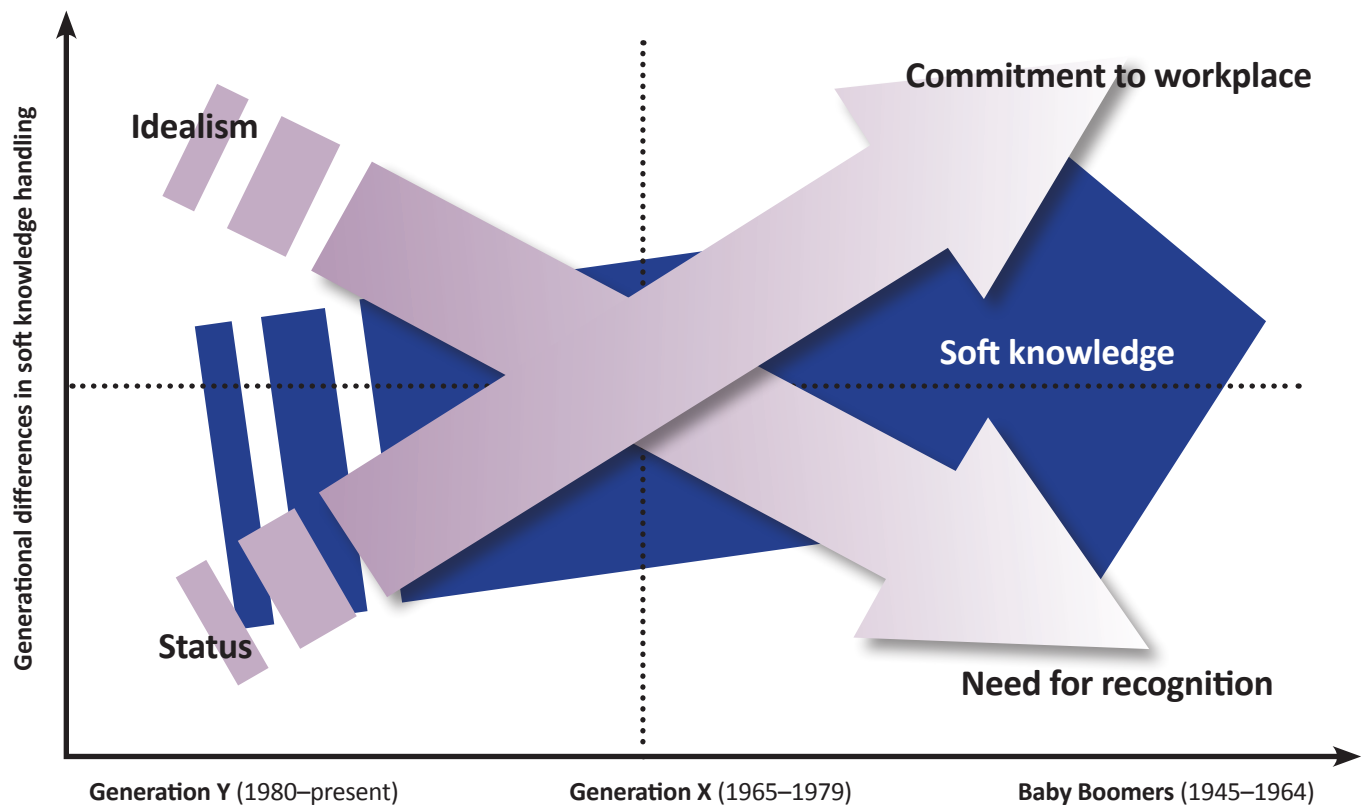


Figure 3.4 Illustrating the implications of enhanced soft knowledge utilisation (Busch et al., 2008)

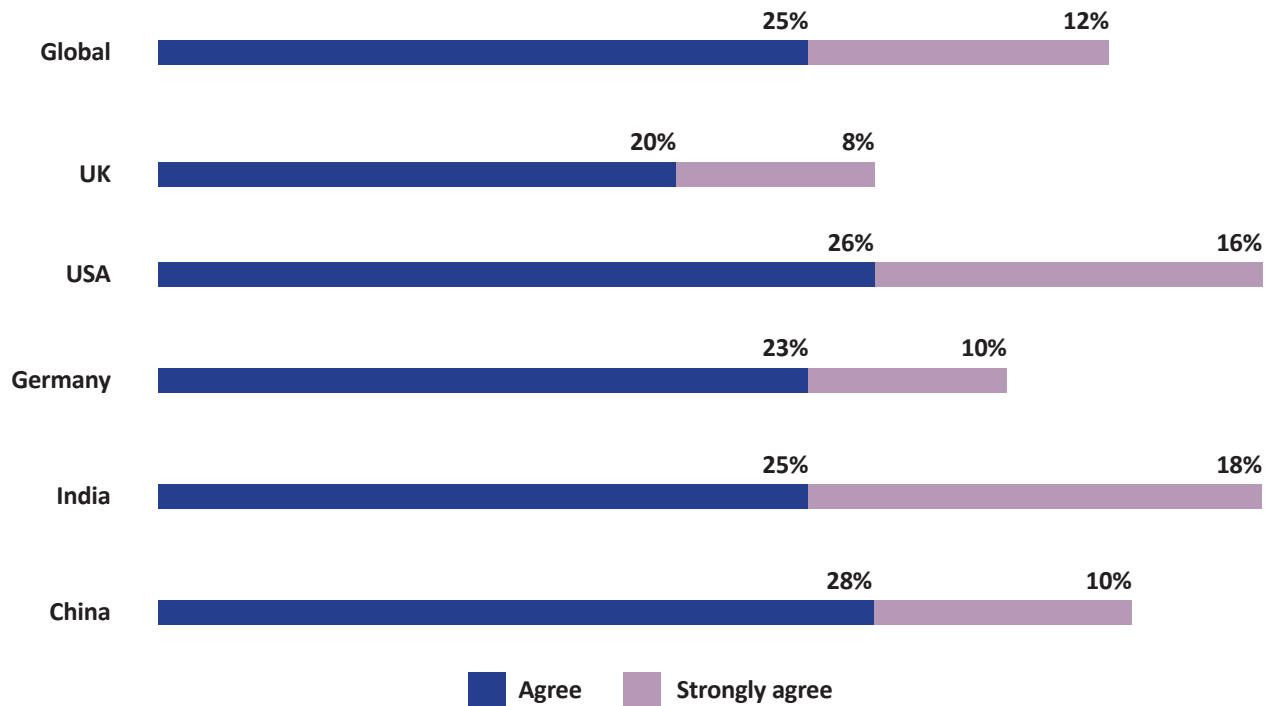
In the above model, the older demographics have developed both a higher level of commitment to the workplace, and a higher level of career-linked ‘soft skills’, either due to experience or generational cohort values. However, the younger generations have a higher level of idealism.

Another finding from the literature regarding youth work values, is evidence demonstrating that reflexivity (self-consciousness) about career-choices is not, as sometimes assumed, a monopoly of middle and upper-class youth. In their study of career choices of 50 young people ages 16–17 in Australia, Laughland-Booÿ et al. (2015, p597) found that:

‘Having resources at their disposal to promote future opportunities or minimise adversity does not mean that middle/upper class youths are actively engaging with their futures in a self-reflexive manner. We suggest instead that reflexivity is more likely to manifest from exposure to adversity. In contemporary society, it is in fact the lack of material and/or social resources that is driving young people on the lower end of the socio-economic spectrum to actively acknowledge barriers, and take personal responsibility to find ways of negotiating those boundaries to ensure that they live up to the expectations of a more individualised society.’

In other words, young people at the lower end of the socio-economic spectrum are just as likely as middle/upper class youth to express understanding about why and how they have come to their career choices.

Perceived anxieties amongst youth about losing jobs to automation is a significant theme that appears increasingly in industry literature and popular discourse (for example, Ford, 2015), but requires a greater evidentiary basis. Hirschi (2018, p192) notes that ‘the academic literature in vocational psychology, career studies, and career counselling has been largely silent on this major phenomenon’. In the PwC *Workforce of the Future* report, Brown et al. (2017) conducted a survey of 10,029 people drawn from the general population in China, Germany, India, the UK, and the US, finding that 37% of respondents were worried about automation putting their jobs at risk (up from 33% in 2014). Additionally, the percentages agreeing with the statement ‘automation is putting jobs at risk’ was significantly different depending on the country, as displayed in the Figure 3.5.



Sample: All respondents: n=10,029.

Figure 3.5 To what extent do you agree that ‘automation is putting jobs at risk’? Source: Brown et al., 2017.

Clearly, the degree to which certain jobs in transport manufacturing and transport maintenance are perceived to be at risk in the Australian context, and how this links to attraction to careers in rolling stock, is a research gap which needs to be better understood.

While this review finds the existing literature on the work values on young people and theories of generational difference as useful, it is important to note that the youth cohort is highly segmented in other ways about work values, notably class, education, gender, geography, and cultural background. The literature on millennials tends to over-emphasise intra-age set difference above otherwise real and important inter-group differences. This is especially important considering the other forms of diversity of the potential applicant pool for rolling stock, that of gender and cultural diversity.

Gender, cultural diversity, and careers in rolling stock

The impact of age, culture, and gender on workplace attraction has been well documented (Amundson, 2007). There is some evidence in the literature to suggest that a diverse workforce has been shown to encourage trust and communication (Hofhius, van der Rijt, and Vlug, 2016), improve group performance (Roberge and Van Dick, 2010), confer psychological benefits (Chrobot-Mason and Aramovich, 2013), and higher levels of innovation and creativity (Phillips et al., 2014). Additionally, there are obvious benefits in securing the range of skills and availability needed to secure the future workforce. Therefore, it is critical to understand barriers to diversity; gender and cultural amongst others.

A significant barrier to inclusion of women in the potentially innovative manufacturing and maintenance careers within public transport is the decreasing rates of women studying STEM. The retention of women in STEM is important for both equity and economic reasons (Hobbs et al., 2017).

The report on Australia's STEM workforce (Office of the Chief Scientist, 2016) puts the total 'STEM qualified' workforce size at 2.3 million, of which 32% are university qualified and 68% are Vocational Education and Training (VET) qualified. However, only 16% of this cohort are female, and a disproportionate number of these are university trained (29% of the STEM qualified university cohort are female, while only 9% of the STEM qualified VET cohort are female). The same report notes that the largest employer of STEM graduates (and within this, also university STEM graduates) is the manufacturing sector, indicating that there may be specific reasons why transport-related subsectors of manufacturing are not attracting graduates to the same extent as other non-transport related sectors of manufacturing continue to do.

Narrowing of potential workforce begins at school, with lower rates of females undertaking advanced maths, physics and chemistry disciplines. A report from Engineers Australia states that is a significant disparity between the number of girls studying Year 12 Physics (5.9% vs 21% for boys) and Advanced Mathematics (6.2% vs 11.5%). Furthermore, the relative numbers enrolled in both subjects have dropped since the mid-1990s (Kennedy et al., 2014). The same report concludes that the pay gap between male and female STEM graduates remains substantial (p158).

The Invergowrie Foundation Report into Women in STEM in Australia (Hobbs et al., 2017) concluded that deeply embedded cultural expectations create gender-bias limiting girl's engagement with, and participation in STEM. These include gendered stereotypes in the home and community, institutional structures in both media and learning environments. One of the recommendations is the building of strategic and long-term partnerships between industries, schools, and communities to encourage greater engagement. The report claims, citing data from a study of schoolchildren in country Victoria, that early career aspirations shaped school subject choice and constrained aspirations from primary school. These aspirations were influenced by two main factors: their local knowledge and contact with that profession, and the range of people they have met in those professions.

It should be noted that the perception of gender in public transport careers varies markedly across culture, country, and context. For example, Wright (2019) points out that:

- In Nairobi, workers on *matutu* (private minibuses) are often perceived as 'disorderly, chaotic, and drug dealers'. This stops many women from taking up the work, as a male union representative stated: 'Women do not want to stay long in the transport sector. The passengers also think that these women are in the wrong place. It's like finding a man in the kitchen' (p54).
- In Bangkok, women have only recently become part of the workforce of metro train drivers, while in Mexico City, there is much greater social acceptance of women operating trains than on roads, due to the perception that the technology involved makes light rail and subways trains easier to drive than road vehicles.

For the last 50 years, Australia's workforce profile has been continually transformed by immigration, and in particular skilled migration intake programs. This has affected STEM-linked employment and manufacturing, with new cultural and work values (for example, Cameron, 2011; Colic-Peisker, 2011; Hugo, 2014). It has been noted that work is a cultural construction (Fouad and Byers-Winston, 2005), in the sense that its importance to individuals varies depending on their cultural frame of reference, incorporating ethno-cultural background, gender, and generational values.

Fouad and Byers-Winston (2005) conducted a meta-analysis of sixteen different studies into the relationship between career choice and ethnicity. They found that in the aspirational sense at least, there were 'few differences' in the careers the studies found as ideal. However, they concluded that since certain cultural groups are over or underrepresented in particular occupations, then ethno-cultural groups must play a role in determining opportunities, the perception of career barriers, and the structure of occupational opportunity.

Leung et al. (2011) examined the role of parental expectations and cultural values in shaping career choices for Chinese students. Based on a study of university students in three cities in China (n=1,342), they found that fulfilling their parents' expectations was a major factor.

Tang, Fouad and Smith (1999) used correlation analysis on a survey sample of 187 East Asian-American college students in the US, and found that stereotype careers led to an increased self-efficacy, and thus attraction to that career. Amongst the careers listed, engineering was at the top. They concluded that the values of Asian-American parents were to push their children to pursue financially secure and practical career choices, the top three of which were engineer, physician, and computer scientist.

Woolnough et al (1997) examined factors affecting student career choice in science and engineering, and looked comparatively at data from Australia, England, Canada, Portugal, China, and Japan. While a complex set of factors was believed to be responsible for different levels of career attractiveness, amongst a number of other factors, two are pertinent here. The first was the attractiveness of careers in science, with status, job satisfaction and salaries under the influence of government, and the second was the involvement of children in scientific, craft and technical hobbies during their formative years.

The World Values Survey (WVS) by Inglehart et al. (2014) provides some additional demonstration as to how the values underlying career choice and attraction vary across culture. The WVS Wave 6 was conducted between 2010 and 2014, and encompassed respondents to a standardised survey all across the globe. For the five countries of interest selected below, the sample sizes were Australia (n=1,477), United States (n=2,232), China (n=2,300), India (n=4,078) and Germany (n=2,046). As an example, it can be seen in Figures 3.6, 3.7, and 3.8 below, that there are significant variations between countries of values related to career choice, including the importance of innovation and creativity, the importance of work to life, and of work needing to be in the interests of society.

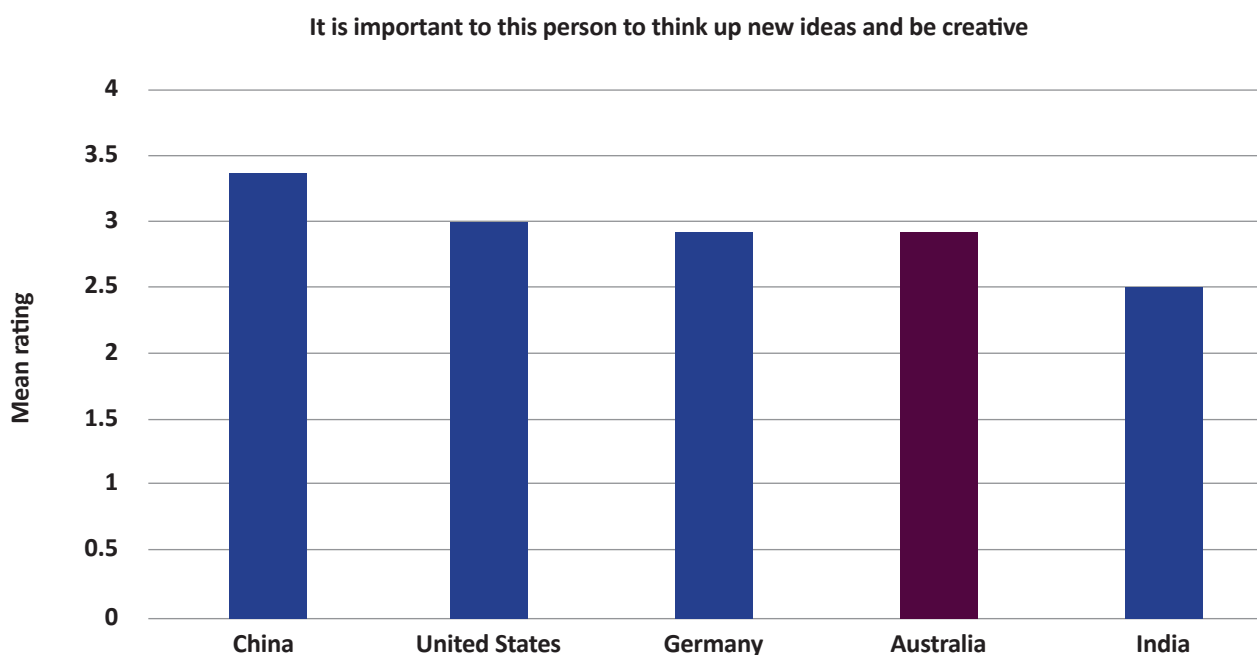


Figure 3.6 Importance of new ideas and creativity (data from World Values Survey 2011–2014)

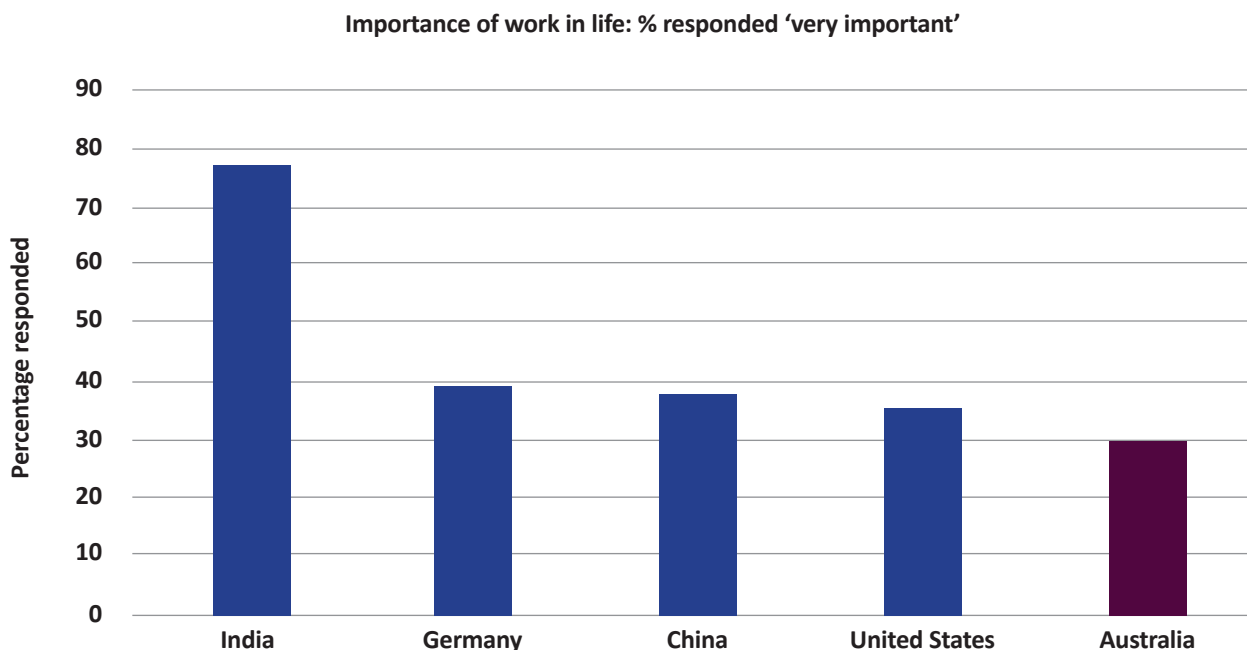


Figure 3.7 Importance of work (data from World Values Survey 2011–2014)

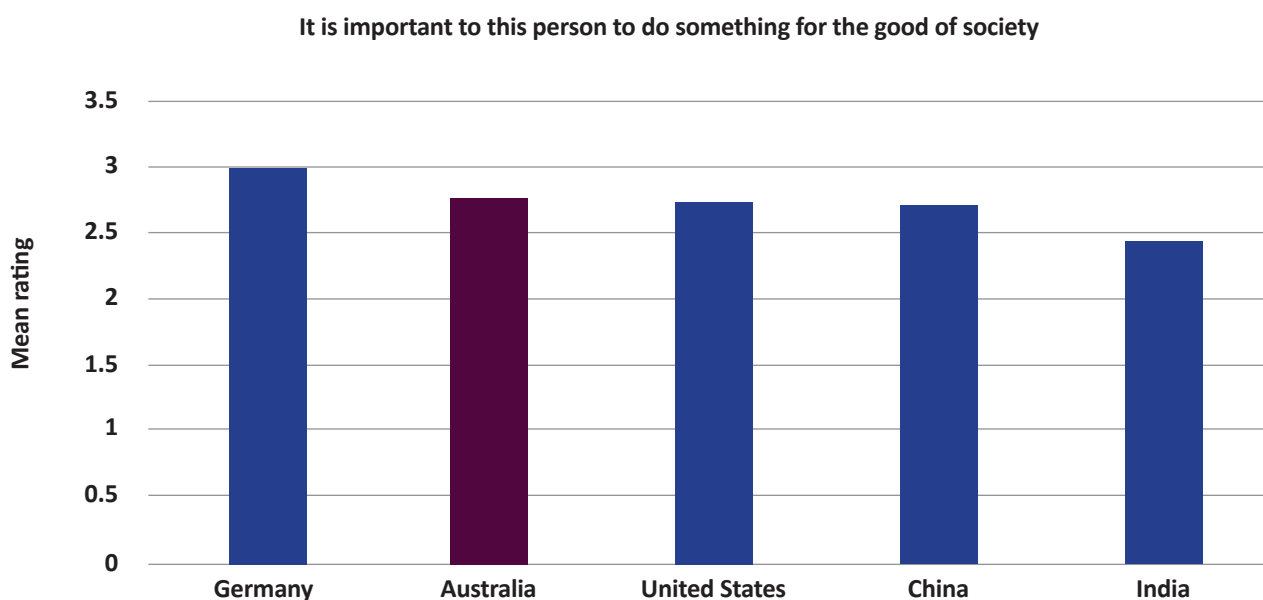


Figure 3.8 Importance of social good (data from World Values Survey 2011–2014)

The literature review of the research available on cultural values and career aspirations reveals a knowledge gap, in terms of the question of how to make careers in rolling stock more attractive. The values of prospective job seekers have changed due to greater cultural diversity. Increasing engagement of job seekers from non-Western cultural backgrounds necessitates:

- An increased understanding of the values of various diverse cultural groups in Australia in relation to prestige, career status, and occupational livelihood.
- An increased understanding of the varying roles played by parents across different cultural minorities in Australia, in determining and influencing their children’s career choices, especially with regard to STEM and rolling stock careers.
- Understanding the varying importance of career attributes such as job security, social mobility, and flexibility for culturally diverse groups in Australia, and how the differing perception of these job attributes with relation to rolling stock careers influences attraction to the sector.

References

- Amundson, N. (2007). The influence of workplace attraction on recruitment and retention. *Journal of Employment Counseling*, 44(4), 154–162.
- Benson, J., and Brown, M. (2011). Generations at work: are there differences and do they matter? *The International Journal of Human Resource Management*, 22(9).
- Bregman, G., and Killen, M. (1999). Adolescents' and young adults' reasoning about career choice and the role of parental influence. *Journal of Research on Adolescence*, 9(3).
- Brown, J., Gosling, T., Sethi, B., Sheppard, B., Stubbings, C., Sviokla, J., Williams, J., Zarubina, D., and Fisher, L. (2017). *Workforce of the future: the competing forces shaping 2030*. PwC. <http://hdl.voced.edu.au/10707/436729>
- Busch, P., Venkitachalam, K., and Richards, D. (2008). Generational differences in soft knowledge situations: status, need for recognition, workplace commitment and idealism. *Knowledge and Process Management*, 15(1).
- Byars-Winston, A., Estrada, Y., Howard, C., Davis, D., and Zalapa, J. (2010). Influence of social cognitive and ethnic variables on academic goals of underrepresented students in science and engineering: a multiple-groups analysis. *Journal of Counselling Psychology*, 57(2), 205–218. Doi: 10.1037/a0018608.
- Busch, P., Venkitachalam, K., and Richards, D. (2008). Generational differences in soft knowledge situations: status. need for recognitions. workplace commitment and idealism. *Knowledge and Process Management*, 15(1), 45–58.
- Cameron, R. (2011). Responding to Australia's regional skill shortages through regional skilled migration. *Journal of Economic and Social Policy*, 14(3).
- Chrobot-Mason, D., and Aramovich, N. (2013). The psychological benefits of creating an affirming climate for workplace diversity. *Group and Organization Management*, 38(6).
- Cogin, J. (2012). Are generational differences in work values fact or fiction? Multi-country evidence and implications. *International Journal of Human Resource Management*, 23(11), 2268–2294. Doi: 10.1080/09585192.2011.610967.
- Colic-Peisker, V. (2011). 'Ethnics' and 'Anglos' in the labour force: Advancing Australia Fair? *Journal of Intercultural Studies*, 32(6).
- Collier, G. (1994). *Social origins of mental ability*. John Wiley & Sons, New York.
- Cronin, C., Alexander, A., Cronin, B., Riches, C., Stern, J., Lazaro, R., and Lazaro, V. (2013). Building a sustainable workforce in the public transportation industry – a systems approach. *Transit Cooperative Research Program Report 162*. US Federal Transit Administration.
- Debevec, K., Shewe, C. D., Madden, T. J., and Diamond, W. D. (2013). Are today's millennials splintering into a new generational cohort? Maybe! *Journal of Consumer Behaviour*, 12, 20–31.
- Ferry, T., Fouad, N., and Smith, P. (2000). The role of family context in a social cognitive model for career-related choice behavior: a math and science perspective. *Journal of Vocational Behavior*, 57(3), 348–364.
- Festinger, L. (1989). Wish, expectation, and group standards as factors influencing level of aspiration. In Schachter, S and Gazzaniga, M. (eds). *Extending psychological frontiers: Selected works of Leon Festinger*. Russell Sage Foundation, New York.
- Ford, M. (2015). *Rise of the robots*. Basic Books, New York.
- Fouad, N., and Byars-Winston, A. (2005). Cultural context of career choice: meta-analysis of race/ethnicity differences. *Career Development Quarterly*, 53.
- Fouad, N., and Santana, M. (2016). SCCT and underrepresented populations in STEM fields: moving the needle. *Journal of Career Assessment*, 25(1). <https://doi.org/10.1177/1069072716658324>
- Goodyer, T., and Kuhr, S. (2017). *How to attract millennials to the transit industry*. Metro.
- Hajkowicz, S, Reeson, A., Rudd, L., Bratanova, A., Hodgers, L., Mason, C., and Boughen, N. (2016). *Tomorrow's digitally enabled workforce: megatrends and scenarios for jobs and employment in Australia over the coming twenty years*. CSIRO, Brisbane.
- Harrington, B., Van Deusen, F., Fraone, J. S., Moreloc, F. J. (2015). *How millennials navigate their careers: young adult views on work, life and success*. Boston College Center for Work and Family.
- Hirschi, A. (2018). The fourth industrial revolution: issues and implications for career research and practice. *Career Development Quarterly*, 66(3), 192–204.
- Hobbs, L., Jakab, C., Millar, V., Prain, V., Redman, C., Speldewinde, C., Tytler, R., and van Driel, J. (2017). *Girls' future – our future: The Invergowrie Foundation STEM report*. Melbourne.
- Hofhuis, J. van der Rijt, P., and Vlug, M. (2016). Diversity climate enhances work outcomes through trust and openness in workgroup communication. *Springerplus*, 5(1), 714.

- Howe, N., and Strauss, W. (2000). *Millennials rising: the next great generation*. Vintage Books, New York.
- Hugo, G. (2014). The role of international migration in Australia's research workforce. *Asian and Pacific Migration Journal*, 23(1).
- Inglehart, R., Haerpfer, A., Moreno, C., Welzel, K., Kizilova, J., Diez-Medrano, M., Lagos, P., Norris, E., and Puranen, B. (eds.) (2014). *World Values Survey: Round Six – Country-Pooled Datafile Version*. JD Systems Institute, Madrid. <http://www.worldvaluessurvey.org/WVSDocumentationWV6.jsp>
- Jerrard, M., Donohue, R., Kimberley, N., and Cooney, R. (2008). Reinventing meatworkers: old skills but new careers for the twenty-first century? *Employment Relations Record*, 8(1), 51–67.
- Kennedy, J., Lyons, T., and Quinn, F. (2014). The continuing decline of science and mathematics enrolments in Australian high schools. *Teaching Science*, 60(2), 34-46.
- Laughland-Booÿ, J., Mayall, M., and Skrbiš, Z. (2015). Whose choice? Young people. career choices and reflexivity re-examined. *Current Sociology*, 63(4), 586–603.
- Lent, R., Brown, S., and Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, 45(1), 79–122. <http://dx.doi.org/10.1006/jvbe.1994.1027>
- Leung, S., Hou, Z., Gati, I., and Li, X. (2011). Effects of parental expectations and cultural-values orientation on career decision-making difficulties of Chinese University students. *Journal of Vocational Behavior*, 78, 11–20.
- National Academy of Engineering. (2018). *Understanding the educational and career pathways of engineers*. The National Academies Press, Washington, D.C. <https://doi.org/10.17226/25284>
- Office of the Chief Scientist. (2016). *Australia's STEM workforce: science, technology, engineering, and mathematics*. Australian Government, Canberra.
- Parry, E., and Urwi, P. (2011). Generational differences in work values: a review of theory and evidence. *International Journal of Management Review*, 13, 79–96.
- Phillips, K. W., Medin, D., Lee, C. D., Bang, M., Bishop, S., and Lee, D. N. (2014). How diversity works. *Scientific American*, 311(4), 42–47.
- PricewaterhouseCoopers (PwC). (2006). *The changing face of rail – a journey to the employer of choice*. Australasian Railway Association, Kingston.
- Roberge, M. and van Dick, R. (2010). Recognizing the benefits of diversity: when and how does diversity increase group performance? *Human Resource Management Review*, 20(4), 295–308.
- Sheu, H-B., and Bordon, J. (2017). SCCT research in the international context: empirical evidence, future directions and practical implications. *Journal of Career Assessment*, 25(1), 58–74.
- Tang, M., Fouad, N., and Smith, P. (1999). Asian-Americans' career choices: a path model to examine factors influencing their career choices. *Journal of Vocational Behavior*, 54, 142–157.
- The Australian Centre for Social Innovation (TACSI). (2017). *Addressing disadvantage in southern Melbourne: towards outcomes*.
- Twenge, J. (2010). A review of the empirical evidence on generational differences in work attitudes. *Journal of Business and Psychology*, 25(2).
- UK Department for Transport. (2016). *Transport infrastructure skills strategy: building sustainable skills*. London.
- Wallace, M., Sheldon, N., Lings, I., and Cameron, R. (14–16 September, 2010). *Attraction and image for the Australian rail industry*. Proceedings of the British Academy of Management Conference. University of Sheffield. Sheffield.
- Wallace, M., Lings, I., Sheldon, N., and Cameron, R. (7–9 December, 2011). *Attracting Young Engineers to the Rail Industry in Australia*. Paper delivered at ANZAM Conference. Wellington. New Zealand.
- Wallace, M., and Sheldon, N. (8–9 April, 2014). *The attraction and image project*. Presentation at Interchange Symposium hosted by the CRC for Rail Innovation.
- Waterhouse, J., and Kerr, C. (2008). *Bridging the gap: towards a better understanding of target cohort belief systems*. CRC for Rail Innovation, Brisbane.
- Woolnough, B., Yuying, G., Leite, M., de Almeida, M., Ryu, T., Wang, Z., and Young, D. (1997). Factors affecting student choice of career in science and engineering: parallel studies in Australia, Canada, China, England, Japan and Portugal. *Research in Science & Technological Education*, 15(1):105–121.
- Wright, T. (2019). *The impact of the future of work for women in public transport*. International Transport Workers' Federation.



Skills gaps and training in the rail industry

Kumi Heenetigala

Introduction

According to the Education and Training Committee (ETC) (2010, p27):

‘The Victorian rail system is experiencing unprecedented growth in patronage, while at the same time planning large-scale investments in infrastructure projects that will significantly improve the operation of the overall system. An adequate supply of appropriately skilled and qualified labour will be fundamental to meeting the challenges of these developments. Rail in the future will rely on the retention of skills to support the existing systems, as well as the skills of the next generation of employees who will be responding to the economic, social, environmental and technological challenges of a modern rail system.’

An Australian Industry Standards (AIS) (2019b) reference committee report stated that over \$100 billion will be invested on new rail projects and upgrades by 2030, which is expected to enhance the rail networks infrastructure, and create jobs for building, managing and maintaining these networks.

The rail industry workforce

In order to understand the skill shortages in the rail industry, it is necessary to have knowledge of the various occupations and job roles involved in rail, as well as the range of skills and qualifications required to undertake these roles successfully (ETC, 2010). The ETC also mentioned the need to understand the characteristics currently held by the existing workforce, including composition by age and gender, and the skills and qualifications, because these factors can influence the extent of current and future skill shortages, and the success or otherwise of any workforce strategies devised to respond to them.

The workforce’s current perception of the rail industry is seen as negative due to the image of the industry, low technology, being slow and resistant to change, and male dominated. The unfavourable image of the rail industry is seen to limit career appeal for many potential recruits, which also has an impact on training for the future workforce (AIS, 2019b; BIS Oxford Economics, 2018; Mahendran and Dockery, 2008).

Job categories and occupations

The workforce in the Victorian rail industry is made up of various job roles, ranging from non-skilled, skilled trades, associate professionals and professional roles. The jobs roles are classified based on their criticality to rail operations. The criteria for assessing whether a job is critical is based on:

‘... roles that require skills that organisations have found difficult to source; roles that require skills that require a long time to develop or grow within the organisation; roles that are critical to the core business of the organisation; and roles that constitute a “critical mass” within the organisation.’ (ETC, 2010, p28)

These critical job roles are then categorised into four broad job families: engineers, trades and trade equivalents, operations, and professionals (ETC, 2010, p29) (Table 4.1, overleaf).

The ETC also states that the 2006 ABS Census of Population and Housing reported that 27.9% of rail industry employment in Victoria accounted for train and tram drivers. Customer service staff, authorised officers and track workers were the other roles identified in this census. The remaining workforce comprises a broad range of occupations including plant operators, metal fitters and machinists, transport services managers, electricians, structural steel and welding trades workers, supply and distribution managers, contract, program and project administrators.

The following career matrix (Figure 4.1, overleaf) reported by Cannon et al. (2019, p58) provides a list of job categories and positions in the rail transport sector against the three management levels for transport planning namely:

- Strategic management addresses decisions for changes in resource acquisition in the long-term, such as changes in the structure of the rail network (e.g., purchasing a new fleet and or building a new terminal). These decisions are associated with significant investments.
- Tactical planning focuses on resource allocation in the medium term. Timetables, schedules and shift allotment generally operate at the tactical level. It is important that activities at the tactical level are responsive to changes to customer requirements, available resources and assets.
- Operational management deals with day-to-day activities of a railway company, for example, rail-orientated services, managing and running trains on a daily basis, loading and unloading operations, and shunting and maintenance of trains in rail marshalling facilities and their depots.

Table 4.1 Critical job families and job roles within the rail industry

Critical job family	Critical job roles
Engineers	<ul style="list-style-type: none"> • Electrical and signalling engineers • Mechanical engineers • Civil engineers • Project managers
Trades or trade equivalents	<ul style="list-style-type: none"> • Electricians • Signalling • Civil/perway • Mechanical
Operations	<ul style="list-style-type: none"> • Drivers • Train/network controllers or operators • Network planners • Transit operators
Professionals	<ul style="list-style-type: none"> • Surveyors • Commercial contract managers • Business and policy analysts

Source: ETC, 2019, p29

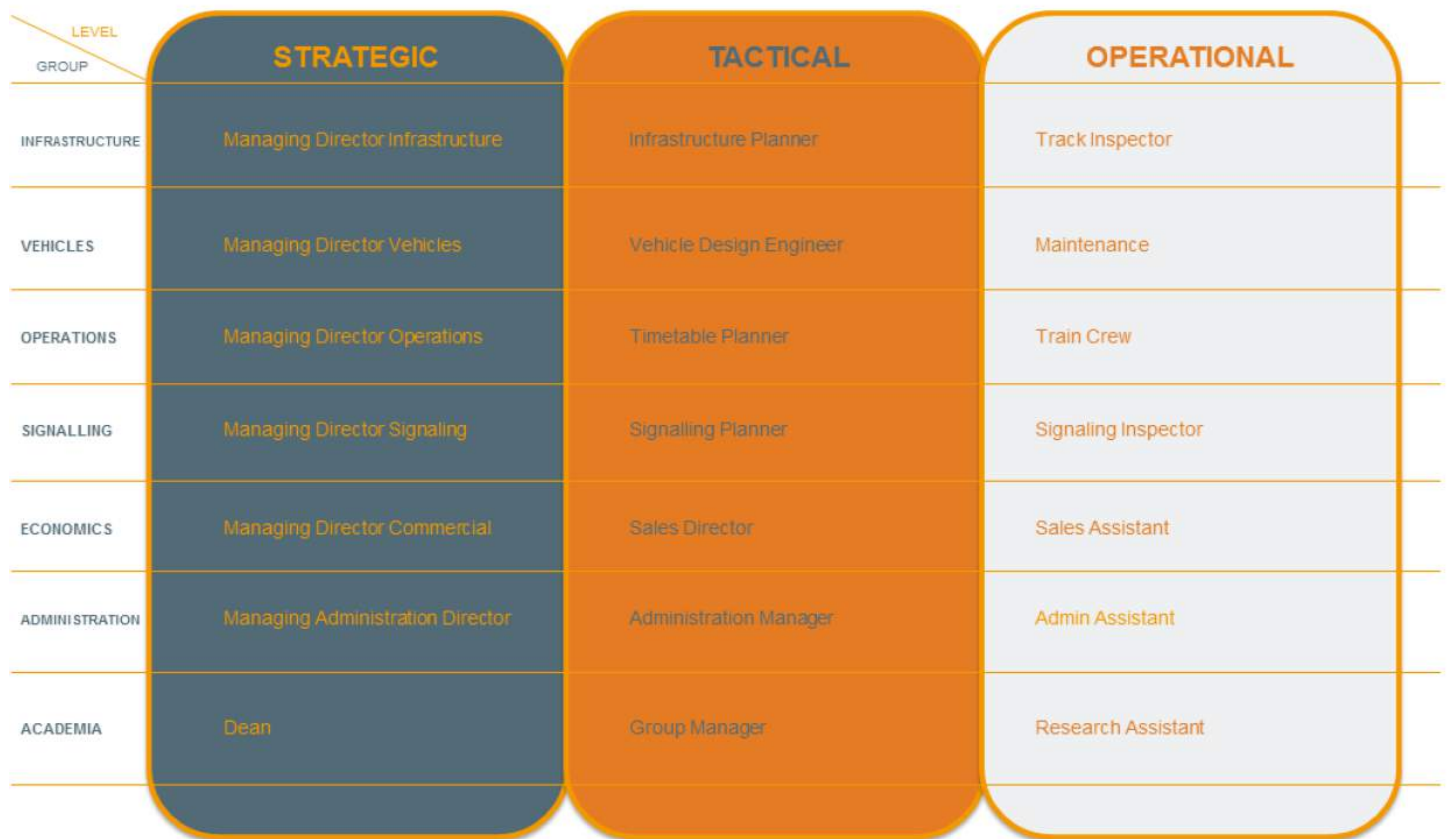


Figure 4.1 Rail careers matrix (Cannon et al., 2019, p58)

Skill shortages in the rail industry Australia

The skills shortage is a major issue facing the rail industry in Australia. According to Loneragan (2018), the challenge of addressing the rail industry's skills gap was a topic of discussion at an AIS forum in September 2018. Loneragan (2018) states that the federal and state governments across Australia have collectively committed \$100 billion over the next 12 years to infrastructure projects to ensure the nation's rail networks can bear the weight of a steadily expanding population and the concomitant increase in demand for rail services. There are a number of large-scale projects already underway or in planning which will require a sizeable skilled workforce to bring them into being. However, the size of the rail workforce in Australia is much the same as it was a decade ago, and is growing older. In the decade between 2006 and 2016, the number of workers under the age of 40 fell by 3%, and the number over 40 rose by 1.4%. Currently, only 11% of the workforce is under the age of 30 years.

Investigating the skill shortage in Australia, the ETC (2010) mentioned that, according to the Australasian Railway Association (ARA), approximately 40% of rail industry employees working in roles identified as critical to the industry are predicted to leave the industry over the next five years, which would result in significant shortages across most job families. The committee questioned the participants and identified a number of general areas and specific rail occupations in which shortages already exist, or are expected to develop. These include: project managers, engineers (including railway signalling and infrastructure engineers), train or network controllers, technical workers, track workers and maintenance trades. In 2009, an environmental scan undertaken by the Transport and Logistics Industry Skills Council also identified shortages for a similar range of rail-related occupations. Even though they identified a current shortage of train and tram drivers, this does not currently appear to be a problem in Victoria (ETC, 2010).

A more recent study was conducted in reference to skills in the rail industry by AIS (2018) via an online survey of all rail stakeholders between December 2017 and January 2018. The study reported that nearly 90% of employers were experiencing a skills shortage in the last 12 months. The specific areas of skills shortage was in relation to train drivers, signalling technicians, educators, trainers and assessors, train controllers and track workers. Reasons for these shortages were identified by the employers as an ageing workforce, current staff retiring, competition from other organisations, cost/time to achieve the required qualification, geographic location of the vacancy and wages/salaries perceived too low. This study identified the top five rail industry occupations as train and tram drivers, railway track workers, ticket sales persons, railway signal operators/train controllers and ticket collectors/railway assistants (Figure 4.2).

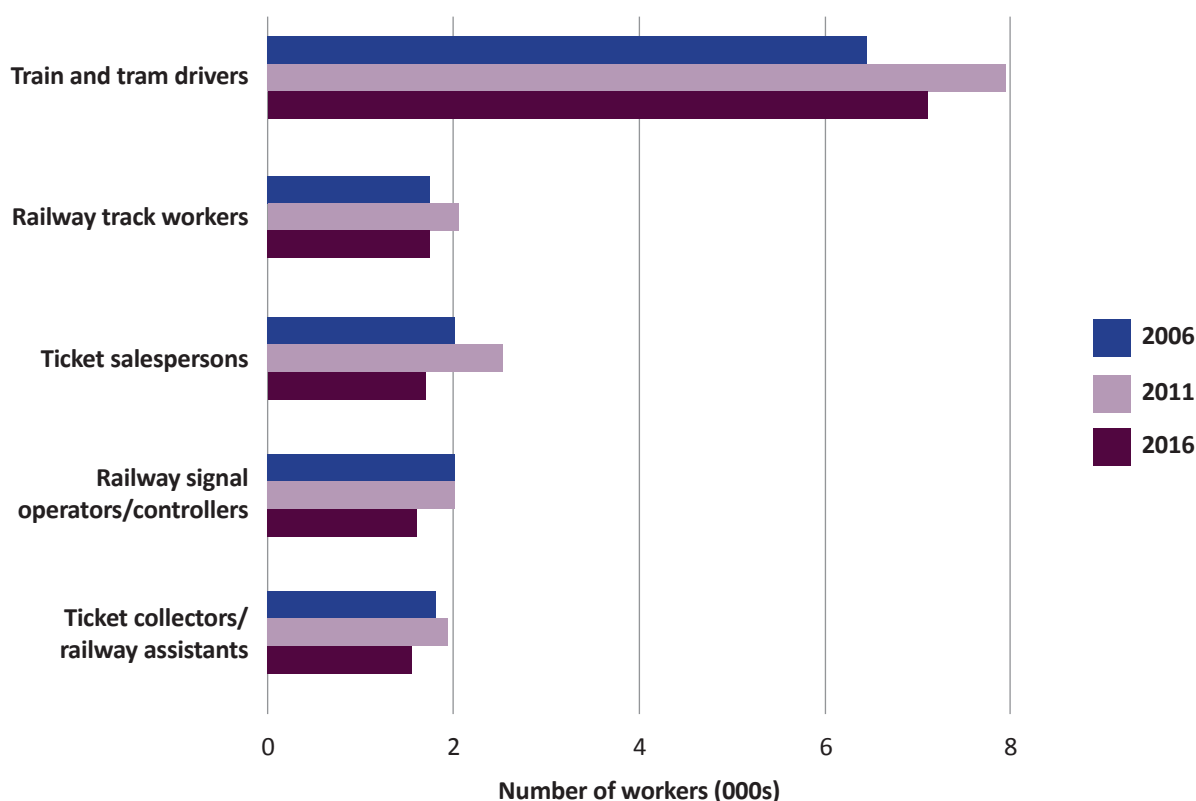


Figure 4.2 Top five rail industry occupations. Source: ABS Census – 2006, 2011 and 2016. Australian Government.

Figure 4.2 shows that there has been a decline in train and tram drivers and railway track workers in the rail industry since 2011. More than a quarter of the decline of train drivers in the rail industry can be attributed to a shift of employment into iron ore mining alone (revealed by analysing ABS Census 2016 data).

BIS Oxford Economics (2018) also noted a number of distinct areas and occupations that are of immediate shortage in the rail industry as railway signalling engineers and maintenance workers, overhead wiring, electrical, tunnelling, train drivers, trainers and assessors, safety and track force protection, and community engagement. However, the current skills requirement are in the construction side of the rail industry, and there are concerns particularly regarding signalling, tunnelling and trackwork. Furthermore, current workforce shortages were considered to be in operations and maintenance positions, as well as trainers of skills themselves.

A shortage of trainers and assessors was identified in the previous two studies. The need for trainers to train in skills for train driver roles was a challenge requiring enough trainers and training environments to grow the pool of drivers to cater for the demand. This shortage of trainers and assessors was also identified in the industry surveys and the AIS skills outlook. Furthermore, challenges to training of the rail workforce capability now and in the future were recognised as a shortage of trainers, the time taken to train people for key roles, meeting interjurisdictional competency requirements and lack of scale in training courses which made them uncommercial and a risk to the quality of training, particularly in periods of high demand.

Areas of current and future skills shortages

Table 4.2 (overleaf) shows the total employment for each occupation and the estimated increase in workforce gaps in Victoria from 2018–2027. This presents the projected gap into the future under the assumption that no new hiring is conducted to replace retirements. Workforce gaps in rail station managers, train controllers, railway signalling technicians, train and tram drivers, railway track workers and rail way assistants were identified (BIS Oxford Economics, 2018). The AIS (2019b) Industry Reference Committee (IRC) also reported a similar skills shortage in the rail industry. They stated nearly 94% of employers experienced a skills shortage in the last 12 months in signalling technicians, train drivers and track workers. They also reported shortages in engineers, educators, trainers and assessors. The skills shortage reported in AIS (2018) showed train drivers, signalling technicians, train controllers, train workers and educators, trainers and assessors were among the rail workforce.

As discussed, the ageing workforce in Australia is an issue affecting the skill shortage. BIS Oxford Economics (2018) referring to the ageing workforce, states that the total rail workforce requirement to meet future rail activity will inevitably be increased by the attrition of the existing workforce through ageing effects; particularly through retirement and death. Table 4.3 provides estimates of the current rail workforce age composition for the broad occupation clusters used in this analysis. This table shows that machinery operators and drivers groups have the greatest share of workforce aged over 54 years (25.3%), followed by managers (22.3%) and then sales workers (22.3%). These occupation groups will tend to feature greater rates of attrition than the other groups considered in this analysis. However, this is likely less of an issue for managers (as seniority is to be expected to a large degree).

Table 4.2 Victoria's estimated total rail employment and workforce gap

Occupation name	FY18 employment	Workforce gap (%)			
		FY18	FY 21	FY 24	FY 27
Managers	4,062	0.9%	10.7%	24.9%	10.0%
Specialist Managers	3,134	1.3%	10.9%	25.1%	9.3%
Advertising, Public Relations and Sales Managers	177	2.0%	8.6%	21.1%	3.9%
Business Administration Managers	316	0.7%	8.7%	21.7%	8.8%
Construction, Distribution and Production Managers	2,463	1.4%	11.6%	26.2%	9.9%
Construction Managers	2,040	1.8%	12.2%	27.0%	9.8%
Engineering Managers	106	0.1%	10.4%	25.9%	12.9%
Other/Unclassified Construction, Distribution and Production	317	-0.3%	7.9%	20.5%	9.2%
Other/Unclassified Specialist Managers	177	0.0%	7.6%	20.3%	7.4%
Hospitality, Retail and Service Managers	431	0.2%	7.8%	20.0%	9.9%
Call or Contact Centre and Customer Service Managers	108	0.3%	4.6%	14.2%	2.1%
Rail Station, Transport Company, and Other Transport Services	189	0.3%	8.6%	18.4%	20.8%
Other/Unclassified Hospitality, Retail and Service Managers	135	0.1%	9.4%	26.1%	0.1%
Other/Unclassified Managers	497	-1.3%	12.0%	27.6%	15.2%
Professionals	1,976	1.0%	9.7%	21.4%	8.2%
Business, Human Resource and Marketing Professionals	643	0.8%	8.3%	19.7%	8.4%
Design, Engineering, Science and Transport Professionals	997	1.1%	10.9%	22.7%	7.8%
Architects, Designers, Planners and Surveyors	157	0.7%	9.3%	22.6%	6.7%
Engineering Professionals	829	1.2%	11.0%	22.4%	8.0%
Civil Engineering Professionals	465	1.7%	13.1%	23.3%	7.4%
Electrical Engineers	131	0.6%	4.9%	15.7%	7.7%
Industrial, Mechanical and Production Engineers	136	1.0%	9.7%	23.1%	8.2%
Other/Unclassified Engineering Professionals	98	0.1%	10.5%	25.1%	10.5%
Other/Unclassified Design, Engineering, Science and Transport	11	-0.8%	21.3%	41.3%	11.7%
Occupational and Environmental Health Professionals	111	1.0%	10.8%	25.4%	12.9%
ICT Professionals	146	1.6%	6.7%	15.7%	4.5%
Other/Unclassified Professionals	79	-0.4%	9.2%	22.7%	11.5%
Technicians and Trades Workers	10,939	0.0%	1.2%	8.8%	-19.1%
Engineering, ICT and Science Technicians	1,286	1.2%	11.9%	27.8%	10.4%
Architectural, Building and Surveying Technicians	976	1.4%	12.7%	29.1%	11.7%
Other/Unclassified Engineering, ICT and Science Technicians	311	0.3%	9.0%	23.7%	6.1%
Automotive and Engineering Trades Workers	1,377	0.3%	16.5%	31.2%	8.3%
Construction Trades Workers	5,816	-0.3%	-7.4%	-11.0%	-39.5%
Electrotechnology and Telecommunications Trades Workers	2,057	0.1%	3.8%	18.9%	-17.6%
Electricians	1,630	0.3%	3.5%	18.1%	-19.0%
Electronics and Telecommunications Trades Workers	389	0.1%	5.9%	22.7%	-10.0%
Other/Unclassified Electrotechnology and Telecommunications	37	-8.4%	-4.2%	15.6%	-40.1%
Horticultural Trades Workers	143	-0.1%	-0.9%	-1.2%	-12.0%
Other/Unclassified Technicians and Trades Workers	259	-0.1%	7.2%	22.5%	-4.6%
Community and Personal Service Workers	123	-0.1%	6.3%	13.8%	5.3%
Security Officers and Guards	28	0.2%	9.5%	21.1%	5.1%
Personal Service and Travel Workers	45	-0.3%	4.7%	9.7%	8.7%
Other/Unclassified Community and Personal Service Workers	50	0.0%	6.0%	13.1%	2.3%
Clerical and Administrative Workers	2,931	0.1%	2.3%	6.8%	-1.8%
Office Managers and Program Administrators	743	0.1%	1.3%	5.9%	-6.9%
Personal Assistants and Secretaries	144	0.4%	3.5%	9.5%	-5.7%
General Clerical Workers	399	0.3%	1.9%	6.8%	-6.9%
Inquiry Clerks and Receptionists	238	0.2%	1.9%	5.9%	-0.5%
Numerical Clerks	608	0.1%	2.1%	7.1%	-7.0%
Other Clerical and Administrative Workers	742	0.1%	3.3%	7.0%	8.0%
Logistics Clerks	314	0.2%	2.6%	6.3%	4.2%
Other/Unclassified Other Clerical and Administrative Workers	427	0.1%	3.8%	7.6%	10.7%
Other/Unclassified Clerical and Administrative Workers	57	-0.2%	3.0%	7.9%	2.8%

Occupation name	FY18 employment	Workforce gap (%)			
		FY 18	FY 21	FY 24	FY 27
Sales Workers	892	-1.1%	1.2%	4.4%	6.0%
Ticket Salespersons	527	-1.8%	3.4%	9.0%	15.6%
Other/Unclassified Sales Workers	365	0.0%	-2.2%	-2.5%	-9.4%
Machinery Operators and Drivers	3,596	0.1%	10.1%	20.2%	8.6%
Machine and Stationary Plant Operators	779	0.0%	11.1%	24.7%	6.1%
Train Controllers, and Railway Signal, Track Plant and Other	380	0.2%	5.2%	12.7%	10.4%
Other/Unclassified Machine and Stationary Plant Operators	399	-0.1%	16.0%	33.2%	1.9%
Mobile Plant Operators	646	0.5%	21.1%	30.4%	-9.1%
Road and Rail Drivers	1,972	0.2%	5.5%	13.2%	14.8%
Train and Tram Drivers	1,660	0.3%	4.3%	9.4%	15.6%
Truck Drivers	240	0.2%	11.4%	30.4%	6.9%
Other/Unclassified Road and Rail Drivers	71	-1.3%	11.6%	27.8%	19.0%
Other/Unclassified Machinery Operators and Drivers	200	-1.2%	8.2%	23.8%	4.7%
Labourers	3,683	-0.4%	10.3%	29.3%	7.8%
Construction and Mining Labourers	2,461	-0.5%	9.8%	29.1%	4.9%
Railway Track Workers	300	-0.1%	8.5%	21.6%	17.7%
Other/Unclassified Construction and Mining Labourers	2,161	-0.6%	9.9%	30.0%	3.1%
Railways Assistants and Other Miscellaneous Labourers	508	0.7%	8.4%	20.9%	15.3%
Other/Unclassified Labourers	715	-0.8%	13.1%	34.7%	12.4%
Total	28,501	0.1%	5.6%	15.6%	-3.2%

Source: BIS Oxford Economics, 2018

Table 4.3 Estimated age profile of the rail construction and operations workforce by group

Occupation group	Age bracket							
	15–24	25–34	35–44	45–54	55–59	60–64	65–69	70+
Managers	4%	19%	27%	27%	11%	7%	3%	2%
Professionals	6%	31%	27%	19%	7%	5%	2%	1%
Technicians and Trades Workers	15%	28%	21%	20%	8%	5%	2%	1%
Community and Personal Service Workers	16%	26%	21%	20%	8%	5%	3%	1%
Clerical and Administrative Workers	8%	21%	24%	26%	11%	7%	3%	1%
Sales Workers	19%	16%	19%	23%	11%	7%	3%	1%
Machinery Operators and Drivers	4%	18%	22%	30%	14%	8%	3%	1%
Labourers	15%	24%	21%	22%	10%	6%	2%	1%
Total	11%	24%	23%	23%	10%	6%	3%	1%

Source: BIS Oxford Economics, 2018, p101

Impact of new technology on the rail industry

Innovation in technology across the world is rapidly changing the way industries are conducting their daily operations. The development of new innovations can improve operations, reduce power consumption, assist in asset management, and monitor safety critical communications in the rail industry (AIS, 2018). Recognising the skills gap between the current capabilities of the Australian workforce and those required in future work, Gallagher (2019) identified the deficiencies in digital skills of the future workforce and the need for unique human skills, which are their competitive advantage in work places disrupted by digital technologies. As reported by Menon (2019, p2) at the World Economic Forum: 'Disruptive technologies such as artificial intelligence, robotics, blockchain and 3D printing are indeed transforming social, economic and political systems, often in unpredictable ways. The technology itself is difficult to map because its growth rate could be exponential, factorial or higher. It is this unpredictability that is making impact assessments difficult but not impossible.' New technology has resulted in many low-skilled, repetitive jobs being automated. However, not all high-skilled jobs are immune either. For instance, greater automation of production processes will require greater supervision and quality control, requiring humans to carry out this function. Figure 4.3 shows the reskilling needs of the future workforce.

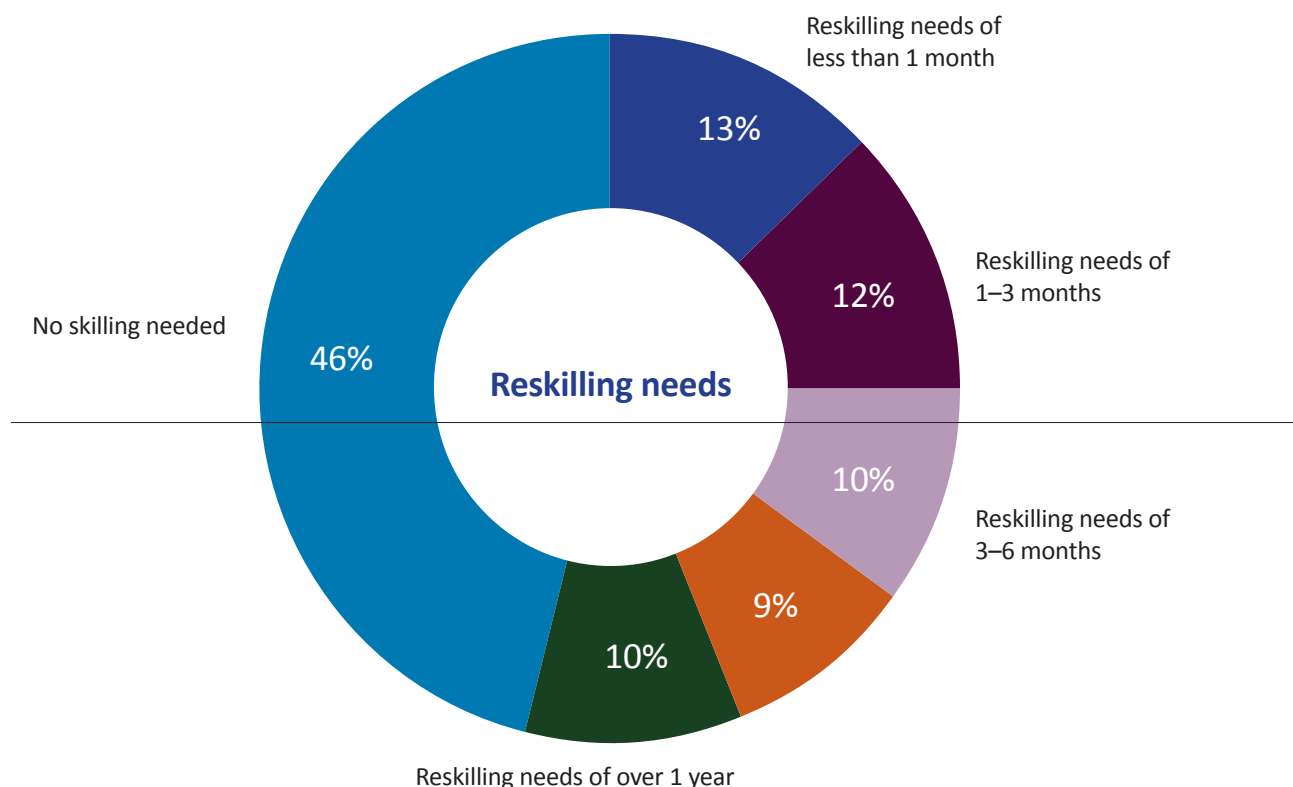


Figure 4.3 Reskilling needs (source: Future of Jobs Survey 2018, World Economic Survey)

Digitisation is considered the necessary precursor to automation (Gallagher, 2019). Therefore, it is important to understand the skills shortages facing the rail industry over the next 10 years, and how it will be impacted by the new technologies that are increasingly being adopted by the rail industry that will influence the future skills requirements for the sector. This includes the new high capacity signalling systems for the new generation of digital train control, the move towards remote condition monitoring, and the increasing level of automated systems across customer service interaction, train control, traffic management, maintenance and system-wide optimisation (BIS Oxford Economics, 2018). BIS Oxford Economics (2018) reports:

'Big data analytics will be applicable across all parts of the rail system, from operations and maintenance, to how customers interact with the rail networks and services. The development of data analytics is the start of a larger requirement to transform the industry into a significant developer and employer of Artificial Intelligence, starting with Machine Learning and other Computational Intelligence technologies. The interface with the digital railway (AI specialists) and the physical railway (process experts) will be key to the development of useful and relevant information and knowledge. It would be anticipated that the two groups would learn from each other about what works with the disparate data sources available for the railway operation.' (p86)

Gallagher (2019) states that there are different levels of digitisation applicable when related industries are grouped together into three broad sectors such as knowledge-intensive, service, and asset-intensive sectors. The knowledge-intensive sector has a relatively high level of digitisation, compared to the service sector, which employs four in five Australian workers, has a medium level of digitisation, and the asset-intensive sector has a lower level of digitisation. The further an industry is down the path to integrating automation technologies, the more workers value the importance of social competencies such as emotional, collaborative, leadership, empathy and entrepreneurial skills relative to expertise.

Types of training methodologies employed in the rail industry

Various training methods are being used in the rail industry such, as traditional face-to-face delivery, stand alone or blended learning programs, onsite, online, 4 and 5D and oculus rift (virtual reality) (Australian Trade and Investment Commission, 2016).

E-learning

According to Becker et al. (2012, p389):

‘The Australian rail industry represents a more traditional and less “high tech” working environment than might exist in other sectors. An industry such as this may, by its very nature, offer additional barriers to the adoption of e-learning. Although there is still a significant move towards the integration of technology into the sector, the workforce in the rail industry remains predominantly blue collar labour undertaking manual work, the majority of whom hold a maximum of secondary or trade qualifications.’

E-learning is also commonly considered to enhance learning, improve performance, develop skills and increase levels of motivation (Ali and Magalhaes, 2008). It is also, more accessible, efficient and cost-effective than other forms of corporate training (Kathawala and Wilgen, 2004). Furthermore, e-learning is a means of providing opportunity for ongoing learning and information sharing across geographically dispersed organisations (Barnes and Blackwell, 2004). As a result, e-learning offers attractive prospects to industries such as rail, but these organisations have embraced e-learning to varying extents.

E-learning provides technological literacy for different generations and the potential for educational change. It has emerged as a learning and development approach to enable organisations to keep up with the changing world (Wellman, 2007).

Conversely there is also widespread argument that traditional organisations and industries with a predominantly older workforce, who are not using computers as an integral part of their work, are unlikely to embrace the opportunities afforded by e-learning. The challenge of an ageing workforce is being felt more acutely in the rail industry than in the general workforce, with the ABS Labour Force Survey for 2006 indicating that the median age of rail transport workers was 44 years, while the median age of all Australian workers was 39 years (ARA, 2008, p5). The ARA expects almost 20% of the current workforce to separate from the industry, further impacted by another 20% in retirements before 2013 (ARA, 2008, p27).

While many rail organisations are considering or are already using e-learning options to deliver training programmes within their widely dispersed organisations, the challenge remains to engage a younger generation of learners who seem comfortable learning with technology, whilst not alienating those older learners who may prefer to learn in more traditional ways (Becker et al., 2012):

‘A problem that faces the rail industry is that youth are not attracted to rail, nor are new recruits retained, and it has been argued that younger employees are a major labour pool which could be better accessed for the sustainability of the industry.’ (ARA, 2008, p13)

‘The overall labour turnover in the rail industry is relatively low in comparison to other industries (ARA, 2006) and retention in general is not seen as a key issue for the industry, with the exception of particular professions and expertise that are subject to shortage beyond the rail industry. However, research has shown that retention is disproportionately low in some demographic groups, especially in the group of employees aged 25 years and below. It is cause for concern that the stereotypical image of the rail industry as being slow and resistant to change is unlikely to change without a key focus on innovation which in turn is difficult without an element of refresh in the workforce.’ (ARA, 2006, p11)

Workers who intend to exit the industry in the short-term report they are not in the least satisfied by training, and this is a reason given for considering their departure from the industry (ARA, 2006). Therefore, there is an imperative to develop training resources available to the industry to meet not only the needs and preferences of the current workforce, but also those of the future workforce, and particularly, the younger generation. As the ARA argues, the view of skills development in the industry is linear and traditional, and this approach 'is unlikely to meet the expectations of younger workers joining the industry' (2006, p15). This is because younger generations are more accustomed to rapid, parallel processing and tend to seek immediate feedback and rewards (Prensky, 2001). Therefore, e-learning is argued to be better suited to meet the needs of these younger workers who are more accustomed to the use of electronic mediums. Furthermore, training in the rail industry occurs within the blue-collar workforce which does not use computers as a part of its daily work and is often assumed to have limited technological literacy. Table 4.4 (overleaf) shows the e-learning approaches being used in the five case studies conducted across Australia by Becker et al. (2012).

Widely addressed content in e-learning was compliant and regulatory in nature, as all five organisations in Table 4.4 identified e-learning as a useful vehicle to meet the statutory and legal obligations of their organisations. E-learning in the rail industry was predominantly used for compliance as it was potentially cost saving and minimised disruption to work. They also stated that compliance training included occupational health and safety, security, rail safety requirements and environmental compliance, and then a range of more specific, technical and job-related compliance topics. Significant variations in regulations, even within the single industry across Australia requiring revision to training, e-learning offered an alternate to face-to-face training. As the Becker et al. (2012) study reported, age was an issue for e-learning in the rail industry. Use of technology was linked to age, where the younger generation preferred to engage with technology than with classroom teaching. Many of the current employees are older and were not prepared to use technology in the learning environment. This research identified barriers to the adoption and use of e-learning across all generations. This was brought the attention of the management to balance the learning preferences of all employees while harnessing the potential of e-learning.

Mentoring

According to Naweed and Ambrosetti (2015), mentoring is provided to support the development of skills and knowledge. It usually occurs in the workplace when on-the-job training is conducted and it benefits both mentor and mentee. According to the Transport and Logistics Industry Skills Council (2014), all the organisations are managed by their own in-house training programs for training train drivers. In the study conducted by Naweed and Ambrosetti (2015), participants reported mentoring was provided by trainers who were experienced drivers, and emphasised the importance of spending quality time with their trainer and have their training customised to their need. They also commented on the absence of a training guide or format for the trainers to use and follow. Furthermore, they also identified that the trainers would benefit from their own training processes.

Other training practices

A study conducted by Mahendran et al. (2007) states the majority of training for operational staff in the railway industry involved a combination of different components, including in-class training, supplemented with some on-the-job training experience. Many of the interviewees stated that training delivered in a classroom type setting was generally reserved for theoretical material, and the majority of the training particularly for frontline staff (e.g., drivers, shunters, etc.) was completed on-the-job. Some rail organisations also used computer and web-based resources to deliver their training to workers. The participants of this study believed that there was a lack of rail-specific training programs and courses offered by the more generic, training providers and educational institutions such as TAFEs and universities.

Mahendran et al. (2007) stated that several operators were also aware of rail-specific training programs and courses offered by several universities, some of which they incorporated as part of their training regimes for their workers. Examples of universities with rail-specific training courses that were utilised by some of the study participants included the Central Queensland University, Queensland University of Technology (QUT), Royal Melbourne Institute of Technology (RMIT), University of Western Sydney and University of Queensland. Furthermore, external training providers including universities and organisations such as the Australian Institute of Management (AIM) and SHL were commonly used by many rail operators to deliver specialised training to professional staff in the areas of business, leadership and management development, and also to develop their skills and expertise in the areas of finance, industrial relations and corporate affairs.

Table 4.4 Details of case organisations – rail industry

Case	Approximate number of employees	Employee locations ^a	E-learning approach	Organisational background
R1	1,400	Across the state – geographically dispersed	In-house, stand-alone e-learning management system	A large regional public transport operator, R1 served over ten million train and coach passengers (pax) in 2009/2010 financial year (FY). This company operates approx 1,500 train services each week, and more than 500 coach services that connect the rail network to regional state communities where trains do not operate. R1 provides access to several thousand kilometres of rail track, which is used by mixed traffic (pax and freight services). Many staff of R1 live in rural areas of the state (sourced from the corporate Annual Report 2009/2010).
R2	720		Open source e-learning management system (limited integration to Human Resources Information System [HRIS]). Some outsourcing to an external e-learning provider.	R2 employs people in fields diverging from customer service, light and heavy rail drivers to a range of engineering and trade disciplines. Over the FY 2008/2009, R2 serviced approx 15 million pax.
R3	10,000+		New learning management system currently being sourced. In-house development tools. Outsource most e-learning development.	This organisation provides city as well as country services. There are over 10,000 kilometres covered by city-based trains, and in the FY 2009/2010, over 250 million pax used the city trains. This company also services several hundred country destinations including interstate. In the FY 2009/2010, almost two million pax made a journey on the trains of the country fleet operated by R3 (sourced from the corporate Annual Report 2009/2010).
R4	10,000+		Internal, fully integrated with HRIS	A large, integrated transport provider in Australia, with a workforce located nationally in several hundred locations. This company operates several thousand kilometres of track and runs more than a quarter of a million scheduled services, both passenger and freight services. In the FY 2009/2010, over 50 million trips were made (sourced from the corporate Annual Report 2009/2010 and the corporate website).
R5	1,400	Mostly metropolitan with some rurally-based employees	In-house stand-alone e-learning system	R5 was established through the amalgamation of several different transport organisations and now operates a number of major services. In the FY 2009/2010, more than 100 million pax boarded their transport services in the metropolitan area. The coach and rail pax services to regional areas cover several hundred locations in the state. In the FY 2009/2010, almost a quarter of a million pax boarded this service. In the same time frame, a significant number of students were carried by the school bus services also operated by R5 (sourced from the corporate Annual Report 2009/2010 and the corporate website).

^aAlthough R1–R4 are all noted as being across the state, each represents a different Australian state.

Source: Becker, K., et al., 2012

Many rail operators also reported that even when they utilised training services from RTOs from within the industry and other external training providers, most still had to work closely with them to design and customise their training programs so that they were specialised enough to service their specific business and operational needs. Therefore, although these operators outsourced the training of their staff to external training agencies, they still provided a lot of internal input. Such training regimes often involved open training systems, where Registered Training Organisations (RTOs) are very much utilised to deliver the training. Despite the fact that these rail organisations delivered their training through external training providers, many stated that they still contributed internal resources from a subject matter perspective and spent time working with the training provider(s) to tailor and adapt the training to best suit their needs. In this way, localised content training is often provided to enable workers to adapt to an operator's specific rail equipment and operations, and thus acts to supplement the broad-based theoretical understanding that is provided as part of the general training.

A study conducted by Gallagher (2019), reported that, Australian workers prefer to 'learn on-the-job' to prepare for the workplace of the future. As evident in this research, Australian workers value the expertise of TAFEs and universities across the country, and the need for a trade or professional expertise for work was considered important. But this research, combined with studies performed by Deloitte and Ernst and Young, indicates Australian workers want formal education to be more job-relevant in these digitally disruptive environments. This study also reported the case for change is built on three findings for work in the disruptive and dynamic environments of the digital future: workers' growing recognition of the importance of their social competencies, the rising importance of tacit knowledge and the imperative of integrating learning with work.

Education and training in the rail industry in Australia

A challenge to education and training in this sector is the lack of scale that makes quality training uncommercial. Hands-on training provided by the operators through access to rail equipment and tracks can be more effective, however they are pressed financially to deliver training on top of their operational requirements (BIS Oxford Economics, 2018). Mahendran et al. (2007) principally focussed on analysing skills shortages, as well as profiling and forecasting the training needs of rail operators within the Australian rail transport industry (ARTI). The skill level of a worker may be improved by their participation in formal education and training, as well as through the acquisition of on-the-job experience. In this way, the fundamental role that training and education plays in developing human capital and its function in contributing to higher levels of production and efficiency within an economy is clearly evident (Burke, 2002). From the point of view of the individual, increased participation in training and skills development can ensure better outcomes in terms of employment and income (Burke, 2002). The Australian rail industry is very diverse in nature. The industry consists of suppliers, track access corporations, rail operators (including those specialising in heritage, tourist, freight, passenger transport, and a diversity of other companies covering all sectors of the industry (Transport and Logistics Industry Skills Council, 2005).

A study conducted by Gekara et al. (2014) reported:

'Employers from the Transport and Logistics industry were invited to comment on their satisfaction with the training system, with specific regard to the appropriateness of skills produced. [They] agreed that continuous workforce training for the purposes of skill development, enhancement and upgrading was important, and the quality of training under the prevailing system was of great concern.' (p496)

'The findings of this study also reported, state continues to perform a major role within the market, its role has significantly changed.' (p500)

Gekara et al. (2014) referring to the study conducted by Smith and Hayton (1999), state:

'In many ways, Australia's 'market-based' training system is highly dependent upon the State's provision of subsidies to training providers and employers.' (p496)

Many employers interviewed in the study conducted by Gekara et al. (2014) were happy with the role and work of the Skills Councils and applauded the fact that employers were directly represented and consulted in developing training packages. But they questioned the training provision arrangement whereby private RTOs, many of which lack the capacity to deliver quality training were being subsidised and entrusted with the responsibility of awarding nationally recognised qualifications. An employer, commenting on training quality, observed that:

'There aren't many TAFEs or RTOs I would use. At least in TAFE they are somewhat accountable whereas in private RTOs, they may be well intentioned but fanciful.' (Employer, March 2012) (Gekara et al., 2014, p496)

Three different training models were identified in this study (Gekara et al., 2014, pp. 499–500):

‘The first model was to setup enterprise RTOs to develop in-house training facilities and their own training programmes with personnel to develop courses.

The second model is where employers opted to develop their own training programmes, based on their own assessment of the company’s skills needs. Independent training providers, private and/or public, were then invited to deliver the training using the company’s workplace systems and equipment. The programmes were designed in such a way that company training personnel would continue with the monitoring and training after initial training is given by the independent providers. A further objective of this model was to gradually grow in-house training capacity and was used alongside other workplace capacity training approaches such as “buddy-ship” and “mentorship”, whereby more experienced employees were either “buddied-up” with new, less experienced ones, or assigned mentor roles in order to provide continuous training and support, as explained by one respondent.

The third training model, was mainly relied upon by smaller employers, and involved a fully outsourced training approach. In this model, employers who required new employees recruited from the open market, and sent their workers to independent providers, private or public, when upskilling training was required. There was little capacity or inclination to develop their own training programmes and often there was little on-the-job training provided. However, in the view of many employers, public providers provide good quality training. TAFEs are perceived to be less responsive to changing industry skills needs. Private providers, on the other hand, are perceived by some employers as suffering from the opposite problem and they are more responsive to industry requirements but do not provide the depth of TAFE training and often provide superficial training.’

In Loneragan (2018), the managing director of TAFE NSW, Jon Black, speaking at the AIS Skills Forum in Sydney, states that the perception TAFE had lesser ‘esteem’ than university was something that had to be addressed. He said, ‘We need to talk about promote how TAFE and VET can address the skills issues that we have today. Vocational training underpins the economy’. He stated that there is a desperate need for more funding for the VET system to provide the trained workforce that will deliver Australia’s infrastructure projects.

The above discussion mainly focused on the capacity of the emerging training system to effectively fulfil industry requirements for agility and flexibility while maintaining quality of training. A conclusion from this study (Gekara et al., 2014, p502) is that:

‘Employers support a market-based system but are unhappy with its emerging form which gives control of delivery of training to independent private providers who are not always equipped and/or motivated enough to deliver quality training programmes. Their responses indicate a preference for the delegation of greater power to individual employers to control the kind of training that provides the specific skills they require in their organisations. Such power would enable employers to determine the quality of training that their employees get and, consequently determine the productivity of their business operations. Even though this option, (e.g., enterprise RTOs established and run by employers), might deliver quality training but, may narrow the skills scope to particular workplaces and undermine trainees’ wider employability. But the state-sponsored traineeships and apprenticeships ensured that people obtained a broad base of knowledge and skills to enable easy employability across a range of employers and sectors.’

According to the Australian Trade and Investment Commission (2016), vocational and academic qualifications that can be taught and recognised anywhere in the world are designed in Australia, specifically for the rail industry.

A study conducted by Mahendran et al. (2007) reported that apprenticeships, traineeships, internships/cadetships and professional graduate recruitment programs were mostly offered by larger rail employers. Furthermore, generous study assistance programs to encourage their staff to take on additional study or further training was also offered by a majority of these rail employers. In addition, they also provided financial assistance and support to workers to help meet the costs associated with undertaking the additional training or education, as well as incentives to workers in the form of monetary rewards and bonuses, and allowed them time off and study leave provisions to enable them to better accommodate their training and study needs.

Mahendran et al. (2007) reported that of the 24 operators interviewed, 14 stated most training was delivered internally and 11 organisations had their own internal RTO. Two indicated looking at the possibility of developing an internal RTO within their organisations in the future. Even though the majority of respondents used internal training resources to deliver training to their workers in-house, most rail operators interviewed commented that they prefer to outsource more training services to external providers, which has led to the emergence of a niche markets for providing rail training by specialised training providers such as CERT, RTI (Rail Transport International) and Skilled Rail. Furthermore, several respondents commented that the current market conditions and skills shortages had also led to the emergence of specialised labour hire

organisations (e.g., CERT, Skilled Rail, Southern Cross) that trained rail workers in specific vocations and then hired them out to rail organisations that required these type of workers. Smaller-sized rail operators were using external training providers and many were downsizing their internal training resources. However, many of the larger-sized operators, who were particularly involved in the provision of passenger transport services, seemed to have continued delivering the majority of their training for workers internally, with many using their accredited RTO status and internal rail schools or training colleges to do so. Most believed that it was better for them to deliver in-house training due to their expertise in the relevant areas, their intimate knowledge of the specific type of training their workers required and their ability to adapt the training to better suit their specific systems and business operations. In addition to the above, some of the respondents pointed out that improving flexibility, and maintaining the delivery of training internally, enabled them to better facilitate the retention of business knowledge within their respective company, and also ensured that they weren't overly reliant on external providers to service their training needs.

The Education and Training Committee (2010, p30) states that:

'Within the vocational education and training (VET) sector, the main training package relevant to the industry is the Transport and Logistics Training Package. Specific qualifications that sit within this package include rail operations and rail infrastructure. The EE-Oz Training Package also has a range of qualifications relevant to rail infrastructure, including signalling and overhead.

The higher education qualifications of most interest to the inquiry are mainly engineering qualifications. All Victorian universities currently offer undergraduate degree courses in a range of engineering disciplines. While rail engineering has traditionally been a part of mechanical, civil and electrical engineering, the growth of electronic components within railway systems means that electronic engineering and computing are increasingly relevant.

There are a small number of rail-specific postgraduate programs available for engineers. Central Queensland University offers rail operations management and railway signalling and telecommunications, the University of Wollongong offers rolling stock engineering, and Queensland University of Technology offers railway infrastructure.'

Industry soundings revealed that the education and training sector continues to adapt to develop core skills useful for the rail industry. Arguably, however, the rail industry will need to do more to engage with educational institutions to help shape the development of skills they will need, when they need them, as well as to increase student awareness of the varied careers that are now available. This study noted, the rise of 'big data' and new rail technology challenges could be seen as an opportunity to partner with relevant tertiary educational institutions and courses (ranging from transport, economics, engineering to computer science, IT and statistics) in developing innovative and practical education programs that could provide the long-term mix of the 'non-traditional' skill sets that the rail industry may need (BIS Oxford Economics, 2018).

The Rail Academy in Newport, 13 kilometres west of the Melbourne's CBD, is one of Australia's leading rail training facilities. It provides educational spaces for training providers that service the rail sector and other industries. The Academy assists industry and training providers to identify the gaps in training related to the rail sector and future needs. It will also work collaboratively to develop new qualifications and training products that are high quality, sustainable and that meet industry needs (Rail Academy, 2019). The Major Transport Infrastructure Authority (2019) reported the Level Crossing Removal Project (LXRP) is working with VicTrack to further develop the training facility at Newport rail precinct.

Types of training courses offered in the rail transport industry

The Australian Industry and Skills Committee (2019) reported that in 2017, private training providers delivered the majority of training, but enterprise training providers delivered 51% of network control/rail safety qualifications and 41% of tram/light rail/train driving qualifications (Figure 4.4, overleaf). For most providers, a high proportion of subjects were funded via a domestic fee for service, except for TAFE where 66% of subjects were government-funded.

Figure 4.5 (overleaf) shows the majority of students were located in the eastern states, with close to 40% of students enrolled during 2017 coming from Victoria, 27% from Queensland and 25% from New South Wales (Australian Industry and Skills Committee, 2019).

Contrary to the Australian Industry and Skills Committee (2019) study, Cannon et al. (2019) conducted a study on current and emerging skills development and training schemes in the rail transport sector in 15 countries. The aim of this study was to identify which job categories showed gaps in training schemes and programmes within the rail transport sector. The data was collected from Australia, Belgium, Bulgaria, China, Germany, Greece, Ireland, Italy, Poland, Portugal, Romania, Slovakia, Spain, Sweden and the United Kingdom.

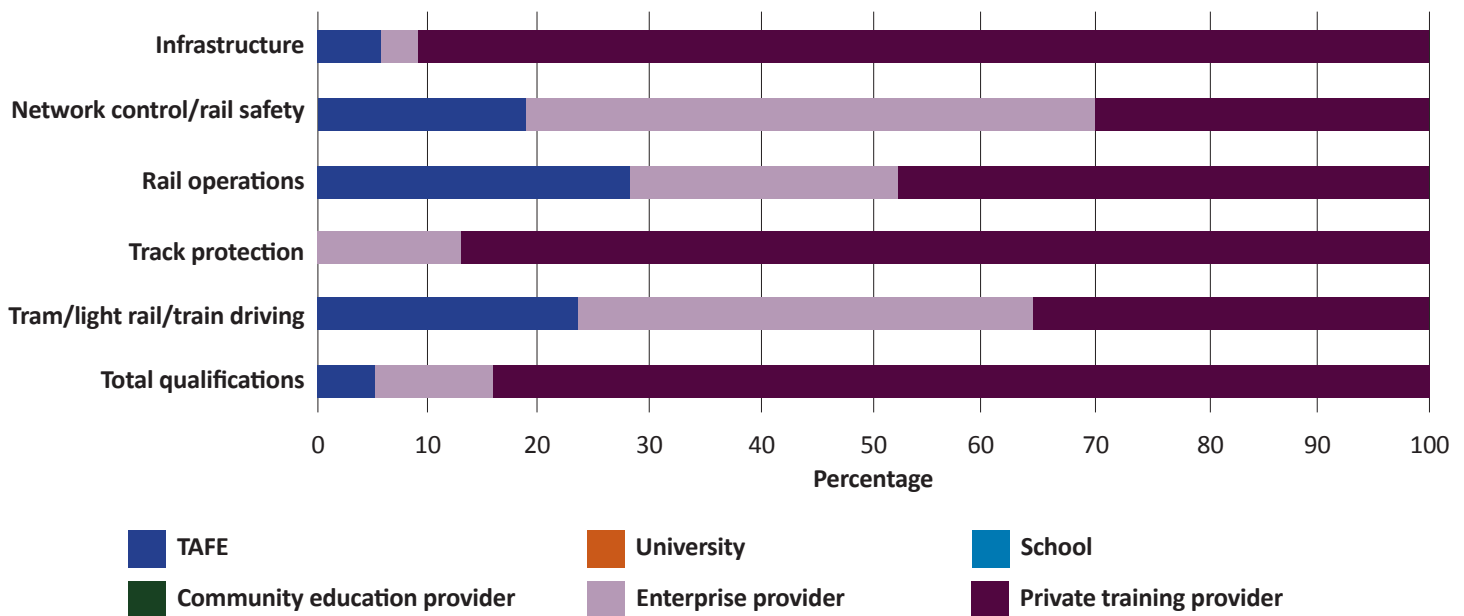


Figure 4.4 Training provider type (source: Australian Industry Skills Committee, 2019)

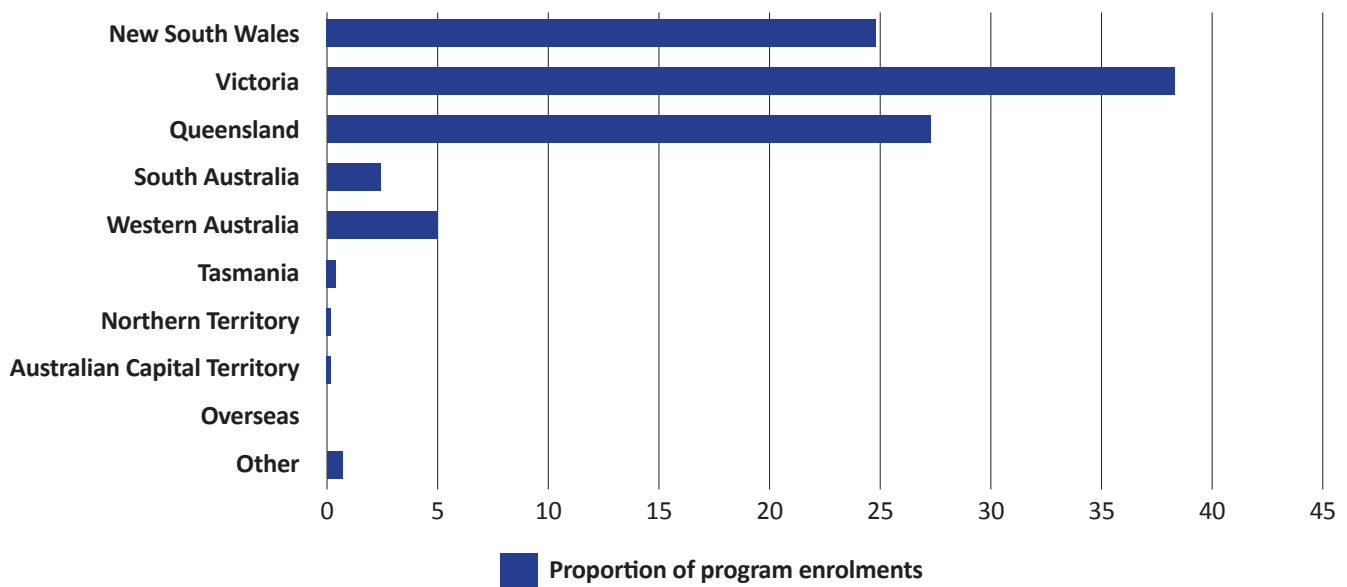


Figure 4.5 Student location (source: Australian Industry Skills Committee, 2019)

Figure 4.6 (overleaf) shows training schemes provided by educational institutes. Most of the training was at university level, with 34% of 412 schemes and programmes being offered at this level. This is followed by those at the Professional Training level at 24%. VET and CVET are in the middle of the training distribution, contributing 17% of training schemes and programmes. Apprenticeships and other training schemes are the least utilised, both contributing 8%, followed by Colleges at 9%.

Figure 4.7 (overleaf) shows the distribution of training schemes and programmes within each management level. Universities provide the majority of the courses, followed by professional training, at the strategic level. Most of the training courses at tactical level are also provided at a university, followed by professional training and VET and CVET. Unlike the other management levels, most of the operational management courses are taught through professional training schemes, followed by those taught through VET and CVET. Comparison of the two figures shows some of the fields of education in Figure 4.7 have a different distribution to those reported in Figure 4.7. For example, course distribution at a university at the strategic and tactical levels is around 10% higher than expected, whereas the operational level is almost 20% lower than expected. The distribution also shows that apprenticeship schemes at the strategic and tactical management levels are lower than expected, whereas the operational level is higher than expected. The Australian education system has developed rail-related education courses in vocational education and training, and academic sectors to gain expertise in various jobs in the rail sector.

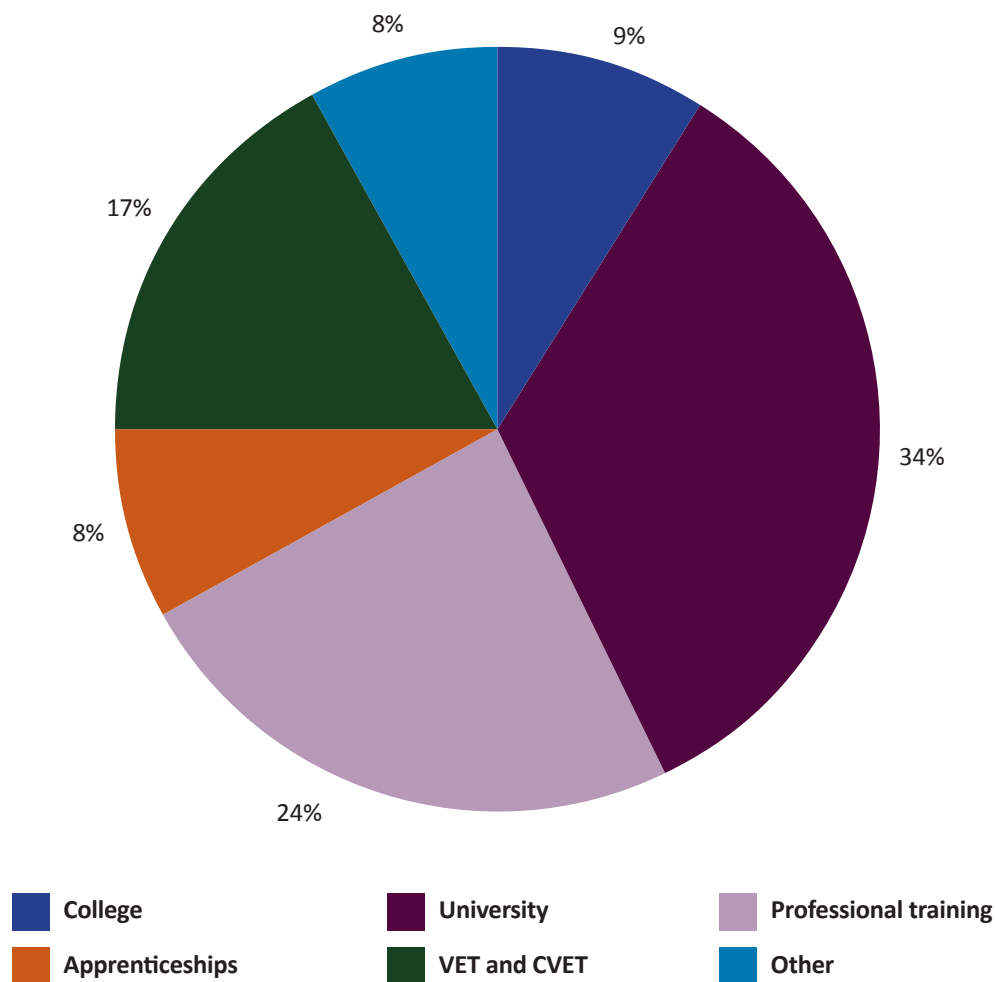
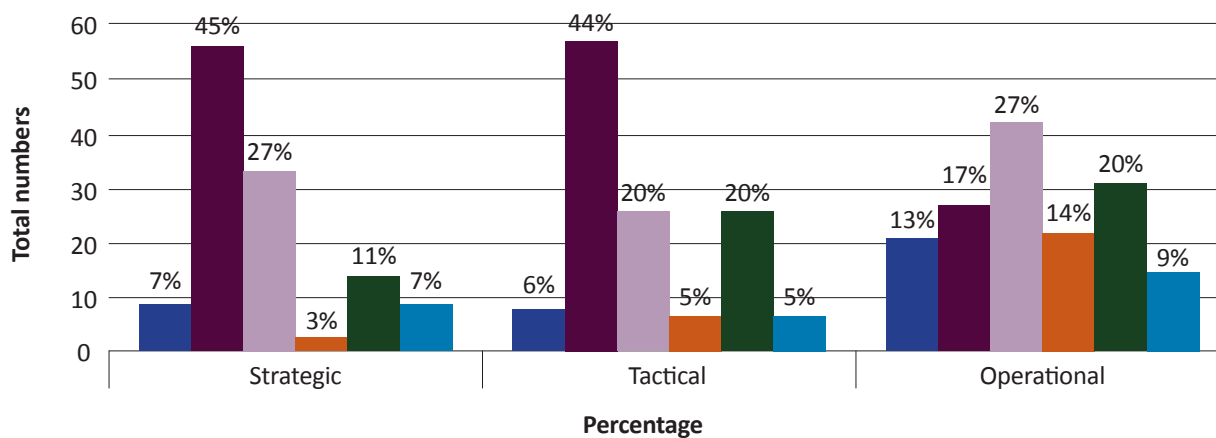


Figure 4.6 Distribution of training schemes and programmes provided by each field of education (source: Cannon et al., 2019)



	Strategic	Tactical	Operational
College	9	8	21
University	56	57	27
Professional training	33	26	42
Apprenticeships	3	6	22
VET and CVET	14	26	31
Other	9	7	15

Figure 4.7 Distribution of categories of training schemes and programmes amongst fields of education within each management level (source: Cannon et al., 2019)

Engineering and rail degrees

Mahendran et al. (2007) reported rail-specific training courses were conducted by Central Queensland University, Queensland University of Technology (QUT), Royal Melbourne Institute of Technology (RMIT), University of Western Sydney and University of Queensland.

The following rail-related education is provided at university level:

- rail engineering (mainly with a civil or mechanical engineering background)
- rail signalling engineering
- systems analyst
- environmental engineering
- asset management
- telecommunications
- traction engineering
- Master of Rail
- network and train control.

The Australian Quality Training Framework (AQTF) is the national framework that must be followed by RTOs, both private and public. The framework ensures consistent, high-quality training and assessment services for the clients of Australia's vocational education and training system. It has built-in quality indicators. The framework is designed to help training organisations conduct evidence-based and outcomes-focused continuous quality improvement, and assist in operational risk assessment. AQTF is the backbone for all training conducted in Australia. Using AQTF means that the qualifications received are flexible enough to be transferred from one industry to another (Australian Trade and Investment Commission, 2016).

Vocational education and training is provided by two main types of providers throughout Australia – TAFE and private training providers. TAFE are owned and operated by state governments across Australia. Training provided by TAFEs includes qualifications from Certificate I to Associate Diploma. They focus mainly on core trades (carpentry, plumbing, electrical, etc.), and are the main provider of training in rail across Australia. Areas of learning with formalised accredited courses include:

- rail infrastructure and rolling stock design
- rail infrastructure construction
- rail infrastructure maintenance
- rolling stock maintenance
- operations employee training including drivers, train controllers and freight handlers
- signalling design and maintenance
- rail communications and networks
- rail operations management including business continuity and RAMS (Reliability, Availability, Maintainability, Safety)
- track maintenance
- rail logistics and supply chain management
- rail safety management.

RTOs deliver training in rail expertise in a variety of methodologies to suit the market and workers alike (Australian Trade and Investment Commission, 2016). Private Training Providers are accredited as RTOs and are private companies. They deliver training courses and training packages that have been assessed as capable of delivering to the AQTF standard. Private providers tend to deliver courses that are more specialised such as train driver and rail infrastructure, and are usually flexible in terms of delivery methodology and location.

Metro Academy is an RTO delivering nationally recognised units of competence and tailored non-accredited training programs for railway workers and contractors. It has access to Melbourne's metropolitan railway and is backed by Hong Kong's Mass Transit Railway.

The following VET qualifications related to rail are provided by the Metro Academy (Australian Trade and Investment Commission, 2016):

- Certificate I, II, III and IV in Transport and Logistics (Rail Operations)
- Certificate II, III in Rail Infrastructure
- Certificate II, III in Track Protection
- Certificate III in Mechanical Rail Signalling
- Certificate III in Rail Track Surfacing
- Certificate III in Rail Structures
- Certificate III in Electric Passenger Train Guard
- Certificate III in Rail Driving
- Certificate III in Rail Signalling
- Certificate IV in Rail Network Control
- Certificate IV in Rail Infrastructure
- Diploma in Frontline Management.

The Major Transport Infrastructure Authority (MTIA) (2019), *Training for the Future Annual Report* states that capability development highlights the following. The third cohort of Rail Signal Engineering Cadets commenced in 2019. The first cohort of Signal Maintenance Technicians (SMT) trainees commenced the Certificate IV in Electrical – Rail Signalling with V/Line in May 2019, utilising the courseware developed by the Rail Academy, Diploma of Railway Signalling licenced to both Metro Trains and V/Line. V/Line are in the process of placing the qualification on their scope of registration in preparation to commence internal training. MTIA delivered nine units of competency developed from the Certificate III in ESI – Power Systems Traction Power for Overhead Lineworkers for Yarra Trams and Metro Trains Melbourne. In partnership with Swinburne, MTIA commenced design of a transitioning engineering pathway program resulting in a vocational graduate qualification. The cadetship program will support engineers from various disciplines from automotive/manufacturing, mining and defence, looking to transition into transport-related roles.

The Rail Industry Capability Project highlights completion of five qualification: Certificate II in Shunting, Lead Shunter Skill Set, Certificate III Rail Yard Coordination, Certificate III in Public Transport Customer Service and Compliance (Authorised Officers) and Certificate III in Rail Customer Service (Station Staff). They also reported completed design of a digital assessment app for release to industry. The app will assist industry RTOs with their in-field practical assessment activities (Major Transport Infrastructure Authority, 2019).

Among the key activities of the Rail Academy, an industry reference group that was convened to develop the curriculum for the Certificate II in Rail and Light Rail Fundamentals (pathway) program, is due to launch in 2020. This Australian first qualification will provide secondary school students with skills and training to enter the rail industry (Major Transport Infrastructure Authority, 2019).

Current and future training to close the skills gap

Training is conducted using the rail-specific components of the TLI Transport and Logistics Training Package to cover the skill shortage (Table 4.2), referred to in the AIS Skills Forecast reports (2018 and 2019). The training package comprises 26 qualifications, 54 skill sets, 247 units of competency and associated assessment requirements (p11). These cover the following skills requirements: light rail, tram and train driving, rail operations management, signalling, safety management, and rail infrastructure.

The TLI Transport and Logistics Training Package is the only nationally recognised VET qualifications for rail occupations related to rail infrastructure, track protection, shunting, rail track vehicle driving, tram or light rail infrastructure, customer service, rail driving, rail track surfacing, signalling, electric passenger train guard, track protection, heritage locomotive assistant or steam locomotive fireman, train driving, safety investigation, network control, safety management, tram/light rail control and rail operations management. The following rail-specific qualifications (Table 4.5, overleaf) in the TLI Transport and Logistics Training Package are introduced to cover the skills shortage addressed above (AIS, 2019a).

Table 4.5 Training for current and future rail skills shortage

Certificates	Diploma
Certificate II in Rail Track Vehicle Driving	Diploma of Rail Operations Management
Certificate II in Shunting	
Certificate II in Rail Customer Service	
Certificate II in Track Protection	
Certificate III in Rail Track Surfacing	
Certificate III in Track Protection	
Certificate III in Rail Signalling	
Certificate III in Terminal Train Driving	
Certificate III in Rail Yard Coordination	
Certificate III in Electric Passenger Train Guard	
Certificate III in Rail Driving	
Certificate III in Mechanical Rail Signalling	
Certificate III in Rail Customer Service	
Certificate IV in Tram/Light Rail Control	
Certificate IV in Rail Network Control	
Certificate IV in Rail Safety Investigation	
Certificate IV in Train Driving	
Certificate IV in Rail Safety Management	

Competency-based training

One prominent change with regard to training of Australian rail industry participants is found in the study conducted by Mahendran et al. (2007), which stated a shift towards more competency-based training. As a result, training within the industry is now nationally accredited, with standards being externally driven by a governing authority that establishes the criteria for training and assessment. This has resulted in rail training being more aligned with Australian National Training Authority (ANTA) standards so that training is increasingly based on achieving specific outcomes to qualify for a nationally recognised certificate of competency.

Competency is defined by Prachi (2019) as a set of individual performance behaviors which are observable, measurable and critical to successful individual and company performance and individual characteristics of a person which result in an effective and superior performance in a job. Figure 4.8 (overleaf) shows the elements of competency includes skills, knowledge, attributes and outstanding performance of tasks.

According to AIS (2019b, p10):

‘The broad concept of industry competency is the ability to perform particular tasks and duties to the standard of performance expected in the workplace. Competency standards cover all aspects of workplace performance and involve:

- Performing individual tasks
- Managing a range of different tasks
- Responding to contingencies or breakdowns
- Dealing with the responsibilities of the workplace, including working with others.

Workplace competency is the ability to apply relevant skills and knowledge consistently over time and in the required workplace situations and environments. Competency standards are determined by industry to meet industry skill needs and focus on what is expected of a competent individual in the workplace.’

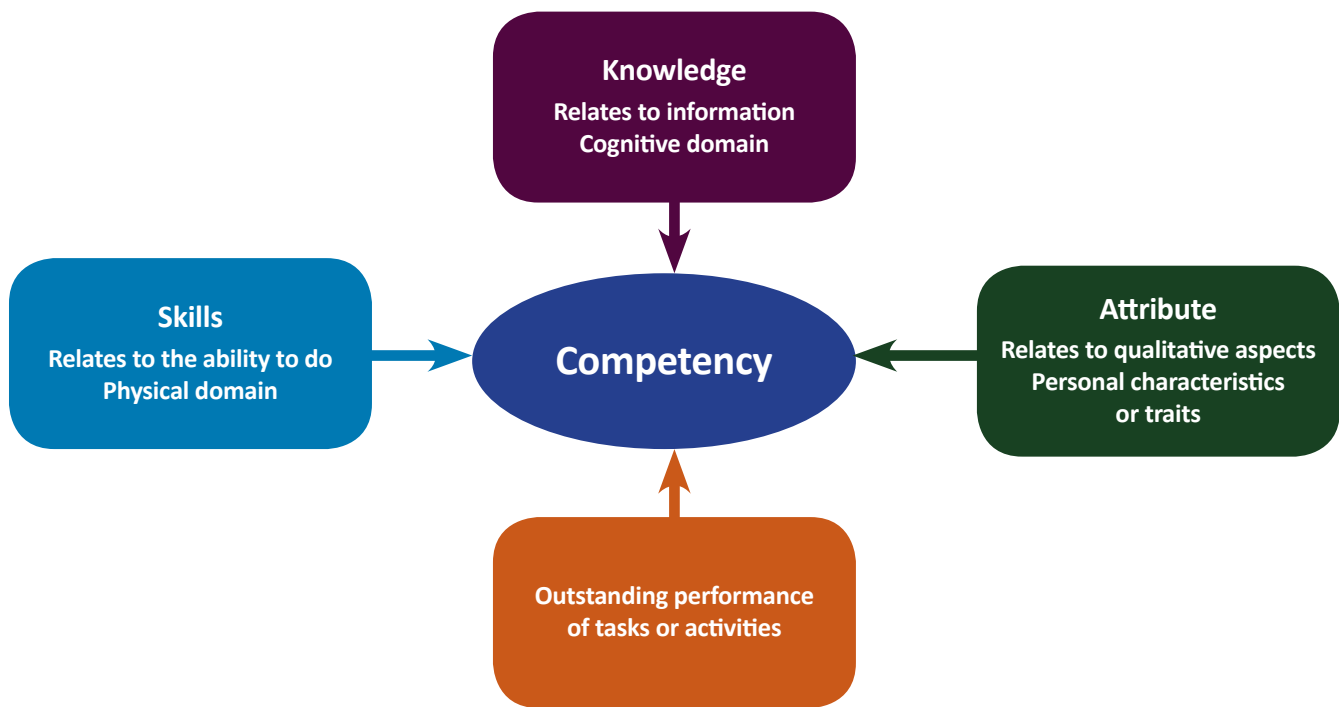


Figure 4.8 Elements of competency (source: Prachi, 2019)

Organisational capabilities

Table 4.6 (overleaf) refers to examples of organisations and their capabilities. According to Savv-e (2017), capability building is about helping people in your team develop the skills they need to succeed in the workplace. They can be:

- Technical or operational, such as meeting compliance needs
- Soft-skills, such as people management
- Related to culture or mindset, such as attitudes to new technologies.

Furthermore, Stevens (2013) refers to capabilities that are not specific to a discipline as general capabilities. According to the Australian curriculum, seven general capabilities are recognised. They are:

- Literacy and numeracy
- Information and communication
- Technology (ICT) competence
- Critical and creative thinking
- Ethical behaviour
- Personal and social capability
- Intercultural understanding.

The Department of Education and Training has provided the following generic skills to the AIS as per a survey conducted by the Industry Reference Committee in order of importance to the rail industry (AIS, 2019b):

1. Design mindset/thinking critically/system thinking/solving problems
2. Learning agility/information literacy/intellectual autonomy and self-management
3. Managerial/leadership
4. Technology
5. Communication/virtual collaboration/social intelligence
6. Science, technology, engineering, mathematics (STEM)
7. Language, literacy and numeracy (LLN)
8. Data analysis
9. Customer service/marketing
10. Financial
11. Environmental and sustainability
12. Entrepreneurial.

Table 4.6 Some examples of organisations and their capabilities

Company	Infrastructure training	Safety training	Operations training	Logistics training	Research	Vocational	Academic	Short courses, non-accredited training and other licenses
Active Training Specialist (ATS)	●			●		●		●
AGB Human Resources		●	●	●		●		●
Australasian Business Excellence Centre ABEX Group			●	●		●		
Australian Institute of Resources Training (AIRT)	●		●			●		●
Centre for Excellence in Rail Training (CERT)	●	●	●	●		●		●
Engineering Education Australia				●		●		●
Exner Group	●	●	●			●		●
GoTrain Industry	●		●				●	●
Industry Training Queensland		●		●		●		●
Informa Corporate Leasing				●		●		●
Major Training Group	●	●	●	●		●		●
Metro Academy	●	●	●			●		●
Monash University (Institute of Railway Technology)	●				●		●	●
Martyr Training Services	●	●	●				●	●
Open Universities Australia	●							●
Professional Training Services Australia			●	●				●
Queensland University of Technology (QUT)	●				●			●
RailTrain	●		●			●		
Railway Technical Society of Australia (RTSA)	●		●			●		●
Real Serious Games	●	●	●			●		●
Rose Training		●		●		●		
Strategix Training Group		●	●	●		●		●
Tide Training Centre			●	●		●		●
Transport Training Centre			●	●		●		
Transport Training Solutions			●	●		●		●
Transqual Logistics Training			●	●		●		
University of New South Wales	●				●		●	●
University of Queensland (UQ)	●				●		●	●
University of South Australia	●				●		●	●
University of Technology Sydney (UTS)	●				●		●	●
University of Wollongong	●		●		●		●	
Vertical Horizons	●	●	●	●				
WH&S Training and Assessment Services	●							●

Source: Australian Trade and Investment Commission, 2016

Research and Innovation

As the rail industry is one of the most technical and innovation-driven industries, to keep up with development, much commitment and expertise from universities and research organisations is required. Australian rail industry bodies and research centres are actively developing products and technologies to enhance all aspects of rail transport, such as software that simulates and explores gear unit designs that are being developed by Central Queensland University (CQU).

Among these are the RMCRC that links participants from major rail companies throughout Australia with leading Australian universities. It supports the development of innovative technologies by fostering, sponsoring and directing collaborative research and commercialisation partnerships. Their research includes power and propulsion, materials and manufacturing, design, simulation and software. The Institute of Railway Technology (IRT) at Monash University, Melbourne, has over 40 years' experience in track and vehicle railway research, and specialises in capacity building through technology and knowledge transfer. The IRT provides technology services to heavy haul railway operations, mass transit railway systems and has an enviable international track record in solving railway-related technical issues. They are currently involved in projects on material behaviour in wheel-rail contact, rail welding, steel sleeper development, instrumentation, heavy haul and mass transit, testing of track substructure, wheel impact monitoring, and the provision of technical and economic tools.

The Centre for Railway Engineering (CRE) is an industry-focused research centre based at CQU and is well known for research expertise in train dynamics, wagon and bogie dynamics, wagon and track system dynamics, erosion control within railway corridors, simulation, instrumentation and field testing. Their current projects include, curve lubrication, heavy haul draw gear, rail grinding, locomotive adhesion, and longitudinal passenger comfort.

The University of Wollongong has also been a participant for a long time in the rail industry both in Australia and overseas (Australian Trade and Investment Commission, 2016).

Future strategy: training needs

The following future strategies in Table 4.7 are identified by the Australian Industry Standard, Rail Industry reference committee. The Committee Skills Forecast 2018 and 2019 reports proposed a schedule of work on their strategy for meeting the future skills need of the rail industry from 2018–2023 (AIS, 2018, pp. 31–32) and (AIS, 2019b, pp. 35–36).

Table 4.7 Future strategies

Year	Project
2018–19	<p>Electric Passenger Train Guard: Revision and Development</p> <p>Incorporate the role of a guard on diesel-powered trains and include the new technologies used by industry. The differing skills required between the electric and diesel modes of power will be addressed in the qualification review. This will be complemented by developing two new Skill Sets that will enable guards/conductors to operate on either motive power units by completion of a Skill Set, thereby creating workforce flexibility in these roles for industry.</p> <p>The Rail IRC has proposed a project to review the TLI32315 Certificate III Electric Passenger Train Guard qualification and develop a stream that caters for the diesel mode of power train guards. The review will also incorporate relevant technologies that have been incorporated into these job roles.</p> <p>The following job role deliverables of the Guard/Conductor to be developed include:</p> <ul style="list-style-type: none"> • Preparation of trains for service • On-train customer service and information • Completion of platform work in relation to the departure of trains • Luggage management at unmanned stations • Fault reporting/management relating to equipment and facilities • Emergency management/service disruption. <p>Throughout the project, broad consultation within state and territory rail operators will be undertaken.</p>

Source: AIS, 2018 and 2019b

Year	Project
2019–20	<p>Train and Network Control Operations: Review and Development</p> <p>Industry has requested the revision and amalgamation of the Rail Network Control and Tram/Light Rail Control qualifications. This will remove a superfluous qualification and provide vocational pathways that enhance the skills transfer of workers across the rail and light rail industries.</p> <p>As the use of autonomous trains and other technologies become more commonplace, the associated operational roles will continue to evolve. Revision and development of qualifications and Units of Competency will be necessary for workers in front line control, train driving and network control. This will further support skills development in safe and efficient pre-journey, in-journey and post-journey autonomous train operation.</p> <p>Network Fault Support: Review and Development</p> <p>The rail industry has recognised the development of skills for immediate support for fault assistance by network control operators in both rail and light rail. This will expedite the rectification of various faults, providing productivity gains and financial savings to the industry, and less inconvenience to commuters. Safety issues associated with network faults will also be addressed. This development will assist rail operators in dealing with the increased reliance on rail transport into the future.</p> <p>Transport and Logistics (Pathways): Revision and Development</p> <p>Industry has requested addition of a stream for rail attraction to the rail industry that has been an ongoing issue. The rail industry offers a large variety of occupational streams that enable career advancement to individuals. Opportunities in rail infrastructure and rail operations will be covered, making this qualification suitable as a school-based structured workplace learning program. This work will develop employability and basic technical skills required by those commencing a career in the rail industry.</p>
2020–21	<p>Train and Rail Vehicle Operations – Review and Development</p> <p>The IRC have proposed that the Certificate II in Shunting and Rail Track Vehicle Driving, Certificate III in Rail Driving, Terminal Train Driving and Certificate IV in Train Driving qualifications will be reviewed to address the identified skills and knowledge gaps identified. The proposed revision will update and align the qualifications with the new and emerging technologies including the pre- and post-operational requirements of a train driver in preparing autonomous or remotely operated trains for their journey. It will also include the driver contingency skill requirements for taking over an autonomous or remotely operated train in the event of a malfunction.</p> <p>Rail Yard Coordination</p> <p>The Rail IRC have proposed a review of the Certificate III in Rail Yard Coordination. The proposed revision will update and align the qualification with new and emerging technologies including advances made in rail signalling and autonomous and remotely operated rail vehicles. It will also integrate the Certificate III in Rail Signalling (TLI32615) and delete this qualification from the national register upon completion of the review. This revision will also provide greater transferability of skills between various sectors of the Industry.</p>
2021–23	<p>TLI (Rail) Transport and Logistics Training Package</p> <p>There are no TLI (Rail) Transport and Logistics Training Package products currently identified for revision or development during this forecast period. TLI (Rail) Transport and Logistics Training Package qualifications, Skill Sets and Units of Competency that have not been subject to revision or development between 2019 and 2021, will be reviewed in this period. Where imported Units of Competency are identified as either deleted or superseded, the IRC may elect to revise the affected qualification(s) through the IRC Minor Change process.</p>

Source: AIS, 2018 and 2019

A study conducted by BIS Oxford Economics (2018) reported the rail industry in Australia faces significant risks to workforce capability over the coming decade. They suggested following actions for future benefits (p92):

- Developing and regularly maintaining a rail project pipeline and providing advice to governments regarding the impact of the pipeline on demands for skills across construction, operations, maintenance and manufacturing over the coming decade so appropriate skills targets can be set or other pipeline actions taken.
- Advocating for education reform and fit-for-purpose training, working closely with the states and industry to coordinate their needs and avoid duplication. The function of the taskforce here will include identifying the need for additional centres of excellence and skills academies, stripping out unnecessary training requirements, addressing inconsistencies between the states to aid transferability of skills and reducing barriers for international workers.
- Enhancing the attractiveness of working in the rail industry. Working with industry to help facilitate improving the attractiveness for entrants into apprenticeships and cadetships, and raising the profile of the rail industry at schools and higher education institutions.
- Working with industry to boost the attractiveness of the sector, helping to develop a consistent, strong brand for the rail industry across Australia. An immediate task here should be to develop a rail careers portal showcasing the industry and linking to all jobs available across the industry in Australia.

Skills requirement for technology challenges in the future

The Australian railway industry is being challenged by technological change. Australia is following European rail models and implementing the European Train Control System (ETCS), requiring workers with specialised skills to implement and maintain these systems (AIS, 2018, pp. 15–16):

- **Automation:** The onset of autonomous systems and vehicles in the rail industry is expected to have significant effects on the workforce and the skills needed to operate new systems. These autonomous operations are to be a key focal point across the rail industry for the foreseeable future.
- **Remote operations:** The operation of trains bears many work health and safety concerns, as well as many safety critical communication necessities. As a result, software-based control centres are being developed which can operate hardware-based equipment remotely and monitor the location and status of trains on the network.
- **Network control operators** within contemporary and integrated traffic management systems are vital to the smooth operation, safety, and delivery of rail-based transportation services. People within these roles communicate, diagnose, and provide information to drivers in real-time. As autonomous systems are introduced, the volume and complexity of information (e.g., data, train telematics diagnostics of vehicle health) will change the role of the remote operator significantly. The operators will require higher-order skills in data analysis, problem-solving, and an understanding of autonomous systems.
- **Big data:** The ever-increasing volume of data being captured by sensors and subject to analysis is further transforming the skill needs of the rail industry. The use of big data enables transport systems to accurately analyse information from the network, to improve real-time operations, decision-making, threat detection, and improve productivity. It will also be used to optimise the network, by identifying points of preventative maintenance before infrastructure is damaged and improve safety control systems. As the volume of data from these sensors across the rail network increases, there will be demand for the operators to be able to interpret and analyse this data meaningfully and in a digitally literate manner. Preparing the workforce for these technological changes in rail network systems will be vital to maintain high operating standards and reliability.
- **Augmented and virtual reality:** Along with other industries, the rail industry is using simulation, either by augmented reality (AR) or virtual reality (VR), to develop and design new infrastructure and provide simulation-based rail control operations training. These methods can deliver high quality and safe practice for new workers in the industry without the expense or liability of incurring damages. This will enable the rail industry in Australia to ensure best practices are employed and maintain relevance with the international community.

Conclusion

Major infrastructure commitment by the federal and states governments of Australia over the next 12 years requires focus on skill needs of the rail sector. This literature review looked at the opportunities and challenges encountered by the rail industry in Australia in relation to its workforce. Skills shortage was a major issue facing the rail industry in the future. The Australian Industry Standard (2018, 2019b) skills forecast reported an ageing workforce and current staff retiring, competition from other organisations, cost and time to achieve the required qualification, wages or salaries considered too low, unattractive jobs and poor industry image, and geographic location as a reason for this shortage.

Through retirement, the ageing workforce will add substantially to the existing workforce gap, especially machinery operators and train drivers who are a large share of the rail workforce. Currently, the sector is perceived as being blue-collar employment, undertaking manual work and requiring secondary or trade qualifications. In recruiting for professional skills, images of the industry as low-tech and male-dominated presents challenges. It will be important for the sector to work with education providers to improve the image of the industry through awareness of rail skills and promoting the industry as a destination (AIS, 2019b).

Automated systems that will be introduced in the rail industry will require the existing workforce to be more technologically savvy to adapt to the new environment. This is an important area that needs to be covered in education and training for the future rail industry workforce.

The future of the rail industry depends on a skilled workforce to meet new technology and innovation, such as automated systems, that will be adopted by the sector and require the existing workforce to be more technologically savvy to adapt to the new environment. Currently, a number of organisations are conducting in-house training. A number of training strategies have been identified and are currently being used by universities, RTOs and TAFEs to deliver courses, from certificates to degrees. Australia has also adopted the Australian Quality Training Framework to ensure consistent, high quality training and assessment for vocational education and training (VET) systems. The TLI Transport and Logistics Training Package provides the nationally recognised VET courses that covers the skills required for light rail and train, and the qualifications for occupations related to these.

There is a lack of clarity in relation to the specific training needs related to rolling stock, particularly in relation to delivery of training.

Current needs are:

- To identify skills shortages related specifically to rollingstock, the type of training conducted and organisations that are conducting training
- To understand what future training needs are, particularly in relation to new technologies
- For training and education to attract and retain the workforce in the sector and to improve the understanding of the value of TAFE
- To address the current deficit of trainers and educators across the sector.

References

- Ali, G., and Magalhaes, R. (2008). Barriers to implementing e-learning: a Kuwaiti case study. *International Journal of Training and Development*, 12(1), 36–53.
- Australasian Railway Association (ARA). (2006). *The changing face of rail: A journey to the employer of choice*. Canberra, Australasian Railway Association.
- ARA. (2008). *A rail revolution: Future capability identification and skills development for the Australasian rail industry*. ACT, Report for Kingston.
- Australian Industry and Skills Committee. (2019). *Industries/Transport/Rail*. Retrieved 29 Sep 2019, 2019, from https://nationalindustryinsights.aisc.net.au/industries/transport/rail#data_sources_and_notes
- Australian Industry Standards (AIS). (2018). *Skills forecast 2018: Rail industry reference committee*. Melbourne.
- AIS. (2019a). Companion Volume Implementation Guide TLI Transport and Logistics Training Package Release 5.1.
- AIS. (2019b). *Skills forecast 2019: Rail industry reference committee*. AIS.
- Australian Trade and Investment Commission. (2016). *Rail education and training*.
- Barnes, F., and Blackwell, C. (2004). Taking business training online: Lessons from academe. *Journal of Applied Management and Entrepreneurship*, 9(1), 3.
- Becker, K., Fleming, J., and Keijsers, W. (2012). E-learning: Ageing workforce versus technology-savvy generation. *Education and Training*, 54(5), 385–400.
- BIS Oxford Economics. (2018). *Australasian Railway Association skills capability study, skill crisis: A call to action*, Australasian Railway Association.
- Burke, G. (2002). *Financing lifelong learning for all: an international perspective*.
- Cannon, C., Marinov, M., and Robinson, M. (2019). Data analysis of current and emerging skills development and training schemes in the rail transport sector. *Journal of Educational Research and Review*, 7(3), 57–75.
- Education and Training Committee. (2010). *Inquiry into skills shortages in the rail industry east Melbourne*. Victoria, Parliament of Victoria.
- Gallagher, S. (2019). *Peak human potential: Preparing Australia's workforce for the digital future*. Hawthorn, Australia, Swinburne University of Technology, Centre for the New Workforce.
- Gekara, V., Snell, D., Chhetri, P., and Manzoni, A. (2014). Meeting skills needs in a market-based training system: a study of employer perceptions and responses to training challenges in the Australian transport and logistics industry. *Journal of Vocational Education & Training*, 66(4), 491–505.
- Kathawala, Y. and Wilgen, A. (2004). E-learning: Evaluation from an organization's perspective. *Training & Management Development Methods*, 18(4), 501.
- Loneragan, D. (2018). *Filling the gap: Overcoming the rail industry skills shortage*. Rail Express. Sydney.
- Mahendran, A., Dockery, A. M., and Affleck, F. (2007). *A profile of training and skills development in the Australian rail industry*. 36th Australian Conference of Economists. Economic Society of Australia. Hobart, Tasmania.
- Mahendran, A. and Dockery, A. M. (2008). Skills shortages: Will they derail the Australian Rail Transport Industry (ARTI)? *Labour Underutilisation, Skills Shortages and Social Inclusion*, 102–115.
- Major Transport Infrastructure Authority. (2019). *Training for the future, Annual Report July 2018–June 2019*. Melbourne, Victorian Government.
- Menon, J. (2019). *The fourth industrial revolution could spell more jobs – not fewer*. World Economic Forum.
- Naweed, A., and Ambrosetti, A. (2015). Mentoring in the rail context: the influence of training, style, and practice. *Journal of Workplace Learning*, 27(1), 3–18.
- Prachi, J. (2019). *Definition of competency – what are competencies?*. Retrieved 4 October 2019, from <https://www.managementstudyguide.com/what-are-competencies.htm>
- Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon*, 9(5), 1–6.
- Rail Academy. (2019). *Rail Academy building capability*. Retrieved 7 October 2019, from <https://railacademy.vic.gov.au/rail-academy-building-capability>
- Savv-e. (2017). *Our 5 step process for building a capability development strategy*. Retrieved 7 October 2019, from <https://www.savv-e.com.au/blog/building-capability-development-strategy>

Smith, A., and Hayton, G. (1999). What drives enterprise training? Evidence from Australia. *International Journal of Human Resource Management*, 10(2), 251–272.

Stevens, R. (2013). Issues in assessment of general capabilities. *The Journal for Educators*, 32(4), 27.

Transport and Logistics Industry Skills Council. (2014). TL110 – transport and logistics training package (Release 4.1). E. a. W. R. Department of Education.

Wellman, J. (2007). Lessons learned about lessons learned. *Organization Development Journal*, 25(3), 65.



The policy context

Celeste Young, Roger Jones and Neil Parry

The Victorian sector governance overview

The most relevant policies for this study concern transport, employment, procurement, diversity and inclusion, and innovation. Employment is included because the primary driver for employment policy in the sector sit within the procurement framework for rolling stock services. Public transport in Victoria is mainly operated through franchise agreements. Trains and trams are procured by government and leased to operators, whereas buses are purchased by operators under contractual agreements with government.

Until 30 June 2019, public transport rolling stock regulation and franchise agreements were largely overseen by Public Transport Victoria with policy and procurement conducted by the Department of Transport Victoria. On 1 July 2019, DoT, Public Transport Victoria (PTV) and VicRoads were merged into a new Department of Transport (DoT). The new department has six main divisions, most of which have some role in the issues considered in this review (Figure 5.1):

- **Policy and innovation:** drive future transport opportunities, legislative and policy reform, and imbed a deep understanding of the user and innovative technology.
- **Network planning:** determine what the network needs, plans and designs the future network to deliver on the transport strategy, system design and service planning.
- **Network integration:** deliver transport priorities through the development and delivery of an integrated pipeline of projects and support the Major Transport Infrastructure Program.
- **Transport operations:** deliver transport operations across all modes that provide a single user interface to the transport network.
- **Investment and technology:** provide investment strategy and deliver commercial and information technology services to drive high performance and improved commercial outcomes.
- **People and business services:** provide business enabling people and corporate services functions, to drive a high-performance culture and to support integrated operations.

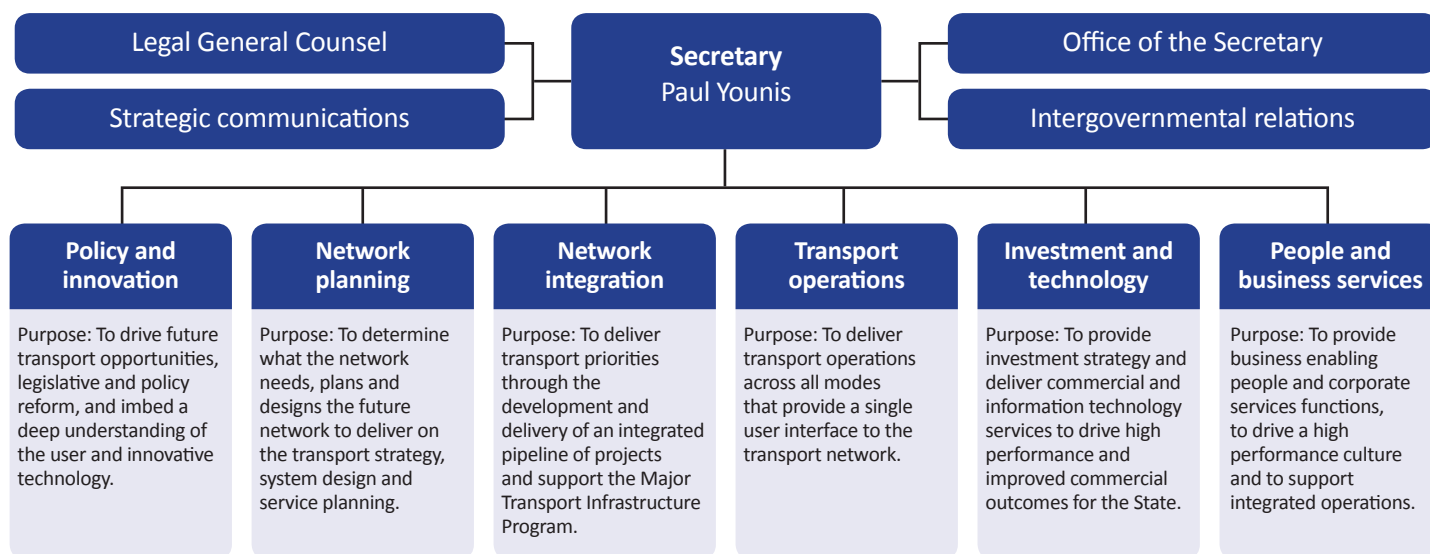


Figure 5.1 High level organisational structure of the Department of Transport, Victoria (source: DoT, 2019a)

Transport

As noted above, the DoT is in the process of integrating its two statutory bodies, VicRoads and PTV back into the main department to take on a much more integrated role to strategy, planning and operations. This has not had a noticeable effect on policy and online presence as yet, with the DoT's online presence largely unchanged. Many of the online policy locations detailed in this review may therefore change.

The main policy areas of note are planning, safety and operations. Planning is taking place in connection with Plan Melbourne¹ for the urban area and statewide under the Major Projects Infrastructure Authority.

Outcome 3 of Plan Melbourne is that Melbourne has an integrated transport system that connects people to jobs and services and goods to market (DEWLP, 2017). Key initiatives relevant to this project are:

- The completion of the Metro Tunnel project
- Better transport infrastructure and services in newer suburbs, including new bus services for outer suburbs and, where there is sufficient demand, expansions to the rail network
- Ensuring Melbourne's air transport remains efficient for passengers and freight, with the potential to establish another airport in Melbourne's south-east.

Three rail network plans that describe these initiatives are:

- Growing Our Rail Network 2012–2025 (2016 update)
- Growing Our Rail Network 2018–2025
- Principal Public Transport Network.

Important suburban and regional initiatives include:

- Western Rail Plan
 - Electrified lines to Melton and Wyndham Vale
 - Possible link Wyndham Vale to Werribee
 - Additional tracks Sunshine to CBD
 - Geelong and Ballarat lines to >160 kmh. Up to 320 kmh being investigated
- Cranbourne Line Duplication
- Melbourne Airport Rail
- Regional Rail Revival – upgrades on all lines
- Suburban Rail Loop
- Sunbury Line Upgrade to run HCMT trains.

Safety policies set the standard for rolling stock integrity and condition, in addition to their ability to deliver the appropriate standards of service. These policies are implemented by Transport Safety Victoria.

Customer service is managed through chartered agreements between PTV and operators. Charters exist for Yarra Trams, Metro Trains, V/Line and Transdev Melbourne (some buses).

Victoria

Procurement takes place under the *Local Jobs First Act 2003*, renamed from the *Victorian Industry Participation Act* in 2018, when a policy overhaul took place. The Local Jobs First policy was released in October 2018 and covers the Victorian Industry Participation Policy (VIPPP) and the Major Project Skills Guarantee (DEDJTR, 2018b). Around that time an Office of Industry Participation and Jobs was established and a Local Jobs First Commissioner appointed. The Commissioner's office takes on a role of advocacy, facilitation and compliance. Procurement itself is administered by the Industry Capability Network (ICN).

1. Plan Melbourne will guide the growth of Melbourne for the next 35 years. It sets the strategy for supporting jobs, housing and transport. See <https://www.planmelbourne.vic.gov.au/>

The VIPP applies to Victorian Government procurement activities of \$3 million or greater in metropolitan Melbourne or for state-wide purchases, and \$1 million or greater in regional Victoria; a 'standard project'. For applicable projects, Victorian public sector bodies are required to undertake a contestability assessment to determine if a VIPP Plan is needed as part of a bidders' tender documentation. If required, VIPP Plans are considered as an evaluation criterion in the procurement process. The information contained in a VIPP Plan includes (DEDJTR, 2018b):

- Local content (defined in accordance with the Australia New Zealand Government Procurement Agreement to include all products and services produced by Australian and New Zealand companies)
- The number of new jobs created and existing jobs retained
- The introduction of new technology, opportunities for skills transfer and training for employees
- The number of new apprentices/trainees engaged and existing apprentices/trainees retained.

Major projects having their whole-of-life costs above \$50 million are deemed 'strategic projects'. Bids accompanying tenders for declared projects need a local industry development plan and for major projects require a Major Projects Skills Guarantee (DEDJTR, 2018b).

The VIPP is 'designed to ensure small and medium-sized enterprises are given full and fair opportunity to compete for Victorian government contracts' (p6). The major project skills guarantee requires local apprentices, trainees and cadets to complete at least 10% of hours worked on projects.

As part of a three-year strategic plan for the years 2019–2022, the Local Jobs First Commissioner is focussing on four key priority areas (Figure 5.2, overleaf). This signals a more hands-on approach than in the past, and also contains a more stringent compliance program (Local Jobs First Commissioner, 2019).

The content of a good, service or construction activity may include the following (DEDJTR, 2018):

- Manufactured goods
- Service provision (e.g., engineering, design, ICT, planning, testing and analysis certification, commissioning)
- Direct capital costs (e.g., equipment, machinery)
- Freight, transport and warehousing
- Fees, taxes (excluding GST), margins and insurances (up to 10% allowable of a project's local content).

The tenders for the public transport franchises and supply of rolling stock are administered through ICN Victoria. The ICN is a not-for-profit organisation funded by the Victorian Government to support the delivery of Local Jobs First. The ICN's key responsibilities include:

- Working with the Department of Jobs Precincts and Regions (DJPR, formerly DEDJTR), and agencies to support the implementation of the Local Jobs First Policy
- Managing the VIPP Management Centre portal where tenders are registered
- Identifying local goods and services for a project
- Acknowledging and evaluating bidders' local content, job and other commitments upon full completion of a LIDP
- Providing local suppliers the opportunity to register interest in upcoming government projects and connecting Victorian SMEs located in metropolitan Melbourne and regional Victoria with the Local Jobs First project and supply chain opportunities
- Mapping local supply chain capability
- Providing access to ICN Analytics for all Local Jobs First projects with a value of \$20 million or more
- Undertaking post-contract verifications on whether or not contractors have achieved the local content commitments as committed to in LIDPs.

The government has moved away from setting strict thresholds for levels of procurement except for the following (DEDJTR, 2018):

The Minister must, unless an exemption is granted, set these requirements at no less than the following for selected Strategic Project types:

- 90% for a construction project
- 80% for a services project or a maintenance project
- 80% for the maintenance or operations phase of a Strategic Project.

Local content requirements for other types of Strategic Projects are set on a case-by-case basis, on advice from the ICN. This includes advice on what industry can sustain. The broad settings for procurement have also evolved over time from basic procurement to encompass social, environmental and strategic procurement.

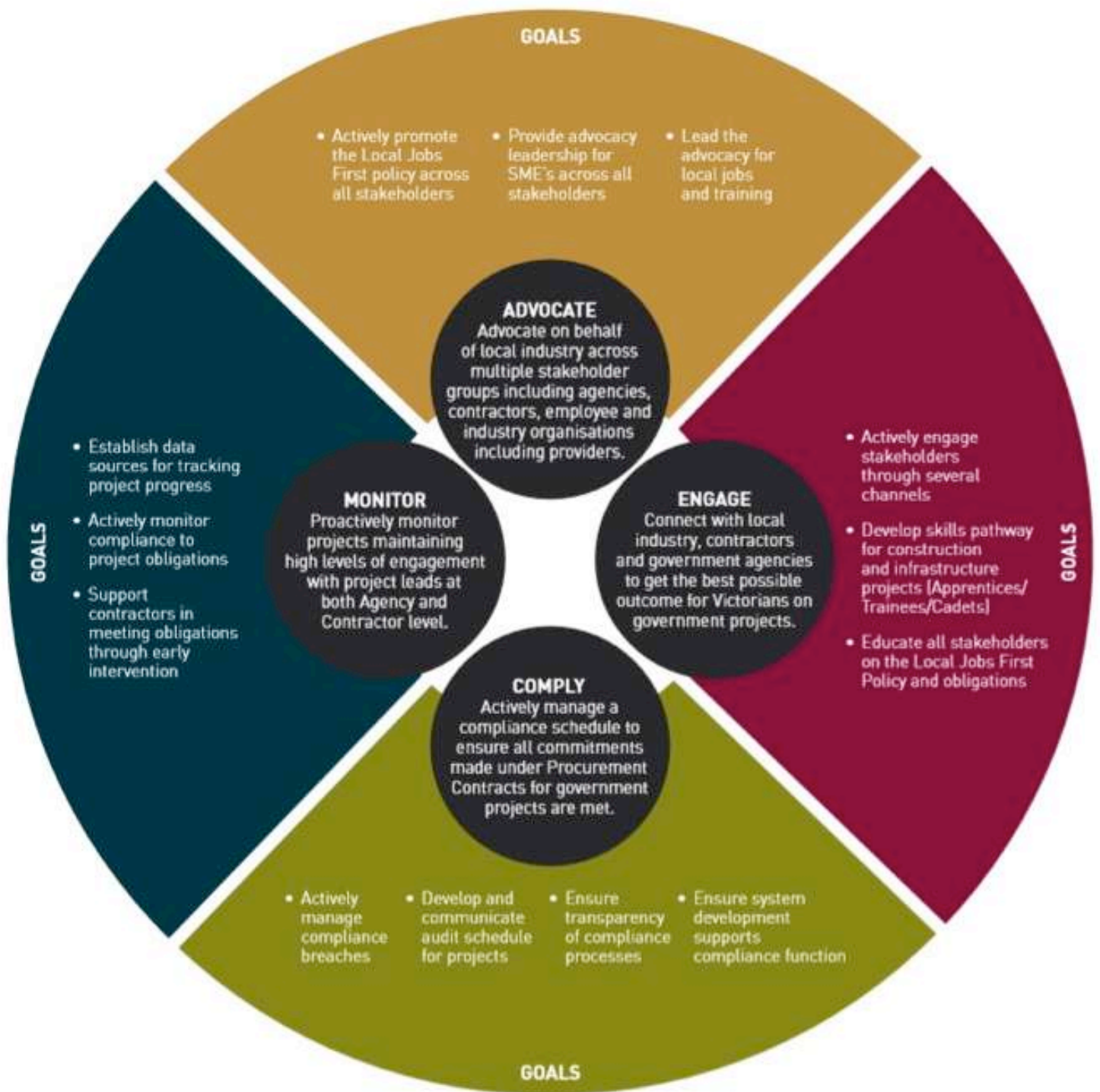


Figure 5.2 Key priorities from the Local Job Commissioner strategic plan (source: <https://localjobsfirst.vic.gov.au/commissioner/about>)

The Victorian Government’s Social Procurement Framework (SPF) sits beneath this and relates to ‘the strategic use of procurement to drive social, economic, and environmental outcomes’ (Victorian Government, 2018 , p3). The SPF sits within the Local Jobs First policy – Victorian Industry Participation Policy.

There are several social procurement outcomes sought that are relevant to diversity and inclusion:

- Purchasing from Victorian Aboriginal businesses
- Purchasing from Victorian social enterprises and Australian Disability Enterprises
- Purchasing from suppliers that comply with industrial relations laws and promote secure employment
- Gender equality within Victorian Government suppliers
- Purchasing from Victorian social enterprises (opportunities for disadvantaged Victorians)
- Job readiness and employment for people in regions with entrenched disadvantage.

The SPF dovetails with existing procurement policies of all government departments and agencies, including the Department of Transport for procurement of rail. As well as seeking young people, particularly graduates, with STEM qualifications, the SPF provides the rail industry with opportunities for people who are culturally diverse, disadvantaged or with disabilities to work in the public transport supply chain.

This policy is encouraged for projects below \$20 million, and there are contractual arrangements for those above it, which are detailed in the economic section of this report.

The framework adopts a scalable approach to setting individual procurement activity requirements, based on the value of an individual procurement activity and has four value thresholds. It requires social procurement activities to be considered in the below threshold (\$1 million) and lower band categories, and is mandatory for middle and upper band categories (Figure 5.3).

Victoria’s Social Procurement Framework (SPF) individual procurement activity requirements				
	Below threshold	Lower band	Middle band	Upper band
	Regional under \$1 million	Regional \$1 to \$20 million	\$20 to \$50 million	Over \$50 million
	Metro or State-wide under \$3 million	Metro or State-wide \$3 to \$20 million		
<i>Planning requirement for government buyers</i>	Incorporate SPF objectives and outcomes into regular procurement planning		Complete a SPF during procurement planning	
<i>Described approach</i>	Encouraged Seek opportunities where available procure directly or indirectly from social enterprises, ADEs or Victorian Aboriginal businesses	Proportionate Use evaluation criteria (5 to 10% weighting) to favour businesses whose practices support social and sustainable procurement objectives	Targeted Include performance standards and contract requirements that pursue social and sustainable procurement objectives	Strategic Include targets and contract requirements that pursue social and sustainable procurement objectives

Figure 5.3 Victoria’s Social Procurement Framework (source: Victorian Government, 2018, p19)

Guidelines for government buyers are set by the Victorian Government Purchasing Board. They have five policies that guide procurement activities: governance, complexity and capability assessment, market analysis and review, market approach and contract management and disclosure.

Within that policy framework, all procurement activity should meet the following principles (Victorian Government, 2018):

- Value for money of the procurement, taking into account:
 - the total benefits and costs over the life of the goods, services or works procured
 - environmental, social and economic factors
 - any risk related to the procurement
- Accountability for procurement commensurate with appropriate levels of authority and responsibility
- Probity through the application of integrity, ethical behaviour, fairness and transparency in the conduct of procurement processes
- Scalability so that the procurement governance policies and processes are appropriate and efficient, taking into account the capability of available resources and the complexity of the procurement undertaken.

Requiring standards to be met and to improve standardisation across the industry for parts and components is a way of both improving and streamlining manufacturing, operations and repair. The Rail Industry Safety and Standards Board (RISSB) is responsible for developing, amending and managing rail industry standards, rules, codes of practice and guidelines, all of which have national application. The full suite of documents is known as the Australian Code of Practice. This includes rolling stock and operations.

Public transport rolling stock procurement, maintenance and operation requires developing an industry-specific approach to setting levels of procurement, training requirements and provisions for social and environmental procurement that can be subject to competitive open tender, invited contract or sole supplier value for money depending on the process pursued by the government of the day.

Recent examples are a minimum local content commitment of 60% for the high capacity metropolitan trains being built in Victoria and 82% for their maintenance. Sixty percent has been set as the minimum local content for the manufacture of the new metropolitan buses, and 86% for maintenance. For trains, this is projected to inject over \$1 billion into the local economy.

Diversity and inclusion

Key State and Commonwealth legislation provide the framework below (Table 5.1):

Table 5.1 Commonwealth and State Government diversity and inclusion legislation

Victorian Government	Commonwealth Government
<i>Charter of Human Rights and Responsibilities Act 2006</i>	<i>Human Rights and Equal Opportunity Commission Act 1986</i>
<i>Equal Opportunity Act 2010</i>	<i>Commonwealth Racial Discrimination Act 1975</i>
<i>Multicultural Victoria Act 2011</i>	<i>Commonwealth Racial Hatred Act 1995</i>
<i>Racial and Religious Tolerance Act 2001</i>	<i>The Workplace Gender Equality Act 2012</i>
	<i>Disability Discrimination Act 1992</i>
	<i>Work Health and Safety Act 2011</i>
	<i>Age Discrimination Act 2004</i>

Source: Adapted from Department of Health and Human Services, 2018, p1–3

Key policies and strategies that support this include the following.

Absolutely Everyone: Victorian State Disability Plan 2017–2020 (Department of Health and Human Services [DHHS], 2016), aims to ensure the rights of Victorians with a disability to live and participate in Victorian society on the same basis as everyone else – to be supported in their aspirations for an everyday life where they are judged by their efforts and achievements (p11). It provides a principals-based framework that outlines four priority actions (pp. 22–25):

- Changing attitudes
- Universal design
- Public transport
- Inclusive schools.

Bullarto-buluk: DEDJTR Aboriginal Inclusion Action Plan 2018–2020 (DEDJTR, 2018a) provides a framework that aims to support working partnerships with Aboriginal people and communities to support inclusive economic participation with them. The five key action areas outlined in this policy that support this are (p9):

- Recognition, respect, promotion and celebration of Aboriginal culture and heritage
- Genuine engagement, partnership and participation
- Place-based projects
- Employment
- Economic participation.

Safe and Strong: Victorian Gender Equality Strategy outlines the Victorian State Government’s approach to ensure ‘All Victorians live in a safe and equal society. They have access to equal power, resources and opportunities. They are treated with dignity, respect and fairness. All Victorians recognise that gender equality is essential to economic prosperity. They understand that gender inequality has significant economic costs’ (Victorian Government, 2019, p1). Goals and targets are across four areas:

- Leadership, empowerment and cultural change
- Safety and freedom from gender-based violence
- Economic security
- Health and wellbeing.

The Victorian State Government also has a Women in Transport Program which has 15 initiatives to encourage more women to enter and stay in the transport sector. It aims to increase the number of women working in transport from 16% to 25% by 2020 and senior role representation to 50% by 2020 (Department of Transport, 2019b). Other policies, documents and bodies relevant to the Victorian Social Procurement framework in Victoria are detailed in Appendix A.

Innovation

In terms of the Victorian Government innovation policy, the innovation and the procurement process – procurement guide states (Victorian Government, 2019a):

‘Encouraging innovation also provides a catalyst for suppliers to improve their products and services which in turn, gives them cutting edge products or services marketable to the wider business community.’

‘The competitive market can be better placed than government to come up with innovative solutions.’ (Victorian Government, 2019a)

Policy relating to innovation in the private sector is overseen by the Department of Jobs Precincts Regions (DJPR). Their *Strategy 19–23* (DJPR, 2019) outlines three key policy directions in relation to economic development:

- More jobs for more people
- Thriving place and regions
- Inclusive communities.

Beneath these directions sit a number of outcomes and specific activities related to innovation and specific bodies who will support delivery of these programs. Of specific relevance to innovation in the transport sector is the role of Victoria’s Lead Scientist who ‘partners with universities and businesses on priority science, technology and innovation issues of the Victorian Government’ (p21).

The *Lead Scientist Strategic Plan 2018–2020* (Office of the Lead Scientist, 2016) provides an overarching framework for activities related to Victoria’s Chief Scientist. Key directions outlined in this policy are:

- Provide strategic advice on priority science, technology and innovation issues
- Foster linkages and collaboration
- Whole of government leadership
- Promote and advocate the importance of STEM across the economy.

Advancing Victoria's Manufacturing: A Blueprint for the Future (Victoria's Advanced Manufacturing Advisory Council, 2017), outlines four key areas for activities (p4–5):

- Prepare for the jobs of the future
- Innovate to capture high-value manufacturing opportunities
- Build scale, capability and supply chain excellence
- Foster a globally competitive business environment.

There are a number of current activities outlined in this plan, as well as future activities to support the manufacturing industry and its supply chain to grow sustainably for the future.

Two key programs are:

- **Innovation and Productivity Program Stream** supports 'activities linked to business innovation or technological commercialisation and provide support for collaboration between industry clusters and research centres that strengthen competitiveness' (DET, 2019)
- **Future Industries Fund** supports 'investment in high-growth industries through industry excellence and development projects, including establishing collaborative networks and building supply chain readiness capabilities' (Business Victoria, 2019).

Commonwealth Government

Innovation policy at the Commonwealth Government level is overseen by the Department of Industry, Innovation and Science (DIIS). This department receives advice from Innovation and Science Australia which is an independent statutory board of entrepreneurs, investors, researchers and educators.

Australia 2030: Prosperity through Innovation (Innovation and Science Australia, 2017) provides an overarching framework for innovation at a national level and contains 30 recommendations. It has five key policy objectives including (p23):

- **Education:** respond to the changing nature of work by equipping all Australians with skills relevant to 2030
- **Industry:** ensure Australia's ongoing prosperity by stimulating high-growth firms and raising productivity
- **Government:** become a catalyst for innovation and be recognised as a global leader in innovative service delivery
- **Research and development (R&D):** improve R&D effectiveness by increasing translation and commercialisation of research
- **Culture and ambition:** enhance the national culture of innovation by launching ambitious National Missions.

Key policy documents related to these programs include:

- *National STEM School Education Strategy 2016–2026* (Education Council of Australia, 2015)
- *National Innovation and Science Agenda 2015* (Department of the Prime Minister and Cabinet, 2015).

Their manufacturing program has three streams (DIIS, 2019):

- Supporting Advanced Manufacturing aims to 'develop an environment that will allow businesses to grow and compete by embracing new technologies'
- Industry 4.0 aims to 'encourage innovation in advanced manufacturing by funding research, investing in emerging engineers and scientists, providing facilities to test new products, and developing business capability'
- Transitioning Australia's automotive manufacturing industry supports 'automotive workers and supply chain businesses affected by the closure of Australia's car manufacturing industry'.

The policy context for rolling stock in Victoria is primarily set by government procurement. It is diffuse, spanning multiple areas of policy and emergent in areas:

- Victoria's procurement policy provides incentives to increase diversity and inclusion and innovation within the workforce and increase the participation of local businesses
- Demand-side procurement can be used to support innovation to increase social and environmental benefits, where these needs are not being met by normal market mechanisms
- Further work is needed to clarify how the different areas of policy across government connect and interact and how these can be best leveraged to increase benefits to the local workforce and economy.

Appendix A: Victoria's Social Procurement Framework Factsheet

Policy or development	About the policy or development
Climate Change Act 2017	Provides Victoria with a legislative foundation to manage climate change risks, maximises the opportunities that arise from decisive action, and drives the transition to a climate resilient community and economy with net zero emissions by 2050.
Every Opportunity: Victorian Economic Participation	Victoria's <i>Absolutely Everyone: State Disability Plan 2017–2020</i> , Every Opportunity drives change for Victorian with a disability across the economy by activating two major stakeholders, Government as a major employer and purchaser of goods and services, and the broader Victorian business community.
Infrastructure Sustainability Council of Australia (ISCA) Rating Scheme	Provides a comprehensive rating system and evaluation of sustainability, including environmental, social, economic and governance aspects, across design, construction, and operation of infrastructure.
ISO 20400 – Sustainable Procurement	A global framework to stimulate the integration of social, economic, and environmental objectives into strategic procurement practice.
Local Jobs First	Incorporates <i>Local Jobs First – Victorian Industry Participation Policy (VIPPP)</i> and <i>Local Jobs First – Major Projects Skills Guarantee (MPSG)</i> .
Ministerial Directions and Instructions for Public Construction	Prescribes principles and procedures that Victorian Government departments and agencies must follow when they procure public construction works and services.
Procurement Activity Plans	Provides forward procurement activity plans for Victorian Government departments and agencies. This fosters early market engagement by providing suppliers with details of planning procurement activities (over the next 12 to 24 months) and who to contact for further information.
Safe and Strong: Victoria's Gender Equality Strategy	Aims to progressively build the attitudinal and behavioural change required to reduce violence against women and deliver gender equality, including introduction of gender ethical procurement.
Supplier Code of Conduct	Sets minimum standards to reduce harm and reflects the Government's commitment to ethical, sustainable and social responsibility.
Tharamba Bugheen – Victorian Aboriginal Business Strategy	Supports Victorian Aboriginal businesses to grow, extend networks and build upon entrepreneurial skills within communities.
Value Capture and Creation (VCC) Framework	Encourages Government sponsors and delivery partners for capital investments, projects to develop public land, and precinct projects, to consider broader opportunities that enhance public value.
Victorian Aboriginal Economic Board (VAEB)	Champions economic development initiatives, advises the Minister for Aboriginal Affairs on projects to be delivered, identifies any barriers to Aboriginal economic development, and provides advice on the implementation of <i>Tharamba Bugheen</i> .
Victorian Government Purchasing Board	Leads the whole-of-Government supply policy framework for goods and services to inform an approach to market. This is underpinned by high levels of probity, accountability, and flexibility with a strong focus on value for money, more interactive engagement with the market and productivity improvement.
Victorian Small Business Commission	Promotes a fair and competitive environment for Victorian small business including social enterprises and Aboriginal businesses to operate, grow and prosper.
Victorian Social Enterprise Strategy	Advocates for greater cross-Government coordination to support the growth of the social enterprise sector and inclusive economic growth across Victoria.

Source: Victorian Government. (2018). Victoria's Social Procurement Framework Essential Information for all Suppliers' Factsheet, p4–5, Victorian Government.

References

- Business Victoria. (2019). *Future industries*. Melbourne. <https://www.business.vic.gov.au/support-for-your-business/grants-and-assistance/future-industries> (accessed 17 October 2019).
- DEDJTR. (2018a). *Bullarto-buluk: DEDJTR Aboriginal inclusion action plan 2018–2020*. Victorian Government, Melbourne.
- DEDJTR. (2018b). *Local jobs first policy. Under the Local Jobs First Act 2003*. Department of Economic Development, Jobs, Transport and Resources, Melbourne.
- DET. (2019). *Workforce training innovation fund*. Melbourne. <https://www.education.vic.gov.au/training/providers/funding/Pages/wtif.aspx> (accessed 26 September 2019).
- DEWLP. (2017). *Plan Melbourne 2017–2050*. Department of Environment, Land, Water and Planning, Melbourne.
- Department of the Prime Minister and Cabinet. (2017). *National innovation and science agenda*. Commonwealth of Australia, Canberra.
- DHHS. (2016). *Key policies, guidelines and frameworks. Designing for diversity*. Department of Health and Human Services, Melbourne.
- DHHS. (2018). *Key policies, guidelines and frameworks. Designing for diversity*. Department of Health and Human Services, Melbourne.
- DIIS. (2019). *Funding and Incentives*. Canberra. <https://www.industry.gov.au/topic/funding-and-incentives> (accessed 15 October 2019).
- DJPR. (2019). *Strategic Plan 2019–2023*. Inclusion Group, Department of Jobs, Precincts and Regions, Melbourne.
- DoT. (2019a). *Governance*. Melbourne. <https://transport.vic.gov.au/about/governance> Accessed 15 October 2019.
- DoT. (2019b). *Women in transport program*. Melbourne. <https://transport.vic.gov.au/about/careers/women-in-transport> (accessed 15 October 2019).
- Education Council of Australia. (2015). *National STEM school education strategy 2016–2026*. Education Council of Australia, Canberra.
- Innovation and Science Australia. (2017). *Australia 2030: Prosperity through Innovation*. Australian Government, Canberra.
- Local Jobs First Commissioner. (2019). *Compliance strategy*, Local Jobs First Commissioner, Melbourne.
- Office of the Lead Scientist. (2016). *Victoria's Lead Scientist Strategic Plan 2018–2020*. Melbourne.
- Victoria's Advanced Manufacturing Advisory Council. (2017). *Advancing Victorian manufacturing. A blueprint for the future*. Department of Economic Development, Jobs, Transport and Resources, Melbourne.
- Victorian Government. (2018). *Victoria's social procurement framework: Building a fair, inclusive and sustainable Victoria through procurement*. Melbourne.
- Victorian Government. (2019). *Safe and strong: Victorian gender equality strategy*. Melbourne.
- Victorian State Government. (2019a). *Innovation and the procurement process – procurement guide. Goods and services procurement guide*. Melbourne. Retrieved from <https://www.buyingfor.vic.gov.au/innovation-and-procurement-process-goods-and-services-procurement-guide> (accessed 21 February 2020).



The economic context

Roger Jones and Sidney Lung

Introduction

The economics of the rolling stock sector are largely dictated by its history, which has resulted in its current status as public-private partnership (PPP) arrangements between government and industry for the design, manufacture, maintenance and operation of rolling stock. That rolling stock is obtained by government procurement so we investigate aspects of international trade policy and procurement agreements relevant to determine what role government procurement can play in supporting local industry, especially through workforce development and training. We touch on the international outlook for rolling stock manufacture and maintenance, before summarising local strategies for increasing rolling stock numbers in Victoria.

Governance history

Governance models can be roughly summarised under the following types (Public Transport Users Association, 2008):

- **Free market model** – 19th and early 20th Century model overtaken by public-funded roads and the motor car.
- **Nationalised model** – owned by government. In Victoria, the Victorian Railways Department and the Melbourne and Metropolitan Tramways Board were later merged into the Public Transport Corporation (The Met and V/Line).
- **Quasi-nationalised model** – where the system is owned by government and private owners provide services for a fee. Government collects fare revenue.
- **Franchising model** – the government acts as a regulator and a private operator either owns the infrastructure outright or operates the infrastructure, leasing it and owning or leasing rolling stock. This best describes the current status of the public transport sector.
- **Transport community model** – an autonomous public planning agency oversees the system which is run by private or public operators. The model originated in Germany.

The history of the government transport sector to 2012 was summarised by Legacy et al. (2012). The public passenger component is updated for trains and trams in Figure 6.1 (overleaf).

In Victoria, private railways lines in the 19th Century were of the free market model. Most of Victoria's history since has been under the nationalised model, but Mees (2015) argues that in the early 20th Century Melbourne's public transport was very free-market oriented and the public trams and trains competed with each other. Post-WWII, Melbourne went from a city with one of the highest patronages in the world to one of the lower proportions. This was a period that coincided with policy incrementalism.

Privatisation began in 1993 with the outsourcing of bus services in a limited franchise agreement. The largest change in governance was the Kennett-Stockdale government's privatisation of services in 1999 to a franchise model. This was set up as a quasi-competitive model with two operators each for trams and trains, an arrangement that lasted until 2002, when Hillside Trains and Swanston Trams ended their agreements. The government took over those operations and renegotiated franchise agreements with Connex and Yarra Trams beginning in 2004. By the mid-2000s as part of the privatisation program, rolling stock had broadly been brought up-to-date. In 2009, the contracts were renegotiated and Yarra Trams passed from Transdev to Keolis Downer. The same operator structure exists today, but the franchise agreements have become much more performance-related.

These separate bodies were all franchised separately as follows:

- Doncaster East and Fitzroy North bus depots → 1993 National Bus Company → 2013 Transdev Melbourne
- Footscray and Sandringham bus depots → 1998 Melbourne Bus Link → 2013 Transdev Melbourne
- V/Line Freight → 1999 Freight Victoria → 2004 Pacific National
- V/Line Passenger → 1999 National Express → 2002 State Government, receivers appointed → 2003 State Government
- Bayside Trains → 1999 National Express (M>Train) → 2002 State Government, receivers appointed → 2004 Connex Melbourne → 2009 Metro Trains Melbourne
- Hillside Trains → 1999 Connex Melbourne → 2009 Metro Trains Melbourne
- Swanston Trams → 1999 National Express (M>Tram) → 2002 State Government, receivers appointed → 2004 TransdevTSL → 2009 Keolis Downer
- Yarra Trams → 1999 TransdevTSL → 2009 Keolis Downer.

The remaining functions of the Public Transport Corporation were transferred to Metlink, later Public Transport Victoria (PTV), in 2012. PTV owns most of the infrastructure and leases it back to franchisees.

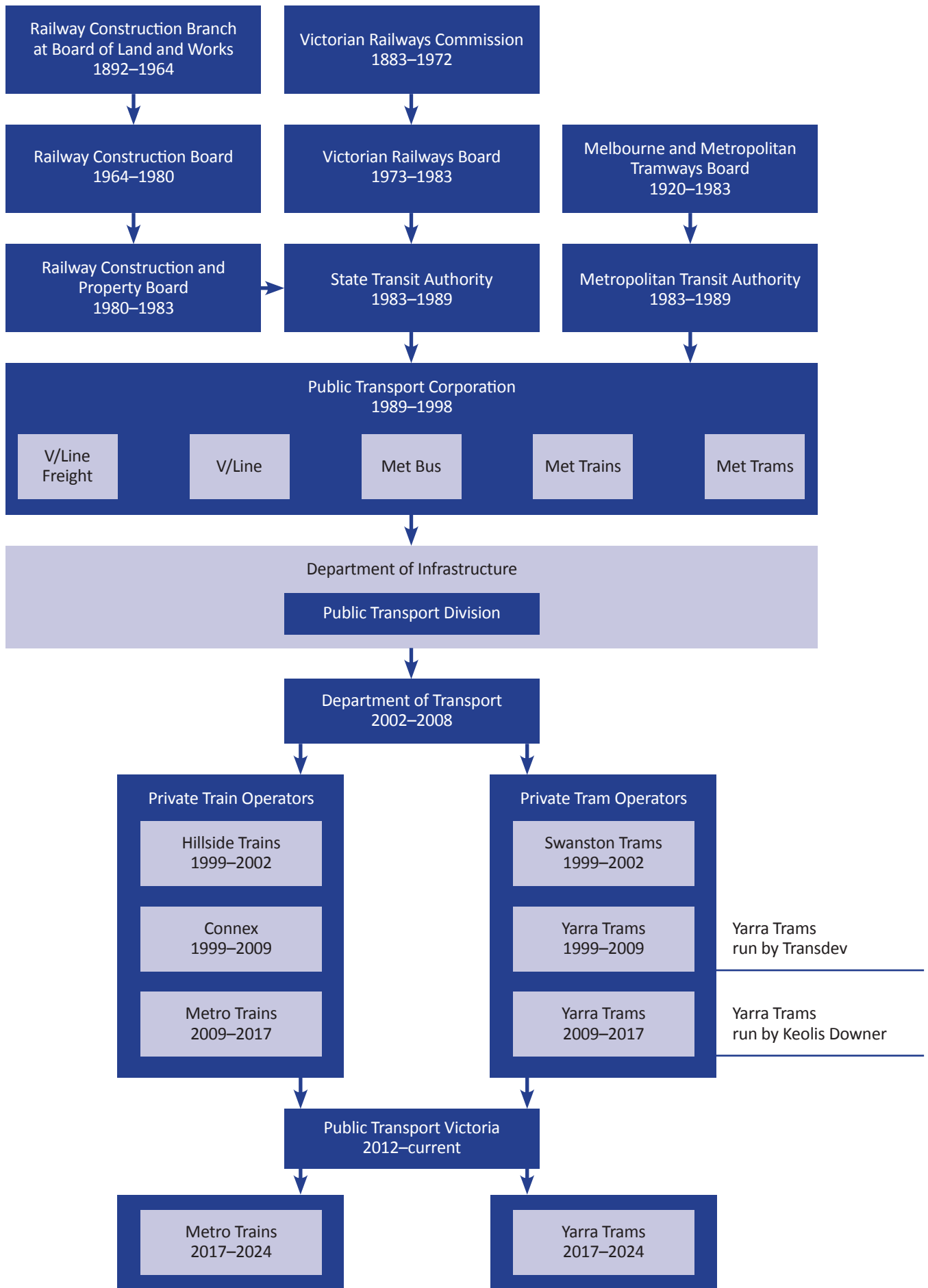


Figure 6.1 History of the public transport sector in Victoria concentrating on urban trains and trams (based on Legacy et al., 2012, and updated)

International trade policy

Local content provisions in place since 2003 have recently been made more comprehensive and compliance has been tightened. Economics has two perspectives on local procurement: one is as an international trade policy and economic issue (a macroeconomic approach), the other sees it in terms of the benefits conferred locally (a microeconomic approach). They clash when free market, free trade issues come into conflict with government trade regulations – local procurement being a variant.

Conflict can arise under trade agreements such as those under the World Trade Organisation (WTO), bilateral, regional and bloc agreements. There is no proviso within the WTO Agreements that outlaws local procurement, but it may violate specific provisos within those agreements (Hestermeyer and Nielsen, 2014). Australia is also a signatory to the Government Procurement Agreement (GPA) of the WTO that gives access to procurement from other signatories and allows concessions to be made for environmental reasons and to benefit developing countries. In theory, this gives Australian businesses access to other local procurement schemes and vice versa.

In one recent case held in the WTO, the EU and Japan challenged Ontario Canada's feed-in-tariff program for wind and solar that required local content in the building of local facilities. This violated Canada's WTO obligations according to the General Agreement on Tariffs and Trade and Agreement on Trade-Related Investment Measures (Charnovitz and Fischer, 2015). Hestermeyer and Nielsen (2014) summarise the finding, showing that purchases for government purposes were sanctioned and those for commercial sale or for production of goods for commercial sale were not. Raising the issue of public transport, they conclude that its legality rests on whether the provision of public transport is seen as a government purpose (Hestermeyer and Nielsen, 2014).

The energy case has interesting parallels to the provision of public transport. While the provision of both transport and energy infrastructure for public use is clearly within the rules, the provision of rolling stock comes from a competitive market, as is the case for wind turbines and solar collectors (Charnovitz and Fischer, 2015). The provision of public transport is within a domestic market, as is energy supply, but public transport is a not-for-profit-service supported by the taxpayer, giving access to transport that would otherwise be unaffordable for many. Both can be considered essential services, so the ruling hangs on how the definition of commercial sale is interpreted.

The Victorian Government reports the Victorian Industry Participation Policy (VIPPP) has been designed to comply with Australia's commitments on government procurement (WTO Secretariat, 2015). However, the surprisingly narrow interpretation of the Ontario feed-in-tariff case leaves important issues unresolved, including what constitutes commercial use and the status of procurement for environmental outcomes (Charnovitz and Fischer, 2015; Hestermeyer and Nielsen, 2014).

Two examples from Hestermeyer and Nielsen (2014) of procurement rules relevant to rolling stock are:

- (i) The requirement for Amtrak to purchase only unmanufactured articles made in the US and manufactured articles with substantial local content for purchases over \$1 million.
- (ii) An EU rule that prohibits more than 50% content from countries the EU has no multi or bilateral agreements within in the water, energy, transport and postal services sectors.

According to Thurbon (2015), the following activities are within the rules of Australia's trade agreements:

- Compulsory local industry participation plans for large projects
- Reserving some government contracts for local small to medium enterprises (SMEs)
- Mandating local content requirements in contracts reserved for SMEs
- Small business innovation research-style pre-commercial technology procurement
- Import substitution focused procurement plans
- Requiring government agencies to purchase specific goods made by SMEs
- Government issued 'performance insurance' for purchase of specific goods by local SMEs
- Mandating local content in government-led foreign aid projects.

Thurbon nominates two strong SME procurement schemes in the US and South Korea as models for a more innovative approach to procurement in Australia. The US scheme is the Small Business Innovation Research Program where agencies with a given level of R&D budgets are compelled to allocate a certain amount to SMEs to explore new technology applicable to that agency. If viable, further development funds are made available to lead the product to procurement stage. The SME keeps the intellectual property (IP), and is therefore free to explore other markets (Thurbon, 2015). With reference to the GPA of the WTO, trade agreements can be developed that define procurement rules between partners.

South Korea maintains exemptions for SMEs in trade agreements including those with Australia, but Australia uses a stricter definition of SME, so is at a disadvantage. South Korea also used a push mechanism, where from 2006, 5% of procurement had to be in strategic products from SMEs, and from 2010, 10% (Lee, 2011). Victoria has implemented targeted grant schemes in the past for SMEs (Berman and Squire, 2011), but they were removed by a subsequent government. This is partly due to differences in policy approaches between successive governments, where those in South Korea have presidential fiat and continuity, and those in Australia can change when governments change (Thurbon, 2015).

The economics of procurement

As mentioned, two approaches to assessing the economic effects of procurement are through market access, competitiveness and international trade, a top-down approach, or locally, via the effects on the local economy that can include employment, training, technological, environmental and social outcomes, a bottom-up approach. The international perspective is more focused on price, whereas the local perspective on procurement is value for money. Value for money has expanded from the 5Rs (Crocker and Emmett, 2008): right quality, in the right quantity, at the right time, from the right place, and at the right cost, to more comprehensive assessments that involve whole-of-life considerations (Victorian Government Purchasing Board, 2016).

Approaches also vary from the strongly normative to the pragmatic. Normative approaches range from the free market with minimum regulation on the one hand (e.g., Hufbauer et al., 2013), to highly regulated market outcomes on the other. The WTO and other trade agreements are more slanted towards the free market end, but with a range of modifications that have already been discussed. The pragmatic approach is less wedded to particular ideologies, and is more empirical and evidence-driven, focusing on assessing whether policies and strategies achieve their stated aims.

As local content requirements are complex, their impact on markets and trade are often viewed as behaving like import quotas or tariffs. Local content requirements (LCR) will affect the quantity of imports (e.g., trains, trams, buses and parts), but not directly their price. The difference is that local content applies to the government sector only and is relatively complex to administer, while quotas are managed at the Customs Office. The economic modelling of local content is usually carried out by modifying quotas or tariffs within a trade model. This is carried out by adjusting the price by an estimated proportion or by calculating a shadow price by the difference between lowest cost and in-country cost of supply (Flaig and Stone, 2017; Hufbauer et al., 2013).

LCRs are reviewed by Hufbauer et al. (2013) who view them as bad policy, although they discuss studies with both positive and negative conclusions. Many procurements cannot be quantified because of too little information (Hufbauer et al., 2013). When LCRs are modelled as price differences in a perfect or equilibrium market model, the outcomes are invariably negative, whereas the different policy designs and market contexts these can be applied in, result in a range of outcomes. Hufbauer et al. (2013) modelled six case studies changing relative prices by 10% and came out conclusively against LCRs, instead recommending tariffs and subsidies as preferable alternatives.

Flaig and Stone (2017) set out to test the change-in-price assumption of LCRs applied by Hufbauer et al. (2013) with the OECD trade model. This is a computable general equilibrium (CGE) model, an idealised economic model, which serves as the standard for estimating a change in the economy, modelled as a shock that returns to economic equilibrium. They represented an LCR as a change in production from foreign to domestic and contrasted that with an import tariff designed to have the same production outcome. The change in production will affect price, but indirectly, rather than the tariff measure, which is a direct change in price that results in a shift in production. They simulated a policy in the Russian Federation to source 60% of car parts domestically by 2020 from a baseline of 5%.

The change in motor vehicle production in the model, directly substituting imports with domestic production reduced GDP by -0.05% compared to -1.66% for the tariff measure. Production patterns changed across the economy as manufacturing switches to producing car parts, whereas the tariff increases prices on imports. Other sectors contract as production moved to the auto industry. The tariff caused the total cost of imports to rise, while the LCR caused them to fall due to lower volumes being imported. The tariff has a greater effect on domestic prices than the LCR because of the value-added effects of the LCR partially compensating through higher wages (Flaig and Stone, 2017).

In the model, the cost of motor vehicle production increased by 2% and consumer prices by 16% as additional profit, which over time reduced as production and exports increased. The economic effects on trading partners under tariffs were greater because of the price effect. Under the LCR, partners lose market share to the host country and also to third-party trading partners because of increased export from the host country. However, the spill-over effect from the tariff more generally has a greater effect on prices than the production changes, which are targeted to a specific tranche of goods. Flaig and Stone (2017) conclude that their outcome casts suspicion on the use of tariff equivalents in measuring the impact of many types of non-tariff measure.

This is a single study, and no systematic exploration of local content versus tariffs or similar mechanisms has been carried out (Flaig and Stone, 2017). However, their example of car parts being manufactured domestically instead of being imported is similar to the issue of import replacement for rolling stock.

The losses due to imposed trade measures are termed deadweight losses after the economic profession's habit of normative terminology (e.g., taxes are referred to as a distorting measure). Such losses will occur because of higher production costs, changes in consumption due to higher prices and changes in the balance of trade, shared by the host country and trading partners. Flaig and Stone (2017) show that losses are smaller when production patterns are modified by volume with an indirect effect on price, compared to the direct impacts of tariffs on input prices.

Governments' main aim is for procurement to invest taxpayers' money in such a way that provides positive returns to the taxpayer (OECD, 2017b). This can be carried out by applying value-for-money assessments. Procurement is seen as a high-risk government activity by the OECD (2017a). The bottom-up assessment of value for money for local content requirement cannot by its nature, incorporate the macroeconomic effects assessed above, except in general terms. Instead it focuses on the costs of implementing and administering local content provisions and the benefits that may accrue. These benefits reach beyond monetary benefits to cover social and environmental benefits that improve human welfare and natural capital (Esteves and Barclay, 2011).

Direct economic benefits include wages, salaries and locally sourced inputs, and profits if the business is owned within the host country. Foreign owned business will repatriate earnings after tax, but preferencing tenders on the basis of ownership is outside the rules for government procurement. Exceptions based on local ownership can be made for social procurement and measures targeting SMEs. Large procurements may require new infrastructure such as manufacturing plants, providing short-term employment during construction (Warner, 2011).

Indirect economic benefits come through an increased tax take above 10% generally (up to 10% is allowable in Victoria), plus returns through GST. Flow-on effects will be felt through increased purchasing power in local communities, which is deemed especially beneficial in areas of disadvantage and rural regions that may not otherwise attract such investment (Esteves and Barclay, 2011b; Warner, 2011). Other goals can be promoting allocative efficiency, customer satisfaction, distribution of wealth, managing risk and promoting uniform standards (Dawar and Oh, 2017). Longer term economic benefits include higher economic returns through training, R&D having a benefit beyond the scope of the specific procurement, providing work for those who would be left behind in the employment market. Another role is to maintain economic diversity, which makes it more robust to downturns and more adaptable in the face of change (Lember et al., 2011). Those objectives could be health benefits, including higher quality of life indices for those who have secure employment compared to those who don't (attached to net gains in employment), improved air quality through fuel use through the internal combustion engine being cleaner than required by regulation, and fuel switching away from fossil fuel generation also provides a clean air effect (Willis, 2010).

Environmental benefits include reduced greenhouse gas emissions by targeted procurement that will provide benefits according to the social cost of carbon (Correia et al., 2013; Hull, 2016; Willis, 2010). 'Local' needs to be correctly identified for LCR to be effectively implemented. Setting inappropriate key performance indicators and local content targets can encourage perverse behaviour and lead to adverse social impacts. An example is 'fronting', where companies are presently local but decision-making and beneficiaries are outside the local jurisdiction (Esteves and Barclay, 2011a).

Value for money (VFM) for Victorian government procurement is the achievement of a desired outcome at the best possible price based on a balanced judgement of financial and non-financial factors relevant to the procurement. It includes the total cost of procurement from planning to disposal and everything in between – the total cost of ownership (Victorian Government Purchasing Board, 2016). A tension exists between price and value that was explored in the Commonwealth Parliamentary enquiry on amendments to procurement, where submissions overall suggested there was too much emphasis on lowest price at the expense of value and that some areas of value were poorly and inconsistently understood (Joint Select Committee on Government Procurement, 2017). Victoria's procurement policy was endorsed as state-of-the-art by a number of submissions from both labour and industry organisations.

Some of the opposition to LCRs comes because of their effect on the perfect market as represented in economic models, but in the real world, the economy is not perfect. Many of the industries that are now expected to operate in a free market, did not develop in free markets but are in protectionist economies. LCR is seen as a vehicle for growing nascent industries in developing countries and for transferring technology to those countries as part of local content. More generally, it is being used for technological and other forms of innovation – known as demand-side procurement (OECD, 2011).

Demand-side procurement is being implemented by governments where societal needs are high and they are not being met by normal market mechanisms (OECD, 2011). Although they can provide for a wide range of purposes, demand-side procurement generally comes under the heading of innovation, it is generally innovative itself and also aims to increase innovation in areas where the procurement takes place. For rolling stock manufacture, maintenance and operation, innovations are outlined in the next section. As part of the OECD (2011) project demand-side innovation policies, Berman and Squire (2011) presented four Australian case studies, one of which was the Boosting Highly Innovative SMEs Program, modelled on the US Small Business Innovation Research Program mentioned above. It was a pre-commercialisation procurement of technologies prioritised by agencies, followed by a commercialisation program if successful. Like the US program, SMEs retained their IP.

This program was evaluated by Jensen and Webster (2014) who said that the absence of a monitoring program being included in the scheme, lack of a control and insufficient knowledge about counterfactuals mean that a proper evaluation was not possible. The program self-reporting noted success for all projects and projected forward sales of over \$1 billion over the next five years, which they found extremely rare (success rates) and unrealistically high (sales estimates) (Jensen and Webster, 2014). While procurement projects can set their criteria for success in advance, the more difficult task of contrasting action with no action, or distinguishing between different policy approaches, needs a more rigorous monitoring and testing regime than has been applied (Jensen and Webster, 2014).

For any particular sector, deadweight losses of a specific LCR will be proportional to the difference between industry best practice and local price subject to the change in production by volume from import to domestic production. The resulting price differential will depend on the capacity of industry to service those requirements. Deadweight losses are greater with a large price and/or capacity to service differential (i.e., if local firms cannot easily service demand). If procurement leads to relatively small volumetric changes globally and is enabled by domestic capacity that can absorb those changes with limited external costs, then deadweight losses will be small. If the opposite occurs due to lack of capacity and/or large volumetric changes, then deadweight losses will be larger.

For developed countries, government procurement as permitted in the GPA, mean that any distorting effects are limited to that proportion in the economy. For Australia, total government procurement in 2015 was about 13% of GDP and about 39% of total government expenditure (OECD, 2017b). Both were slightly higher than the OECD average. Deadweight losses can be minimised if government procurement is small compared to the market size in a particular good or service, the domestic economy can handle the change in production and its consumption is also relatively efficient (i.e., the procurement is well targeted).

Engaging SMEs creates business for local suppliers percolating down through the tiers of the supply chain. Benefits of sustained investment include improving the quality of life for employees and business owners, disseminating of new technology and innovations to other market participants, and attraction of investment in social infrastructure (Esteves and Barclay, 2011). An importance of local procurement is to provide a platform to bring together government and business to facilitate access to information for SMEs.

LCRs generally cost more to implement and administer than tariffs or subsidies, but the literature quantifying those costs is limited. The administration costs for Victoria's Science Agenda Initiative was 3.1% (Jensen and Webster, 2014). Costs incurred by government may act as a hidden subsidy if not accounted for; those by industry become a production cost and if too high, can be a disincentive, often bundled into 'red tape' – the cost of doing business with government. Such costs are hard to quantify and to model, which is largely due to the context-specific nature of local requirements.

How costs and risks are distributed between government and industry, contract style, performance targets and monitoring are all instrumental in whether performance and price offer the value for money intended. For bus contracts covering rolling stock and operations over 135 French bus networks 1995–2002, gross-cost contracts where the production risk was taken by the transport company and revenue risk by the local authority, performed better than net costs, where both risks were borne by the company (Roy and Yvrande-Billon, 2007). The authors attribute this to the transport company maximising profit in the latter and performance in the former. Management contracts where there were no performance controls were the least efficient, but none were below 96% efficiency (Roy and Yvrande-Billon, 2007). Privatisation to 2002 in the same market had not produced the cost savings seen elsewhere (Yvrande-Billon, 2006). Nominated were unclear service specification with a mix of negotiation and competitiveness, collusion between a few main players (the three operators fined for cartel behaviour 1996–99 are all current or former franchisees in Victoria) and the first incumbent advantage over new entrants (Yvrande-Billon, 2006). In new privatisations, low bids are often put in to obtain such advantage.

In Sweden, quality incentives and penalties had mixed results within an overall long-term record of 5–10% reductions in costs (Jansson and Pyddoke, 2010). A sizeable number of studies have reported an evolution since privatisation of an initial decrease in costs followed by gradual increases over time (Iossa and Waterson, 2019; Jansson and Pyddoke, 2010; Wallis et al., 2010; Yvrande-Billon, 2006), which has also been the case for Melbourne (Smith et al., 2010). Looking at competition versus negotiation for Adelaide buses, Wallis et al. (2010) conclude that competition serves well for the initial contract and a combination of competition and negotiation thereafter.

Local content is frequently opposed because of its transaction costs. In addition to their recommendation for tariffs or subsidies in place, Hufbauer et al. (2013) make the following recommendations:

- Create a business-friendly environment
- Encourage corporate social responsibility
- Expand training
- Improve logistics
- Invest in infrastructure.

If the conclusion of Flaig and Stone (2017) holds for different styles of procurement tested under a variety of conditions, then the impact of procurement on deadweight losses may be less than generally thought. The other recommendations from Hufbauer et al. (2013) are all encouraged to foster demand-side procurement focussing on innovation (OECD, 2011). Therefore, they do not replace procurement, but enhance it. Reducing the costs of compliance without losing its effectiveness and creating conditions where local content can be provided more efficiently can lower the cost of procurement while increasing business access to procurement schemes.

Global snapshot

In 2016, new rolling stock (train and tram) generated around €120 billion in sales (50–60) and after service (60–70) (Hein and Ott, 2016). OEMs capture about one quarter of this, suppliers almost half, and operators and third-party maintenance one-quarter. Very often economies of scale are small, with some vehicle runs being under 100. The market share of the top OEMs is increasing with CRRC, Chinese OEMs having over one quarter of the market. Factory over-capacity in 2015–16 was 40% in Europe and the US, and 60% in Asia. Tier 1 suppliers' share of the market is increasing while those of OEMs is decreasing. Note that this is rolling stock in a market dominated by freight, however, most recent growth to 2016 had been in passenger vehicles, except in Australia due to the mining boom (which has now passed its peak). Tier 1 in Hein and Ott (2016) is split into systems and components – there is less competition in this market segment than for OEMs.

According to the UITP (International Association of Public Transport), the public transport sector has progressed beyond mass transit to take in every collective and shared mobility solution. For the customer, instead of being taken from stop A to B, this means service excellence, a memorable experience, ease of use and comfort (UITP, 2019). This means being able to provide for a wide range of customers from young to old, catering for a range of abilities, including aids to mobility such as wheelchairs and companion animals.

For rolling stock, this influences overall design, and the use and application of data-rich systems in design, inter-modality, operation and maintenance. Not only do vehicles need to run efficiently, they need to interact with their environment through the application of monitoring systems and artificial intelligence.

The economic structure of the sector has also changed, mainly in the areas of costs and finance. Technological innovation provides the opportunity to provide better service, but also reduced costs, especially in the area of maintenance and continuity. Preventing unscheduled outages, especially those requiring service replacement, is one significant area of saving. The change from scheduled to predictive maintenance is also an area of saving. Another area is regard to environmental concerns, the two largest affecting fuel sources and fuel efficiency, and the other where public transport is being integrated into the urban form.

Financing has also changed significantly over time. Earlier state-funded and state-run models covered the cost difference between income from fares and expenditure on infrastructure, rolling stock investment and maintenance, and operations. Privatisation has been fuelled by two different but related forces:

1. Increasing demand on government budgets leading to the need to seek lower-cost solutions.
2. An ideological preference for free markets based on the view that the private sector offers more efficient and lower-cost solutions.

Economic outlook for procurement, maintenance and operations in Victoria

The demand for rolling stock in Victoria is a combination of population growth, urban expansion, network capacity, convenience and the attraction of public transport over other modes. The main limitation is the ability of the train and tram network to cope with the morning rush hour. Future expansion is based on new infrastructure and faster, more efficient operations and services, which mainly requires upgrading existing infrastructure and the introduction of new technology. Expansion is also possible on the bus network and non-peak times. Recent patronage across the networks is shown in Table 6.1. There was a step change of around 30 million trips from 2015–16, with trains and trams increased and buses decreasing. The bus numbers are potentially due to changes in estimation methods (PTV, 2016a). Train and tram patronage increases are due to higher employment and added services (PTV, 2016a). Most growth has been on lines feeding from areas of urban expansion (PTV, 2016b).

Table 6.1 Reported patronage on Victoria’s public transport networks

Mode	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18
Metro trains	222.0	225.5	232.0	227.5	233.4	236.8	240.9
Metro trams	191.6	182.7	176.9	182.1	203.9	204.0	206.3
Metro buses	123.2	115.7	127.6	124.0	122.5	118.0	117.8
Rural trains and coach	15.5	14.7	14.5	15.0	17.6	19.3	20.8
Regional buses	14.3	14.7	15.2	15.4	14.7	11.8	12.5

Source: PTV annual reports

Basic forecasts for increasing demand are made on the basis of simple population growth projections with some allowance for increasing rates of patronage. Victoria’s population growth is the strongest of all Australian states. Total population was 6.5 million in March 2019. The current planning target is for 7.8 million people in Melbourne for 2050 and 2.1 million people in rural Victoria by 2051 (PTV, 2016b). Detailed forecasts have been made for the business case of the Melbourne Metro project currently under construction (PTV, 2016b). By 2031, average weekday journeys are projected to reach 1.5 million, double those in 2011, and passengers on the morning peak into the city increase by 90%. The expansion of the system through Melbourne Metro and related transport strategies are expected to absorb most of the increase in commuting, with road traffic remaining relatively constant. Bus patronage is expected to increase into new hubs but decrease slightly overall.

Industry roadmaps for rolling stock have been developed in two phases: one overseen by the ARA and culminating in the *On Track to 2040 Roadmap* (DIISRTE, 2012). The latest phase, funded by the ARA and CRC for Rail Manufacturing has produced a smart rail route map (IISRI, 2018). The Roadmap took a two-pronged approach of looking at strategy and technology. The technology approach was three-pronged, covering materials and manufacturing, monitoring and management, and power and propulsion, mapping out timelines for each of these areas. The more recent route map, although dealing with the same subject had three focus areas: the user experience for passenger and freight, traffic and networks, and high performing railways (IISRI, 2018). The emphasis in the first was squarely on engineering and the material side of rolling stock. The emphasis in the route map had moved from better trains to better service, so two of the areas (disregarding freight customer experience) were services areas dominated by data and communications to deliver better customer experience and better network operations. This reflects the international progression from manufacture to service delivery and the rapid growth of ICT in the sector. Such changes will have significant impacts on the industry workforce composition, skills and culture.

Investigating rolling stock nationally, Deloitte Access Economics (2013) identified four sets of actions for passenger rolling stock in trains from the five mainland states:

1. Improved scale: Purchase size (economies of scale). Price reduces rapidly with order size, the price inflection point being 40–60 single rail cars (production price adjusted data for Australia).
2. Smoother demand: Price lock-in – 80% of the final price is locked in at pre-build cost of 20%.
3. Savings in planning and design – order pre-planning and smoothing could save \$2.3 billion finance on outlay of \$17.8 billion (for \$15.5 billion activity, or 13% saving).
4. Harmonisation – platform and componentry harmonisation nationally could save \$2.5 billion planning and design cost and \$1.1 billion componentry.

They estimated a total saving of \$5.9 billion for \$15.5 billion activity over 30 years, or just over 25%. This work was based on a database constructed from the roadmap for future demand conducted by the industry and government. They calculated a multiplier of 1.8 for manufacturing, based on value-added industry estimates from the Australian Bureau of Statistics (Deloitte Access Economics, 2013). Table 1.1 summarises employment in passenger rail rolling stock manufacturing and repair in Victoria from the 2016 census. These figures are unlikely to include many of the SMEs.

After the removal of tariffs from the automotive sector, the economic output of manufacturing is growing after a period of contraction. Employment in transport equipment manufacturing is down 14% since 2015–16, but wages and salaries, and sales and service income per person employed have increased by 11% and 8%, respectively. The employment level of the whole sector is steady, but wages and sales income per employee are showing strong growth (DJPR, 2019).

Most rolling stock SMEs are local businesses. In 2010, over 90% of the small firms and 85% of medium firms in the national rolling stock industry were Australian-owned (ACIL Tasman, 2011). Some firms may source their supply from imports because they are unaware of suitable suppliers in other parts of Australia due to insufficient communication within the industry (ACIL Tasman, 2011). Linking government with SMEs also facilitates access to financing and skill training programs. Other potential social benefits could be local demographic profile change through skilled worker intake, training and employment.

According to Cawe (2014), there is a link between learning and the upgrading of industrial capabilities. Industrial upgrading refers to how firms advance through different stages of the global value chain towards high value-added activities. This involves reaching the capacity to take part in global competition, investing in manufacturing and improving productivity, disseminating these skills across the working population and lastly, stepping up the quality ladder (Khan, 2010).

The design, build and maintenance strategy being adopted in Victoria separates rolling stock and operations. For example, if an operator's contracts are for five or seven years and they controlled the rolling stock, leasing is an option to manage the risk of not having a contract extended. Separating rolling stock ownership from operations allows flexibility in addressing how operations are franchised. This reduces the risk of any failure on the part of the franchisee. This is the case for rolling stock that is dedicated to a specific system and has no other purpose. For buses, which can provide other income, owner/operator may be a more viable strategy (see section on buses on page 18).

A range of innovations in rolling stock have the potential to reduce operating costs and also the need for the upfront purchase of trains, trams and buses. For example (DJPR, 2019):

- Real-time monitoring improves punctuality, reducing the number of vehicles used to transport a given number of passengers. Improved punctuality also increases patronage maximising the potential of scheduled trips
- Increased speed has a similar effect
- Integrating different modes into a single service via a public transport platform that dovetails into different modes of personal transport, especially those that promote active living (e.g., walking, cycling)
- Environmental monitoring that has the potential to prevent breaks in service.

A global report on digital maintenance (Stern et al., 2017) estimates that roughly 50% of the total rolling stock budget goes on maintenance, similar to the breakdown of the Victorian workforce. The historical maintenance model has been one of prevention and breakdown: prevention is a precautionary timetabled approach for essential parts (often mandated) and other parts break down and are repaired. Much of the existing cost is manual failure diagnostics (30% of repair time), which could be reduced by at least 60%.

With monitoring and digitisation, the next two stages are condition-based and preventive maintenance. Condition-based maintenance is projected to save 10–15% of the total maintenance cost and is technically feasible now, whereas prevention may save another 5–10% but needs time for development. Much of the cost in the latter involves environmental monitoring.

Economic benefits of training

The economic benefit of skill training can be measured by improvement in worker productivity, higher wages, a greater tax revenue and stronger economic growth. Higher skills are associated with lower crime and more trust, improved individual wellbeing through job satisfaction leading to better health, fewer workplace injuries, more engagement with professional bodies and associations, and greater social inclusion. Investing in skills and education assists workers in being a productive member of the workplace and their communities (Bloom et al., 2014).

Skill training is also linked to labour-market outcomes. According to Cedefop (2011a), labour-market outcomes often reflect direct or indirect individual productivity. In its research on Vocational Education and Training (VET) benefits from 16 European countries, the main labour-market outcomes were summarised as high participation in the labour market, low unemployment, the opportunity to acquire a qualification for categories that previously were unqualified, and the chance to advance in a professional hierarchy. Higher skills benefit individuals and organisations, but the social benefits are likely even greater and especially strong in areas with high concentrations of STEM graduates (Winters, 2018). It leads to a society with a competent population, cultivates the desire and the ability to learn throughout life (Bloom et al., 2014), facilitates adapting, generating and growing ideas which leads to innovation, technological progress (Cedefop, 2017) and spurs economic and social advancement.

Labour and its productivity are an indispensable part of the economy. Human capital and its economic impacts have been extensively researched in both macroeconomic and microeconomic approaches. The macroeconomic analysis of human capital concerns national incomes, economic growth/decline as a result of changing labour capabilities, and labour endowment and comparative advantage in international trade. Microeconomic analysis concerns the economic returns of skills to individuals such as family, firm and the public sector.

Macroeconomic approaches often consider labour as homogenous and treat continued education as having diminishing returns in the same way that capital does – the neoclassical approach. For example, Mankiw et al. (1992) estimated that for secondary education as a proportion of working-age adults, every 1% average increase would increase GDP for that share by 0.7%. Other economists have included human capital and skills in modelling production, where more skilled workers are better able to learn by doing. They also argue that human capital has a spillover effect where new working knowledge and process innovations are shared and transferred across industries – known as endogenous growth (Grugulis et al., 2017; Lucas, 1988). To continue this cycle, continuing investment is needed to increase output. This is especially important if older skills and processes are being superseded. Empirical estimation of endogenous growth was performed in a panel econometric analysis by Barro and Lee (1994), who found that per worker GDP grows by 1.4% with each year of secondary schooling. Cedefop (2017) stressed the importance of learning outcomes rather than education attainment (years of school/university) as a better measure of skills because of a stronger empirical association with economic growth.

To individuals, training is an investment. Training sessions take up time and effort, they incur financial cost in course fees, as well as the opportunity cost of not earning an income if taken in work time, or social amenity if taken out of hours. Individuals expect a return, which must be greater than the cost to make the investment worthwhile. Rewards from training can come in different ways. Non-economic rewards include a higher self-esteem if elevated in the workplace, or as an end in itself. Most people are expecting to gain new skills and capabilities and to become more employable, attracting a higher economic return. This raises the marginal product of labour. In a competitive labour market with a skills oversupply, firms may not fully cover the marginal cost of training, but if in undersupply, may pay a premium.

Hanushek et al. (2015) used the Program for the International Assessment of Adult Competencies (PIAAC) data, estimated wage premiums of 17.8%, 17.1% and 14.3% for the skills group of literacy, numeracy and problem-solving, respectively. The Obama Administration notes that adults scoring below a 1 on the PIAAC assessment of literacy earn an average of \$20,000, while those at a levels 4/5 earn an average of \$55,000 a year (Jacobson, 2016). Taking the average across OECD countries, and using International Standard Classification of Education (ISCED) level 3 (upper secondary education) as a point of comparison, Holmes (2017) found that a typical individual with an education level below ISCED 3 earns 23% less and is 19% less likely to be employed. Those with high levels of VET (ISCED 5B) earn 24% higher and are 11% more likely to be employed than ISCED 3. Workers with ISCED 5 or 6 (tertiary and advanced tertiary), on average earn 65% more and are 16% more likely to be employed. However, these studies are snapshots without considering the dynamics of training on working lives.

In studying income inequality, Fournier and Koske (2012) reasoned that with a small proportion of higher educated workers, income inequality widens initially, but with more people gaining higher education over time, income inequality subsides. Data analysis showed that a rise in the number of tertiary graduates significantly lowers the relative returns to tertiary degrees. This result can be explained by a partial equilibrium analysis. If demand remains constant, a rise in supply will reduce the benefit of training per worker. This shows that with greater access to training, the economy needs to be able to absorb those skills through higher productivity and/or a premium on the type of production.

The economic benefit of training is also shared by employers, where higher worker productivity translates into higher profit and lower cost. Following the endogenous growth theory, firms that invest in human capital should perform better. In a meta-analysis of 66 US studies, Fournier and Koske (2012) found that performance is correlated with training, particularly for the operation areas such as customer satisfaction and employee performances. However, profitability is not clear because wages increase along with productivity. If wages rise faster than productivity, profitability falls. Cedefop (2011b) reviewed 62 studies on the empirical relationship between employer-provided training and productivity gains. The different methodologies applied in those studies complicated the results, but in general, they concluded that training had a positive impact on performance. Estimating the rate of return to organisations who provide staff training is difficult because of the range of factors that can complicate this (Grugulis et al., 2017).

However, even qualitative studies could give us clues about:

- What motivates or deters employers to engage in training activities
- What forms of training (e.g., on-the-job, off-the-job, online, technical college or higher education and so on) are effective
- What might maximise training effectiveness
- What constrains training activities.

An alternative is to look at the costs if training is not provided or skills are lacking. Although loss of business opportunities can be costed, it is difficult to generalise across firms, industry or wider economy. Such costs are different case-by-case, even within the same firm. However, if firms are not providing in-house skill training, then they have to hire skilled workers by offering higher wages to poach skilled workers from other firms, incurring higher recruitment and remuneration costs. Productivity can be constrained by low growth and low innovation associating with low skills. Konings and Vanormelingen (2015) found that half of the productivity gains were brought about by training. The loss of business opportunity due to lack of skills to accommodate new projects could be the most profound. If a whole industry lacks capacity, the alternative is to import and hence leak GDP.

Questions relating to how education and training are funded, what skills are needed, what size the skilled workforce should be, and when certain skills are needed, are complicated social, economic and political issues. Although market mechanisms in a free economy can sort out much of occupational skill supply and demand, governments around the world continue to publicly fund skill training, with the belief that skill capability is fundamental to productivity, innovation and economic growth. If left to the free market, the level of training may meet the private optimal level but be below the social optimal level.

Private training can pose a risk to the firm because of labour mobility and market competition. For firms, training incurs cost. The investment in training is expected to provide an ongoing benefit, but if trained workers moved to competitors that investment is lost and the competitor strengthened. With this risk, firms, particular smaller firms, may only train their workforce sufficient to operational requirements. When the benefit of investment leaks outside the organisation, a positive externality is created. Fear of such leakage can lead to a suboptimal level of private training that restricts the economy from realising its full potential. The positive externality argument thus favours government intervention in skill training. Firms may also be price takers and not have the margins required to fund training. A certain level of profit is necessary to provide the incentive for firms to invest in R&D and training.

Khan (2010) assesses training in market structures similar to those for rolling stock. When firms are in the supply chain for an industry, where there is only one large buyer of their product, that buyer sources its supplies from a large number of competing smaller firms. This is described as a monopsony market structure. Where there are few buyers to sellers, monopsony power – the ability to use the purchasing quantity to affect the market equilibrium price may come into play. Monopsony power may allow the buyer to gain a price advantage over the seller that is even lower than would prevail in a competitive market. A similar market structure can potentially occur in government procurement process. Once awarded with a government procurement contract, the large firm obtains the monopsony power over their suppliers. Government interventions may be needed to balance the powers between the monopsony and the smaller supplier firms, and encourage skill training to maintain and growth skills.

Governments will subsidise training if they want skills to be better distributed across a wider population to reduce unemployment and income inequality, and to promote economic, social and political wellbeing. A more skilled workforce is also better equipped to accommodate technological and structural economic change.

Governments are also willing to train a highly skilled workforce for their high-skill visions of industrial policy. Newly developed products that use highly skilled labour tend to push back or delay competition. The assumption is, if nations can be the leader of new products in the early stages of the product life cycle, and production for those products requires labour with new skills that are yet to be diffused, nations can avoid direct competition against low labour cost countries. If a nation has abundant human capital and skilled labour compared to its trade partners, it is relatively more efficient to produce skill intensive products with the potential to be a net exporter. However, this is a necessary but insufficient condition for a high-skill workforce vision (Grugulis et al., 2017). Unless those skills are in demand, there is a risk of redundancy. Technology can change fast and production process may be streamlined to those requiring less skills.

Some researchers stress the need for highly skilled workers to be more entrepreneurial and to continually upskill through lifelong learning to accommodate the constant change in skill demand in order to sell their specific labour power for continual employment (Heisig, 2009). However, this places a great of risk on the individual. Any investment, including investment in skills, involves risks of uncertain future. Individual workers may be unwilling to invest in future skills or are unsure about what skills will be most needed. Government intervention in training could play a role in educating the workforce to reconceptualise the meaning of 'skills' in the world of continuing evolving technology and changing market conditions. In a submission to the G20 Employment and Labour Ministers' Meeting in Washington, the G20 Training Strategy (International Labour Office, 2011) suggested that governments need to address future skill needs and to align training with the future labour market.

Workforce and training issues

The Victorian rail service has a history dating back to 1854 (Education and Training Committee, 2010). By the time it was fully owned by the Victoria colonial government in 1878, it employed about 10,000 workers which accounted for about two-thirds of the government employees. Sammartino (1998) studied the employment practices of Victoria railways for the period from 1864 to 1921. Although it is a historical study and the business model of today's railway industry is very different, it gives us an insight about the length of time required for workers to form the industry skills and knowledge collectively and individually. It helps us to understand how skill formation lags behind the skill requirement to cater for the rapid changing business and technological environment.

Along with the global trend of franchising public transports in the early 1990s and with the primary objective of cost saving, skill shortage in the public transport sector started to emerge. Between 1992 to 1997, the staff level of the Victoria railway was reduced from 18,000 to 8,400 (Department of Infrastructure, 2005). This mass reduction of the labour force in a short period of time represents a major skill loss collectively as an industry. Skill shortage in a labour market occurs when the number of available workers falls short of the number needed by firms at the wages they offer.

On the demand side, BIS Oxford Economics (2018) projected that by 2027, a workforce shortage of 2,800 persons will occur in maintenance and operation, which accounts for about 20% of the available workforce in Victoria. For the construction and manufacturing workforce, by 2025, about 11,700 persons would be in demand, or about 24% of the available workforce.

On the supply side, the industry finds it difficult to attract younger workers to enter into the industry. Even if they start, they tend to leave soon after. Turnover of the newly recruited tends to be five times higher than any other groups in the industry (Education and Training Committee, 2010). As it is, the rail industry worker profile shows a relative high average age (from 42.3 to 52.5 years of age in 2021 (Mahendran and Dockery, 2008) (see Table 6.2, overleaf), leaving the industry vulnerable to the risk of an ageing workforce who retire from the industry without passing on their skills to the younger generation workers. BIS Oxford Economics (2018) projected the attrition rate of the current workforce for machinery operators, drivers and managers will be 24%. The Parliament of Victoria inquiry into the skills shortages of the rail industry (Education and Training Committee, 2010) has identified that primary skills shortage are relating to engineering and various trades.

Factors such as insufficient project lead-time notice and lumpy nature of rail projects could hinder the industry for a worker training plan (Bombardier Transportation Australia, 2009), which contributes to further skill shortages. The market structure of rail manufacturing between the large Tier 1 business and the smaller Tier 2 (SMEs) is unevenly distributed. Tier 1 businesses accounted for 10% of the firms in the industry who are generating 88% of the revenue of the industry (RMCRC, 2017). This market structure of the industry with a large proportion (90%) of SMEs earning a total of only 12% of the industry revenue leaves SMEs (predominantly local business) with little financial capacity for innovation and skill training.

Table 6.2 Average age by occupation, rail workforce projections

	2001 ^a	2006 ^p	2011 ^p	2016 ^p	2021 ^p
Managers	44.0	44.9	47.8	50.4	52.5
Professionals	40.3	40.4	42.2	43.9	45.0
Associate Professionals	42.0	43.5	45.8	47.4	48.1
Tradespersons	40.0	40.3	41.6	41.9	41.4
Adv. Clerical and Service	38.6	39.8	41.4	42.4	42.3
Int. Clerical, Sales and Service	41.2	42.8	45.4	47.1	47.7
Int. Production and Transport	43.0	44.6	47.7	49.9	51.3
Elem. Clerical, Sales and Service	39.3	41.4	44.5	47.0	48.6
Labourers and Related Workers	42.1	43.6	46.2	47.9	48.7
Total	41.6	42.8	45.4	47.2	48.0

Notes: ^aActual, ^pProjected.

Source: Mahendran and Dockery, 2008

The rolling stock industry structure is concentrated in the hands of a relatively small number of large original equipment manufacturers (OEMs) and Tier 1 firms whose components, systems, services are supplied by a large number of SMEs. Ten percent of the firms are large firms who employ three-fourths of the industry labour force (ACIL Tasman, 2011). The average employment for medium and small firms is 17 and 9 respectively, versus the average employment for large firms of 557 (Table 6.3). Since the standard deviations for all level of firms are greater than their respective averages, the statistics paint a positively skewed picture of employment distribution. A small number of firms employ a substantially higher than average number of workers, while the majority of firms employ around the same as the average number of workers for all levels of firm sizes.

Table 6.3 Industry employment

	Total	Average per firm	Standard deviation
Large firms	11,154	557	1,016
Medium firms	2,436	17	17.2
Small firms	1,783	9	12.7
All firms	15,373	N/A	N/A

Source: ACIL Tasman, 2010

In an interview with rail operators, Mahendran et al. (2007) found that with privatisation, there is a significant structural change within the rail industry having an impact on how workers are recruited, trained and developed. With competitive tendering practice, resources allocated to training program by government-owned rail organisation are viewed as a non-core operational cost and are rationalised. Investment in training contents with considerable financial and time costs were perceived as a risk of losing investment, as highly trained staff are valuable and subject to poaching by other firms. There has been a substantial reduction in training investment across the industry.

The inconsistent nature of government infrastructure projects and short franchise terms create greater uncertainty for business, therefore rail employers no longer provide workers with a career path as was the case in the past. This includes planning for staff training throughout their whole career progression (Mahendran et al., 2007).

Lacking an industry body who is responsible for long-term industry training strategy, individual firms are increasingly looking to recruit workers who have already acquired rail industry qualifications and experiences. This minimises their training costs, leading them to avoid recruiting younger, less qualified and less experienced workers. As a fallacy of composition, a collective action to minimise training cost effectively manifests the skill shortage of the industry, particularly for SMEs, which adversely affects the skill capability in the lower areas of the supply chain.

About 12% of industry revenue is earned by the bottom 90% of firms (SMEs) (ACIL Tasman, 2011; RMCRC, 2017). SMEs are price-takers in the market, with relatively large number of firms selling similar products and services to a small number of larger firms (an oligopsony market). The profit margins are often whittled down to cost, leaving no economic profit that can be used for innovation and staff training. It is argued that firms should be allowed to earn sufficient profit so they can reinvest in innovation and staff training.

In regard to training cost and economies of scale, the majority of small-sized firms employ less than 10 employees. When staff training is provided internally, it is not large-scale enough to be financially viable, while engaging external Registered Training Organisations (RTOs) could be a cost-effective alternative.

Some small rail organisations who continue to train and employ apprentices are now increasingly using labour hire companies to manage the administration and contractual responsibilities. Those labour hiring companies leverage the economies of scope from a number of firms to provide 'group training' to the apprentices, where a single business is unable to sustain an apprentice job otherwise. Larger-sized firms are more likely to offer apprenticeships, traineeships, internships and cadetships, and graduate recruitment programs. Large-sized rail operators, particularly those involved in provision of passenger transport services, have continue to deliver the majority of training for workings internally, and those internally trained skills are developed for their specific system forming their competitive advantage in the industry.

Some rail organisations temporarily import skilled workers for certain jobs, or maintain and service their system with workers imported from overseas for a variety of reasons. It could be that training of those skills may require investment in high cost tools, equipment or training facilities.

The economic analysis of skill training in the rolling stock industry in Victoria will involve quantifying all aspects of the causes of skill shortage mentioned above by assessing the cost and benefit of providing training versus the opportunity cost of not providing training. The efficiency will be the difference between private provision of training and public provision of training, and who pays for the training cost (private funding, public funding, trainee contribution and a share cost model).

Quantifying the economics of skill shortage and skill training in the rolling stock industry is hard to find in the economic literature. The following are areas of interest for further research:

- Assessment of the cost and benefit of providing training versus the opportunity cost of not providing training
- The efficiency difference between private and public provision of training, and who pays for the training cost (private funding, public funding, trainee contribution and a share cost model)
- The economic benefit to trainer, trainee, the firm employing the skilled worker, and the local and national economy
- The cost and benefit of importing skilled workers by temporary visa compared with locally trained skilled workers for the jobs.

Summary

Internationally, the rolling stock sector is experiencing rapid changes in technology, but is also highly competitive, and under pressure to deliver lower life-cycle costs for rolling stock, while improving their service delivery as passenger vehicles. The sector in Victoria is subject to the same pressures. International trade policy allows government a substantial role in procurement, specifically with SMEs, with the latest research suggesting that local procurement has a limited impact on prices because production volumes are low globally. This allows governments a fair degree of leeway when designing procurement strategies and assessing value for money. Procurement agreements can be designed to:

- Deliver new technology, with the government as purchaser
- Support SMEs to innovate through technology transfer and to generate new intellectual property
- Deliver social and environmental outcomes as public good benefits by specifying employment, training and environmental conditions.

Quantified estimates of the economics of skills shortage and training in the rolling stock industry are hard to find in the economic literature. The following are areas of interest for further research:

- Assessment of the cost and benefit of providing training versus the opportunity cost of not providing the training
- The efficiency difference between private provision of training and public provision of training, and who pays for the training cost (private funding, public funding, trainee contribution and a share cost model)
- The economic benefit to trainer, trainee, the firm employing the skilled worker and the local and national economy
- The cost and benefit of importing skilled workers by temporary visa compared with locally-trained skilled workers.

References

- ACIL Tasman. (2011). *Railway manufacturing industry: A profile of the railway manufacturing industry in Australia*, Department of Innovation, Industry, Science and Research Canberra.
- Barro, R., and Lee, J. (1994). Sources of economic growth. *Carnegie-Rochester Conference Series on Public Policy*, 40, 1–46. doi:10.1016/0167-2231(94)90002-7.
- Berman, T., and Squire, M. (2011). Demand-side innovation policies in Australia. In OECD (Ed.), *Demand-side Innovation Policies*, 95–113. OECD Publishing, Paris.
- BIS Oxford Economics. (2018). *Australasian Railway Association skills capability study. Skills crisis: A call to action*. Australasian Railway Association.
- Bloom, D., Goksel, A., Heymann, J., Ishikura, Y., Kothari, B., Milligan, P., and Paucek, C. (2014). *Introduction education and skills 2.0: New targets and innovative approaches*, 8–15. World Economic Forum, Geneva.
- Bombardier Transportation Australia. (2009). Submission. Inquiry into the State of Manufacturing in Victoria by the Economic Development & Infrastructure Committee of the Parliament of Victoria, Bombardier Transportation Australia, Melbourne.
- Cawe, A. (2014). *Programmatic procurement: A political economy review of the Transnet Freight Rail competitive supplier development programme*. ERSA Working Paper 447, Economic Research Southern Africa (ERSA), Cape Town.
- Cedefop. (2011a). *The benefit of vocational education and training*. Research Paper No. 10, No. 978-92-896-0698-1. Publications Office of the European Union, Luxembourg.
- Cedefop. (2011b). *The impact of vocational education and training on company performance*. Research Paper No. 19, Publications Office of the European Union, Luxembourg.
- Cedefop. (2017). *Investing in skills pays off: The economic and social cost of low-skilled adults in the EU*. Research Paper No. 60, Luxembourg: Publications Office, Luxembourg.
- Charnovitz, S., and Fischer, C. (2015). Canada–renewable energy: Implications for WTO law on green and not-so-green subsidies. *World Trade Review*, 14(2), 177–210.
- Correia, F., Howard, M., Hawkins, B., Pye, A., and Lamming, R. (2013). Low carbon procurement: An emerging agenda. *Journal of Purchasing and Supply Management*, 19(1), 58–64.
- Crocker, B., and Emmett, S. (2008). *Excellence in services procurement: How to optimise costs and add value*. Cambridge Academic, Cambridge.
- Dawar, K., and Oh, S. (2017). *The role of public procurement policy in driving industrial development*. Department of Policy, Research and Statistics Working Paper 8. United Nations Industrial Development Organization (UNIDO), Vienna.
- Deloitte Access Economics. (2013). *Opportunities for greater passenger rolling stock procurement efficiency*. Australasian Railway Association, Canberra.
- Department Industry, Innovation, Science, Research and Tertiary Education. (2012). *On track for 2040: Preparing the Australian rail supply industry for challenges and growth roadmap*. Commonwealth Government of Australia, Canberra.
- Department of Infrastructure. (2005). *Public transport partnerships: An overview of passenger rail franchising in Victoria*. Public Transport Division, Department of Infrastructure, Melbourne.
- DJPR. (2019). *Strategic Plan 19–23, Inclusion Group*. Department of Jobs, Precincts and Regions, Melbourne.
- Education and Training Committee. (2010). *Inquiry into skills shortages in the rail industry*.
- Esteves, A., and Barclay, M. (2011). Enhancing the benefits of local content: integrating social and economic impact assessment into procurement strategies. *Impact Assessment and Project Appraisal*, 29(3), 205–215. doi:10.3152/146155111X12959673796128
- Flaig, D., and Stone, S. (2017). Local content requirements versus tariff equivalents: how we measure matters. *The World Economy*, 40(5), 931–948.
- Fournier, J., and Koske, I. (2012). The determinants of earnings inequality: evidence from quantile regressions. *OECD Journal of Economic Studies*, 1, 7–36. doi:10.1787/eco_studies-2012-5k8zs3twbrd8.
- Grugulis, I., Holmes, C., and Mayhew, K. (2017). The economic and social benefits of skills. In C. Warhurst, K. Mayhew, D. Finegold and J. Buchanan (Eds.), *The Oxford Handbook of Skills and Training*, 72–398. Oxford University Press, Oxford.

- Hanushek, E., Schwerdt, G., Wiederhold, S., and Woessmann, L. (2015). Returns to skills around the world: Evidence from PIAAC. *European Economic Review*, 73(C), 103–130. doi:10.1016/j.euroecorev.2014.10.006
- Hein, A., and Ott, A. (2016). *Huge value pool shifts ahead – how rolling stock manufacturers can lay track for profitable growth*. McKinsey, Dusseldorf.
- Heisig, U. (2009). The deskilling and upskilling debate. In Maclean, R., and Wilson, D. (Eds.), *International handbook of education for the changing world of work: bridging academic and vocational learning*, 1639–1651. Springer Science and Business Media B. V., Berlin.
- Hestermeyer, H., and Nielsen, L. (2014). The legality of local content measures under WTO law. *Journal of World Trade*, 48(3), 553–591.
- Holmes, C. (2017). The individual benefits of investing in skills. In Warhurst, C., Mayhew, K., Finegold, D., and Buchanan, J. (Eds.), *The Oxford Handbook of Skills and Training*, 345–371. Oxford University Press, Oxford.
- Hufbauer, G., Schott, J., Cimino-Isaacs, C., Vieiro, M., and Wada, E. (2013). *Local content requirements: A global problem, Vol 102*. Peterson Institute for International Economics, Washington D.C.
- Hull, J. (2016). Hey now, let's be social: The social cost of carbon and the case for its inclusion in the Government's procurement of electricity. *George Washington Journal of Energy and Environmental Law*, 7, 18.
- IISRI. (2018). *Smart rail route map interim report*. Institute for Intelligent Systems Research and Innovation, Geelong.
- International Labour Office. (2011). *A skilled workforce for strong, sustainable and balanced growth: A G20 training strategy*. International Labour Organization, Geneva.
- Iossa, E., and Waterson, M. (2019). Maintaining competition in recurrent procurement contracts: A case study on the London bus market. *Transport Policy*, 75, 141–149. doi:10.1016/j.tranpol.2017.02.012.
- Jacobson, E. (2016). Workforce development rhetoric and the realities of 21st Century capitalism. *Literacy and Numeracy Studies*, 24(1), 3–22. doi:10.5130/lins.v24i1.4898.
- Jansson, K., and Pyddoke, R. (2010). Quality incentives and quality outcomes in procured public transport – Case study Stockholm. *Research in Transportation Economics*, 29(1), 11–18. doi:10.1016/j.retrec.2010.07.004.
- Jensen, P., and Webster, E. (2014). *Evaluating Innovation Programs*. Report for the Victorian Department of State Development, Business and Innovation, Melbourne Institute of Applied Economic and Social Research, University of Melbourne, Melbourne.
- Joint Select Committee on Government Procurement. (2017). *Buying into our future*. Review of amendments to the Commonwealth Procurement Rules. Commonwealth of Australia, Canberra.
- Khan, M. (2010). *Learning, technology acquisition and governance challenges in developing countries*. University of London, London.
- Konings, J., and Vanormelingen, S. (2015). The impact of training on productivity and wages: firm-level evidence. *Review of Economics and Statistics*, 97(2), 485–497.
- Lee, W. (2011). Demand-side innovation policies in Korea. In OECD (Ed.), *Demand-side Innovation Policies*, 151–162. OECD, Paris.
- Legacy, C., Curtis, C., and Sturup, S. (2012). Is there a good governance model for the delivery of contemporary transport policy and practice? An examination of Melbourne and Perth. *Transport Policy*, 19(1), 8–16.
- Lember, V., Kalvet, T., and Kattel, R. (2011). Urban competitiveness and public procurement for innovation. *Urban Studies*, 48(7), 1373–1395.
- Lucas, R. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3–43.
- Mahendran, A., and Dockery, A. (2008). *Forecasting the workforce needs of the Australian Rail Transport Industry (ARTI)*. Paper presented at the 4th PATREC Research Forum Edith Cowan University, Perth.
- Mahendran, A., Dockery, A., and Affleck, F. (2007). *A profile of training and skills development in the Australian rail industry*. Paper presented at the 36th Australian Conference of Economists, Hobart.
- Mankiw, N., Romer, D., and Weil, D. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407–437.
- Mees, P. (2015). *A very public solution*. Melbourne University Publishing, Melbourne.
- OECD. (2011). *Demand-side innovation policies*. OECD, Paris.
- OECD. (2017a). *Government at a Glance 2017*, 277. In OECD (Ed.). OECD, Paris.

- OECD. (2017b). Size of public procurement. In OECD (Ed.), *Government at a Glance 2017*, 172–173. OECD, Paris.
- Public Transport Victoria (PTV). (2016a). *Annual Report 2015–16*.
- PTV. (2016b). *Melbourne Metro. Public transport demand forecasts for business case*.
- Public Transport Users Association. (2008). *Transport governance. Public transport management that works for passengers*. Public Transport Users Association, Melbourne.
- Rail Manufacturing CRC. (2017). *Senate Rual and Regional Affairs and Transport References Committee Inquiry into Australia's Rail Industry Submission*. Rail Manufacturing CRC, Melbourne.
- Roy, W., and Yvrande-Billon, A. (2007). Ownership, contractual practices and technical efficiency: The case of urban public transport in France. *Journal of Transport Economics and Policy*, 41(2), 257–282.
- Sammartino, A. (1998, 3–5 February). *Employment practices in a large public organisation: Evidence from Victorian Railways 1864–1921*. Paper presented at the Current Research in Industrial Relations proceedings of the 12th AIRAANZ Conference, Wellington.
- Smith, A., Nash, C., Sanders, S., and Hood, I. (2010). *How to get value for money through private sector participation in rail passenger service delivery: International evidence*. Paper presented at the European Transport Conference 2010, Glasgow.
- Stern, S., Behrendt, A., Eisenschmidt, E., Reimig, S., Schirmers, L., and Schwerdt, I. (2017). *The rail sector's changing maintenance game*. McKinsey and Company.
- Thurbon, E. (2015). The abandonment of procurement-linked strategic activism in Australia: Standing still with room to move. *Australian Journal of International Affairs*, 69(5), 577–594.
- UITP. (2019). *Public Transport Trends 2019: Executive Summary*. Public Transport Trends, International Association of Public Transport, Brussels.
- Victorian Government. (2019). *Innovation and the procurement process: Procurement guide. Goods and services procurement guide* [Online]. Melbourne. Available: <https://www.buyingfor.vic.gov.au/innovation-and-procurement-process-goods-and-services-procurement-guide> [Accessed 21 February 2020].
- Victorian Government Purchasing Board. (2016). *Achieving value for money – procurement guide*. In Department of Treasury and Finance (Ed.) Department of Treasury and Finance, Melbourne.
- Wallis, I., Bray, D. and Webster, H. (2010). To competitively tender or to negotiate: Weighing up the choices in a mature market. *Research in Transportation Economics*, 29(1), 89–98. doi:10.1016/j.retrec.2010.07.012
- Warner, M. (2011). *Local content in procurement: Creating local jobs and competitive domestic industries in supply chains*. Routledge, London.
- Willis, K. (2010). Is all sustainable development sustainable? A cost-benefit analysis of some procurement projects. *Journal of Environmental Assessment Policy and Management*, 12(3), 311–331.
- Winters, J. (2018). *Do higher levels of education and skills in an area benefit wider society?*. IZA World of Labour, Germany.
- WTO Secretariat. (2015). *Australia: Trade Policy Review*. Report by the Secretariat, Trade Policy Review Body, World Trade Organisation, Geneva.
- Yvrande-Billon, A. (2006). The attribution process of delegation contracts in the French urban public transport sector: Why competitive tendering is a myth. *Annals of Public and Cooperative Economics*, 77(4), 453–478.

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Policies and strategies

Advancing Victorian Manufacturing – A Blueprint for the Future (2017): <https://djpr.vic.gov.au/about-us/overview/strategies-and-initiatives/advancing-victorian-manufacturing>

Local Jobs First – Victorian Industry Participation Policy (2018): <https://www.localjobsfirst.vic.gov.au/key-documents:>

- The Local Jobs First Act
- The Local Jobs First Policy
- Local Jobs First Agency Guidelines
- Local Jobs First Supplier Guidelines
- Local Industry Development Plan
- Financial reporting directions.

Victoria's Local Jobs First Commissioner including monitoring and review process: <https://www.localjobsfirst.vic.gov.au/commissioner>

Victorian Rolling Stock Strategy: Trains, Trams, Jobs 2015–2025: <https://transport.vic.gov.au/our-transport-future/our-projects/new-and-upgraded-trains-and-trams/victorian-rolling-stock-strategy>

Victoria's Future Industries: Transport Technologies Sector Strategy: https://www.business.vic.gov.au/__data/assets/pdf_file/0006/1275351/Transport-Technologies-strategy-web-version-20160310.pdf

Industry Capability Network (Tenderer's guidance): <https://icn.org.au/victoria>

Buying for Victoria (Tenderer's guidance): <https://buyingfor.vic.gov.au/how-government-buys>

Buying for Victoria (Buyer's guidance): <https://buyingfor.vic.gov.au/goods-and-services-procurement-policies>

Victoria's Social Procurement Framework: <https://buyingfor.vic.gov.au/social-procurement-framework>

Goods and services procurement policies and frameworks: <https://buyingfor.vic.gov.au/goods-and-services-procurement-policies-and-frameworks>

Growing Our Rail Network 2012–2025 (2016 update): <https://www.ptv.vic.gov.au/footer/legal-and-policies/growing-our-rail-network-2018-2025/>

Growing Our Rail Network 2018–2025: <https://transport.vic.gov.au/about/planning/transport-strategies-and-plans/>

Principal Public Transport Network: <https://transport.vic.gov.au/about/planning/principal-public-transport-network>

Transport Safety Victoria Regulatory Approach Policy: https://transportsafety.vic.gov.au/__data/assets/pdf_file/0008/30023/TSV_REGULATORY_APPROACH_POLICY_web.pdf

Customer service charters for Yarra Trams, Metro Trains, V/Line and Transdev Melbourne (some buses): <https://www.ptv.vic.gov.au/footer/customer-service/customer-service-charters>

Minister for Public Transport

Relevant Acts: <https://www.vic.gov.au/general-order-dated-1-january-2019#minister-for-public-transport>



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