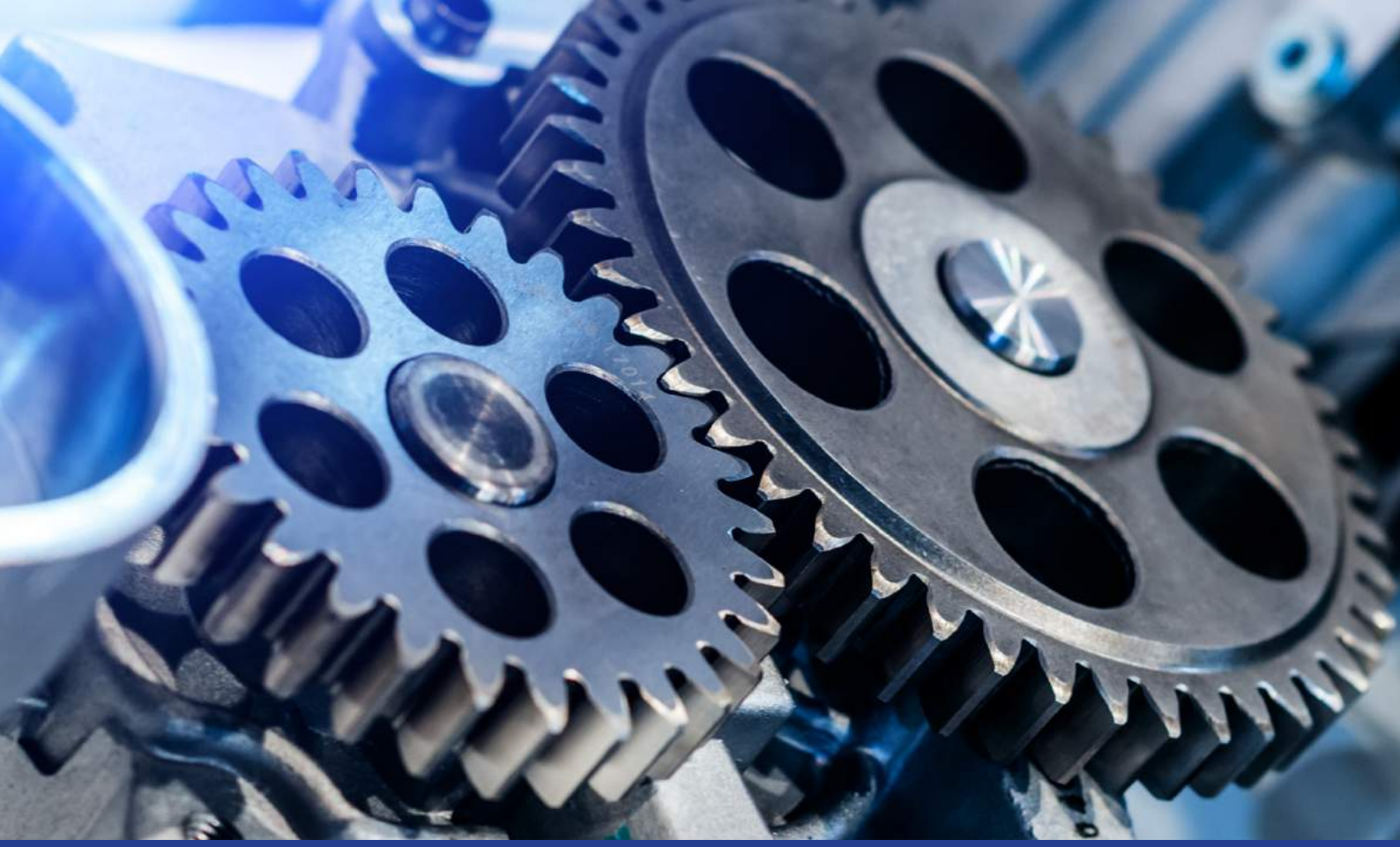

Reimagining the workforce: the economics of rolling stock manufacturing, maintenance and operations for Victoria's public transport sector

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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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Project summary

Reimagining the workforce: building smart, sustainable, safe public transport is a collaborative research project between the Department of Transport (DoT), the Rail Manufacturing Cooperative Research Centre (RMCRC), Victoria University (VU) and industry which commenced on 1 July 2019 and will be completed by 30 June 2020. This research aims to provide a starting point for addressing the current knowledge gaps in the transport industry workforce, with a specific focus on above track rolling stock. Its purpose is to understand what practical steps might be taken to address critical skills shortages currently facing the sector, and what is needed to build a sustainable and resilient future workforce.

The project provides a systemic assessment and case study of the Victorian public transport rolling stock sector from three perspectives: economic, organisational and community in the broader context of the public transport system. It undertakes a case-study approach examining specific organisations across the rolling stock and public transport system in Victoria using an 'end user-based research methodology', which is transdisciplinary and combines end user and academic knowledge. Findings from these assessments were used to inform a workshop with industry held in early 2020 to identify key actions and develop an interim plan to support these actions.

Our key purpose is to understand:

- The current above track, rolling stock workforce context.
- The barriers, needs, opportunities, benefits and existing strengths of organisations and their ability to respond to current recommendations, and achieve a sustainable, inclusive and innovative future workforce.
- The economics of developing and growing capability within transport organisations' workforce as a result of the investment in training (Tiers 2 and 3) and potential economic opportunities for small to medium enterprises (SMEs) at a local level. This is being approached via the benefits and costs of local procurement.
- How the 18–30 year old cohort perceive and understand public transport as a potential employer and their expectations more generally in relation to work.

This research builds upon previous research undertaken by the Australian Rail Association and the RMCRC.

This report looks at the economics of the rail, tram and bus rolling stock manufacturing, maintenance and operations sector nationally, with particular reference to how procurement contributes to Victoria's economy and workforce. Currently, tests for government procurement are based on whether the public or private sector would provide better value-for-money. These tests have not yet been adapted for assessing trade-offs between overall project costs and specific levels of local content, employment and training.

This report also ties employment to production within the sector and its supply chain, estimating the potential benefits to employment of local procurement and changes in production. This provides the foundation for understanding investment and training needs as industry builds new rolling stock for Victoria's expanding public transport sector, and maintains and operates existing rolling stock. It also examines the intangible benefits of employment on health and wellbeing. Work on the economics of training itself can be found in Young, et al. (2020b).

Key conclusions

This report describes the economics of the rolling stock sector at the national scale even though the project is focused on Victoria. This is because the relevant data needed to analyse the employment opportunities of local procurement are not available at the State scale.

Table 1 summarises the vital national statistics of the four main sectors investigated for this report. They outline production, employment, imports and gross value added (GVA). For Victoria, proportions in terms of employment are difficult to estimate, but rail manufacturing is approximately 25%, rail transport over 30%, bus manufacturing is too difficult to estimate but is likely to have the largest state share, and road passenger transport about one-third.

Table 1: Summary of production, employment and imports for main rolling stock sectors. The GVA component represents the total sector production.

Sector	Production (million)	Employment	Supply chain	Supply chain employment	Imports (million)	GVA (total sector)
Rail rolling stock manufacturing and maintenance	$3,016	4,370	61%	4,555	$404 primary $567 supply chain	20%
Rail transport (passenger where possible)	$4,305 urban $632 regional	27,148 (passenger est.)	49%	19,348 (total sector) 6,043 passenger	$583 million supply chain	47%
Motor vehicle manufacturing (buses <8%)	$626	N/A	46%	Unknown	$4,383 supply chain	32%
Road transport	$4,016 urban $1,714 regional	41,944 urban 6,719 regional	46%	98,552 total sector	$195 urban $427 regional	46%

Source: Australian National Accounts: Input-Output Tables, 2016–17 (ABS, 2019a), Labour Force, Australia, Detailed, Quarterly, Nov 2019 (ABS, 2019b) and this study.

We have used the input-output (I-O) tables from Australia's National Accounts (ABS, 2019a) to estimate the number of jobs in direct manufacturing and in the supply chain for rail manufacturing. These equate to approximately 3.7 jobs for every additional $1 million of rolling stock manufacturing at 60% of local content, with the potential increase to 4.4 jobs with full procurement. These jobs are direct, within rolling stock manufacturing, intermediate, within the supply chain, and induced, as a result of additional spending from wages and salaries.

We have also examined a range of industries making up the supply chain showing that replacing imports in capital-intensive manufacturing will produce an estimated 1.2 to 1.5 jobs per $million of import replacement, but 3.1 to 5.3 jobs per $million for advanced manufacturing.

Similar opportunities for import replacement exist for the rail transport sector (though not to the same level of value), along with the materials for outfitting and maintaining rolling stock in good quality. Although we were unable to drill down to the same level of detail for bus manufacture, and bus and tram operations, there are similar opportunities there.

These sectors, however, have higher employment rates for every $1 million in added production: 9.3 jobs for rail transport, 6.6 jobs for motor vehicles manufacture (we could not calculate this directly for buses) and 14.7 for road transport (buses and trams).

Looking at the intangible benefits for increased employment, we used current data on mental health for the unemployed and employed to test the sensitivity of the health benefits of gaining work, using a health economics approach. Together, the benefits of reducing government funding on Centrelink payments such as Newstart and improvements in health and wellbeing outweigh the costs of modestly funded programs, even when very conservative assumptions are used. This indicates that targeted employment programs can be considered as public health measures.

Discussions with small to medium enterprises (SMEs) suggest that they are being negatively affected by risks being passed down the supply chain, procedural complexity and a lack of transparency in organising future contracts. Planning for new technologies and skill acquisition present industry challenges, but there are untapped opportunities to increase local content.

Economic inputs to the procurement process

Sector structure

In the literature review (Young et al., 2020a), we described the physical make-up of Victoria's rolling stock sector, its coverage, numbers and types of rolling stock, the procurement process and policy background. Here, we build on that to describe the structure of economic activity and employment in the sector.

Some key points from the literature review that also inform this report are:

- In 2016 globally, new rolling stock (train and tram) generated approximately €120 billion in sales (50–60) and after service (60–70), with original equipment manufacturers (OEMs) capturing about one quarter of the global market, suppliers almost half, and operators and third-party maintenance one-quarter. The economies of scale are often small, with vehicle runs similar to those in Australia. In 2015–2016, factory over-capacity was 40% in Europe and the US and 60% in Asia. Tier 1 produces systems and components, has less competition than OEMs and its market share is increasing while the OEM share is decreasing, although for the top OEMs market share is increasing.
- Rolling stock is becoming more sophisticated, moving towards a service model that caters to all as a regulated public good, affecting design, and the application of data-rich systems in design, inter-modality, operation and maintenance. Technological innovation can provide better service and reduced costs, especially in the area of maintenance and continuity, and in preventing unscheduled outages. Condition-based maintenance could save 10–15% of the total maintenance cost and is feasible now, and prevention may save another 5–10% but needs development.
- In Melbourne, trains and trams are projected to take most of the projected growth in commuter traffic, with overall capacity being dictated by the capacity to run services for the morning peak. By 2031 this may increase by 90% from 2016 levels, with new acquisitions of trains, trams and some buses anticipated to service this. More modest growth in interurban commuting is expected.
- The market structure of rail manufacturing between large Tier 1 businesses and smaller Tier 2 and 3 SMEs in Australia is unevenly distributed. Tier 1 businesses accounted for 10% of the firms who generate 88% of total production, leaving the remaining 90% of mainly SMEs earning a total of only 12%. This gives them a limited financial capacity for innovation and skills training. Most SMEs (a decade ago 90% of small and 85% of medium businesses) are Australian-owned.

Economic data describing the sector has two main sources. One is the data collected by the industry itself and by government purchasers, mainly through industry surveys. The other is via surveys and data collection conducted by government agencies, principally the Australian Bureau of Statistics (ABS). The first source is usually opt-in and covers those who identify with a particular industry – rail, tram, bus or transport generally and/or the manufacture of rolling stock and equipment. The second is mandatory and part of doing business. It includes industry and employment surveys, income-expenditure reporting and general population census. The definitions as to what industry a business or employee is associated with are more formal.

There are advantages to both types. The first coalesces around a set of economic activities, skills and organisational characteristics and is covered more fully in organisational and workforce reports. The second collects data that allows the sector to be analysed as part of the national accounts covering its individual performance and role in the broader economy, particularly as part of the manufacturing sector.

The method of collection also affects some very basic statistics, such as how many people are employed by the sector and how far down the supply chain a survey goes. For example, the Victorian DoT has conducted its own survey of the rail and light rail rolling stock supply chain, which identifies the original equipment manufacturers and Tier 1–3 direct suppliers (unpublished data). This is incomplete and only partially identifies rail and non-rail activities, Victorian and national staff and key occupations. For privacy reasons some of this information is kept confidential. It is important information for the purchaser, but because it is incomplete, does not lend itself to further economic analysis, although it has contributed to shaping what follows. The analysis here is therefore almost entirely based on data from the ABS, and informed by discussions with industry participants. Any errors remain with the authors.

Supply chain economics

This section describes the methods used to analyse the supply chains for manufacturing and operations, in order to estimate direct, indirect and induced employment, and the effects of import substitution. We concentrate on two industry sectors from the national accounts to better understand the economics of rolling stock manufacture, maintenance and operations, especially the benefits of local procurement. These are Railway Rolling Stock Manufacturing and Maintenance and Rail Transport. Most of the analysis was undertaken at the national scale for two reasons: (1) the sector is relatively homogenous, and (2) regional disaggregation would distort supply chain calculations. Some additional information from the Motor Vehicle Manufacturing and Road Transport sectors has been included where possible to support passenger bus transport.

The most recent national industry accounts for input-output analysis and understanding industry value-added contributions to the economy were for 2016–17 (ABS, 2019a). The national input-output tables contain 113 sectors, divisions and activities making up the economy, with manufacturing being the most detailed sector, and wholesale and retail sectors having single entries. The input-output tables contain sector and product outputs that have subtle but important differences. For example, in the sector column, not everything produced by the rolling stock sector is rolling stock (although most is), and in the product row, all rolling stock is not produced by the rolling stock sector. This is because businesses may produce goods and services for more than one sector, and the destination for a good or service can be as an intermediate input into the production of another good or service, or may contribute directly to national production through consumption, additions to capital stock or inventory or export. Some imports contribute to Australian production as a finished product, while the remainder contributes to the supply chain, allowing domestic production to be substituted.

The I-O tables are divided into four quadrants (ABS, 2001) and we are interested in three. The largest block is the intermediate inputs: the goods and services used at product (row) and sector (column) scale, comprising a 113 x 113 matrix (Figure 1). The right-hand columns aggregate production (final demand) and the lower-left rows sum primary inputs including imports. The bottom row contains industry gross added value from which gross domestic product (GDP) is calculated, and the far-right column, total production.

For sector production, all inputs in the top-left matrix describe intermediate use by that sector, or value-chain inputs. Employee wages and salaries, gross operating surplus and mixed income and taxes less subsidies on products and production constitute primary use. This is where each sector takes those inputs and adds value by producing goods and services. Gross value added for each sector equals wages, operating surplus and taxes on production, so equals what each sector adds, less its supply chain inputs. Domestic production is separated from imports in the initial accounts, but imports and exports are brought together in the final I-O tables produced by the ABS.

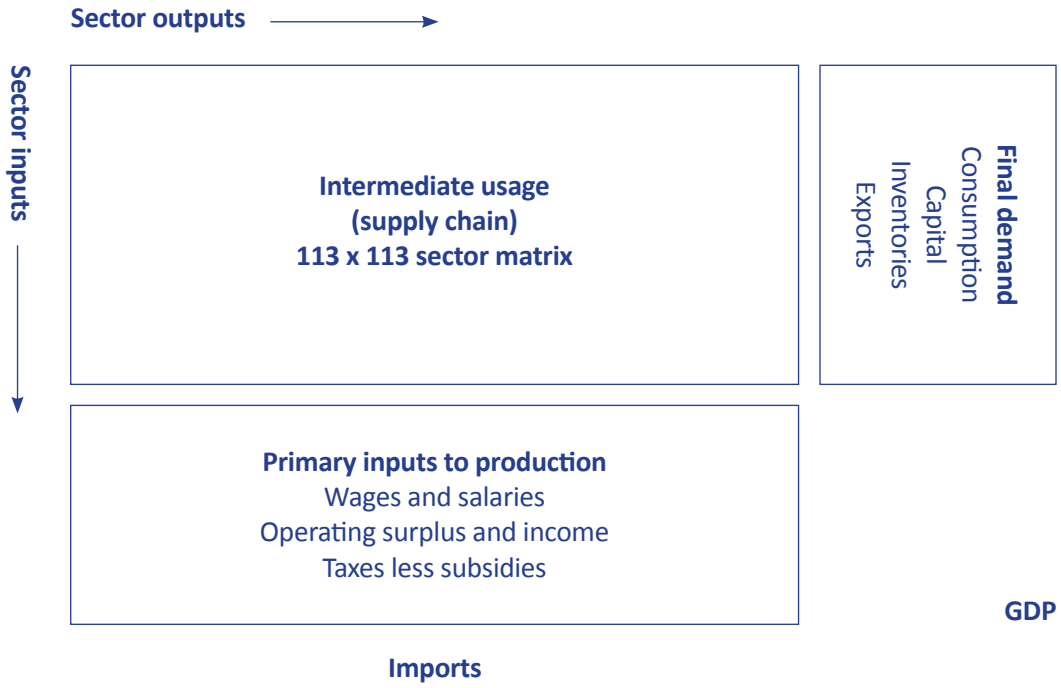

Figure 1: Schematic of ABS I-O tables showing major variables

These complex tables are first constructed for direct intermediate use of goods and services by each sector. The next step calculates indirect plus direct inputs (i.e., it traces the prior inputs to the direct inputs, making the supply chain more complex). This does not change GVA, but does change the mix between industry categories, and between domestic supply and imports. A final set of tables take a further step of assuming that all imports within the supply chain are sourced locally. This provides a scenario for 100% local procurement. Selected data for the rail rolling stock sector is shown in Appendix 1.

Keeping GVA constant between current imports and full domestic production allows the difference between current levels of imports and 100% domestic production to be calculated. From there, the incremental benefits of changes to procurement levels can be estimated. Changes are assumed to be linear and in theory, could be scaled from total imports to totally domestic production. Reaching 100% imports is impossible, because there will always be some domestic transport, wholesale and retail, even if all manufacturing is done overseas.

We have also estimated employment for each sector. The ABS census data offers greater detail, providing data down to the four-digit ANZSIC industry classification (Australian Bureau of Statistics and Statistics New Zealand, 2006, 2013). The ABS employment surveys are more reliable but contain less detail. The difference is because the census tends to underestimate employment because the information is volunteered and not always complete, whereas the more focused, compulsory employment surveys are conducted by phone. The surveys provide the three-digit classification, and the I-O tables are a combination the three and four-digit classifications, especially for manufacturing, so the surveys were used to scale the census results proportionally to conform with the survey totals.

The census was held in August 2016 and the average employment survey results from the four quarters of 2016–17 were used to conform with the financial year results for the I-O tables (ABS, 2017a, 2019b). Induced employment from employee compensation was also calculated (i.e., wages and salaries). The latest ABS Household Expenditure survey data for 2015–16, specifically the middle quintile of income, was used to estimate that 78% of gross household income was being spent on goods and services (ABS, 2017b). This expenditure was divided by $ per EFT for Australian production based on the household consumption column in the I-O table (Appendix 2).

Rolling stock manufacturing and maintenance

We consider the national I-O data for this sector to be representative of the manufacture of passenger trains and trams in Victoria, with some qualifications. Rolling stock is manufactured for freight and passenger purposes, but the accounts do not specifically separate the two. It is possible, however, to judge relative proportions by looking at the sectors that rolling stock is supplied to. Some is obviously freight, contributing to iron and coal mining, whereas other rolling stock going to lease is more likely to be passenger vehicles. Based on employee numbers, approximately one-quarter of production occurs in Victoria.

One way to view a train or tram is via the components that make up a single vehicle. Data provided by DoT describes a generic tram, showing the capital cost for the main components (Figure 2). An electric train is similar in structure. A diesel train will contain most of the components but with a combustion engine and different configuration. Train cars consist mostly of a body, components and bogies, with smaller amounts of most other components. Undercarriages (bogies and wheelsets) are sometimes also made separately, serving as inputs in the supply chain. Carriages are simpler and flat freight cars are the simplest. Maintenance is required for all stock, and the nature of maintenance differs according to type.

In 2016–17, the rolling stock manufacturing and maintenance sector produced $2,204 million rolling stock, $514 million non-residential property operations and real estate services, and $200 million professional, scientific and technical services totalling $3,016 million. Property and real estate consist mainly of rolling stock leasing, and professional, scientific and technical services relating to testing and certification of standards. This is the simplest representation of supply I-O tables omitting inputs in the supply chain. For rolling stock product produced by any sector, locomotives and trams (including wheelsets and bogies) totalled $1,328 million, with $409 million imports, totalling $1,737 million (this figure from the ABS detailed supply tables is slightly different to the I-O tables). Imports ($404 million) amount to 24% of basic manufacturing or 76% of local production. Repair and servicing totalled $1,068 and included no imports.

Most rolling stock production is used by other industry, mostly in freight transport or added to private fixed capital, as in leased rolling stock for public transport. The accounts are quite varied, with rolling stock contributing to diverse industries. Most inputs to other industries will be freight cars, but some small contributions are hard to explain. The large contributions to rail transport ($714 million) are mainly repair and maintenance. Private gross fixed capital ($781 million) represents commercial freight and government lease-back under public-private partnership (PPP) arrangements. Some of this may include private freight lines, but most of this activity is linked to industry sectors such as coal and iron ore mining.

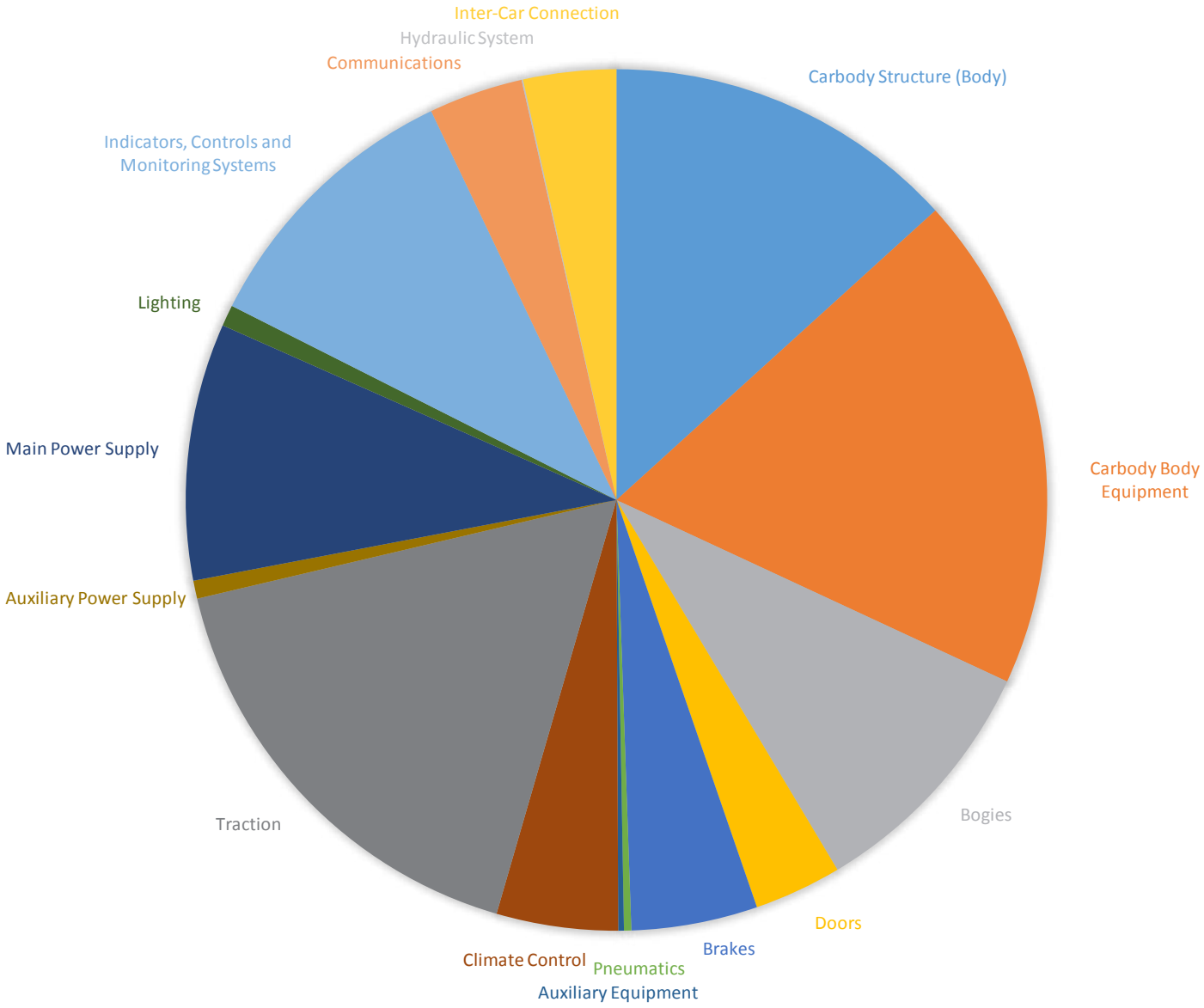

Figure 2: Generic tram, capital cost of components (percent). Data provided by DoT.

In the I-O tables, the $2,204 million of rolling stock product was produced by the rolling stock sector and $170 million by the rail transport sector. If the direct imports of $404 million in rolling stock are sourced through the whole supply chain, the total increases to $567 million. For total production of $3,016 million, gross value added (GVA, primary inputs) included $433 million employee wages (13%), $146 million operating surplus and mixed income (4%), and taxes and subsidies total $30 million (1%). The total GVA figure for the sector was $595 million. The gross operating surplus of 4% reflects the relatively low margins operating in the rolling stock industry. The final cost of a train or tram is close to the basic supply cost, comprised of intermediate input and GVA.

The next stage of the supply chain in the I-O tables contains the domestically-sourced inputs to rolling stock manufacture and repair. In this formulation, the I-O tables need to balance both sides of the I-O matrix in order to balance the national accounts. GDP is made up of the contribution each sector makes to a product or service in achieving total production, less its inputs. For a guide, Australian production in 2016–17 was $5.3 billion and GDP $1.7 billion, showing that on average $3 was spent to produce $1 of GDP.

The domestic inputs into the supply chain, omitting imports and totalling $1,839 million, are shown in Figure 3. Rolling stock manufacturing, professional scientific and technical services, structural metal product manufacturing and finance are the top categories. While the simplest representation has three products, 19 sectors each contribute more than 1% to intermediate production ($18.4 million or more).

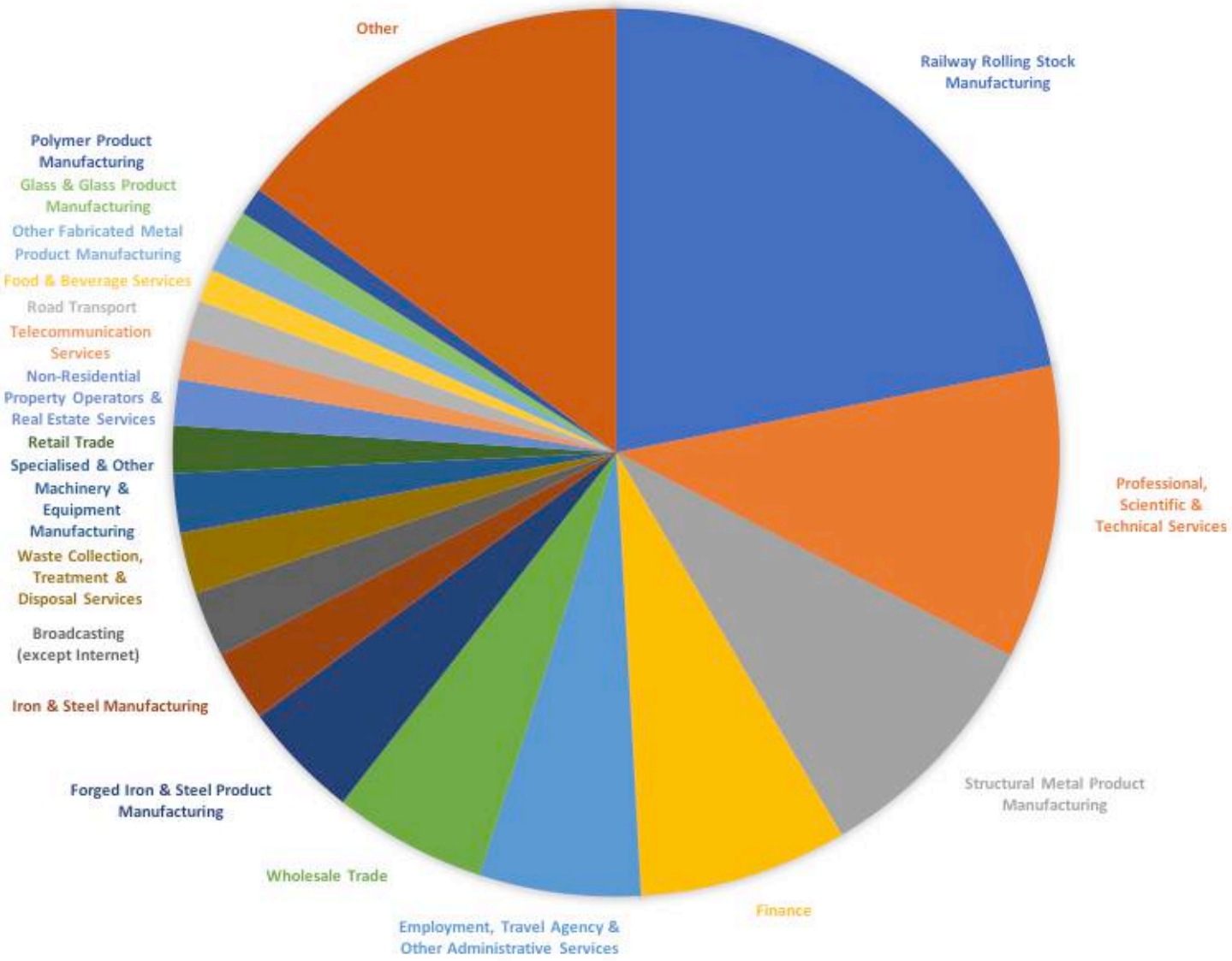

Figure 3: Intermediate (supply chain) inputs to the rolling stock sector excluding imports (percent). Source: ABS I-O tables.

The ABS considers that all imports can be sourced domestically. The I-O tables allow imports to be represented as domestic production in two ways: (1) the intermediate inputs are directly produced locally, and (2) by assuming all imports in the supply chain producing the components in (1) are produced locally. This is represented by the increase in imports from $404 million to $567 million. The largest area of imports was rolling stock manufacture ($118 million), followed by specialised and electrical equipment ($91 million and $74 million). Non-ferrous metals were 50:50 ($47 million), possibly suggesting procurement quotas, and basic chemicals ($25 million) as well as high tech equipment ($22 million) exceeded $20 million.

When these imports are included in the domestic economy, the domestic supply chain becomes slightly more complex, but the order of the top five inputs remains constant. Employment and administration swap places and the smaller inputs are rearranged. The difference between the two scenarios of existing and full Australian production is shown in Figure 4. All sector categories above 1% intermediate content ($5.7 million) are manufacturing, except for professional, scientific and technical services.

Import substitution can be considered as an approximate proxy for local procurement, but the actual percentage depends on what total is being considered. If pegged to total production of $3 billion, then imports of $404 million would constitute 88% local content. Currently, for rolling stock the intermediate supply chain is 61% of production, but if all production becomes domestic, the supply chain takes up almost 80%. If compared to the basic cost of a train or tram, then the total will be the basic price agreed to with the OEM. This will contain the capital costs similar to Figure 2 inclusive of components, wages and margins, but may not include some of the services included in the supply chain, which may be 'hidden' in the costs – for example, wholesale costs, training costs, administration costs and transport.

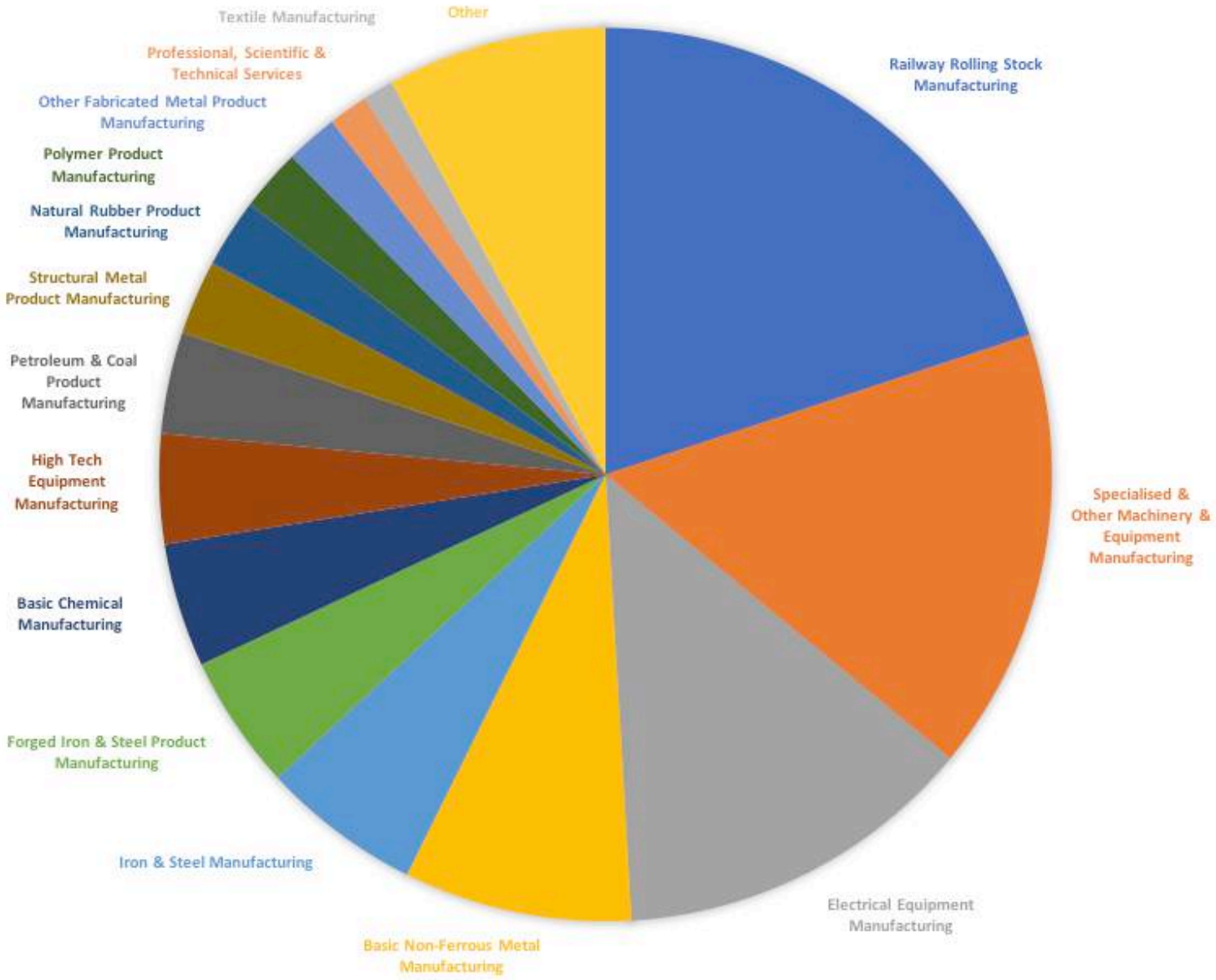

Figure 4: Intermediate (supply chain) import replacement for the rolling stock sector (percent). Source: ABS I-O tables.

The detailed supply tables from the ABS separate manufacture from maintenance and repair. These identify domestic manufacture of rolling stock of $1,328 million at basic prices with imports of $409 million making up 24% of total manufacture. The full supply chain effect is $587 million, or 32% of total manufacture. The recent manufacture of rolling stock in Victoria has approximately 60% local content (Appendix 3).

Nationally, about half of all imports go straight into private capital, which is likely to be whole imported trains going straight to lease. Rolling stock imports into intermediate supply (i.e., the supply chain) totalled $148 million. Percentages of this and other imports in the rolling stock supply chain are shown in Figure 4. Imports are dominated by heavy and advanced manufacturing sectors.

Rolling stock employment

From the ABS 2016 census, national employment in the rolling stock sector was 3,477. Deloitte (2013) reported employment of 3,972 for just over $3 billion production based on 2011 census data. On the surface this would suggest a decline, however, using the employment 2016–17 survey data for transport manufacturing scaled to the 2016 census, total full-time equivalent (FTE) positions for rolling stock manufacture and maintenance were an estimated 4,370. Using the same method to assess change over time historically was not attempted due to the policy-induced changes in automotive manufacturing over the past decade, which fundamentally alters these proportions.

For Victoria, the picture is less clear. There were 861 employees identified in the census, adding up to 1,082 if the same pattern of underestimation that exists nationally is applied. For the employment survey at the state scale, only three sectors are collected: manufacturing (no further details), motor vehicles and parts manufacturing, and other transport manufacturing (aircraft, trains, ships and boats). Approximately one quarter of manufacturing in other vehicles is in Victoria, so 1,100 employees might be a reasonable estimate.

Employee wages comprise 13% of sector production, with more jobs embedded in the supply chain. Although we do not have detailed data on skills matching these inputs, the diversity of tasks in Figures 3 and 4 require a wide range of skills. In some areas, the skilled trades dominate – rolling stock manufacture, structural metal products, specialised machinery, electrical, iron and steel and non-ferrous manufacturing – and the sector also utilises professional scientific and technical skills, finance and administration. To make this all work, managerial skills are also important.

To estimate the direct and indirect contribution of labour to the supply chain, employment for all industry activities from the 2016 census was compiled into the same 113 industry categories in the I-O tables. Compensation per FTE position was then estimated for each category, along with the ratio of jobs per $million of domestic production. The rolling stock sector is confirmed as capital intensive with one job per $690,093 produced, with average employee compensation of $99,075. Alternatively, professional, scientific and technical services are more labour-intensive with $220,807 job/production for an average employee compensation of $61,059.

Total employment for the sector supply chain and production is 8,925 and the distribution is shown in Figure 5. Based on rolling stock employment of 4,370, that is an additional 1.0 job for every rolling stock job. Rolling stock employment comprises 31%, and professional and scientific and technical services employ an estimated 891 people at 10%. The change in distribution between Figures 3 and 5 is due to changes in balance between capital and labour-intensive sectors.

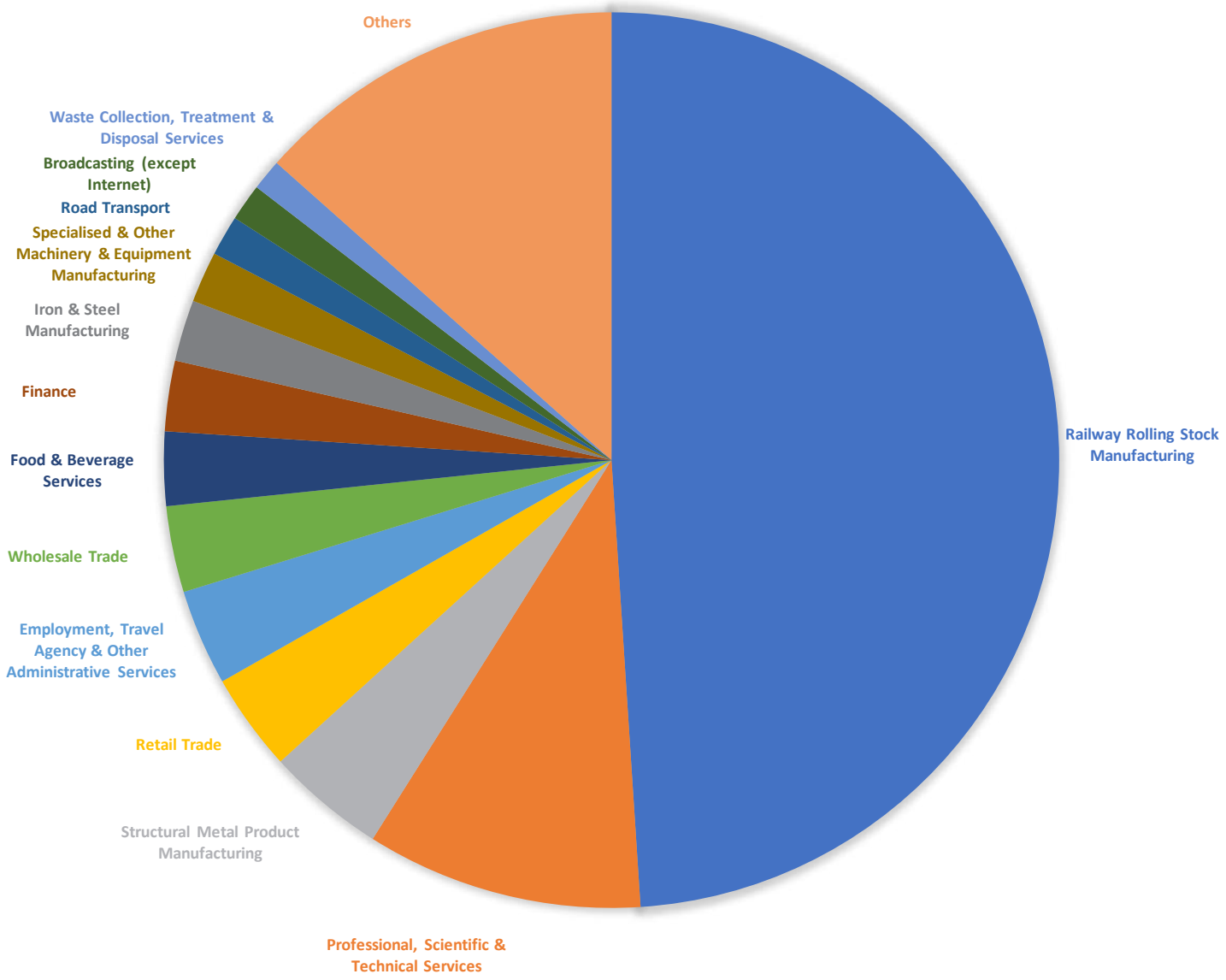

Figure 5: Primary and intermediate employment in the rolling stock sector excluding imports (percent). Based on data from 2016–17 ABS I-O tables and the 2016 census.

The compensation paid to employees will also result in additional household expenditure, with the resulting consumption supporting induced employment from the sector. Most of this will be spent close to employees' places of residence rather than business. Based on 78% of gross wages being converted into consumption, another 2,345 jobs would be supported, or 0.5 jobs for every job in the rolling stock sector.

Replacing $567 million of imports with domestic production would employ an estimated additional 164 rolling stock jobs and 1,495 in other industries, with induced employment from worker compensation producing another 338 jobs. If all production was domestic (not just rolling stock), the supply chain results would result in an increase of 742 induced jobs rather than 338.

The sectoral distribution of primary and intermediate jobs created by 100% import replacement is shown in Figure 6. Most projected employment increases would occur in the manufacturing sector, with approximately 50% in advanced manufacturing.

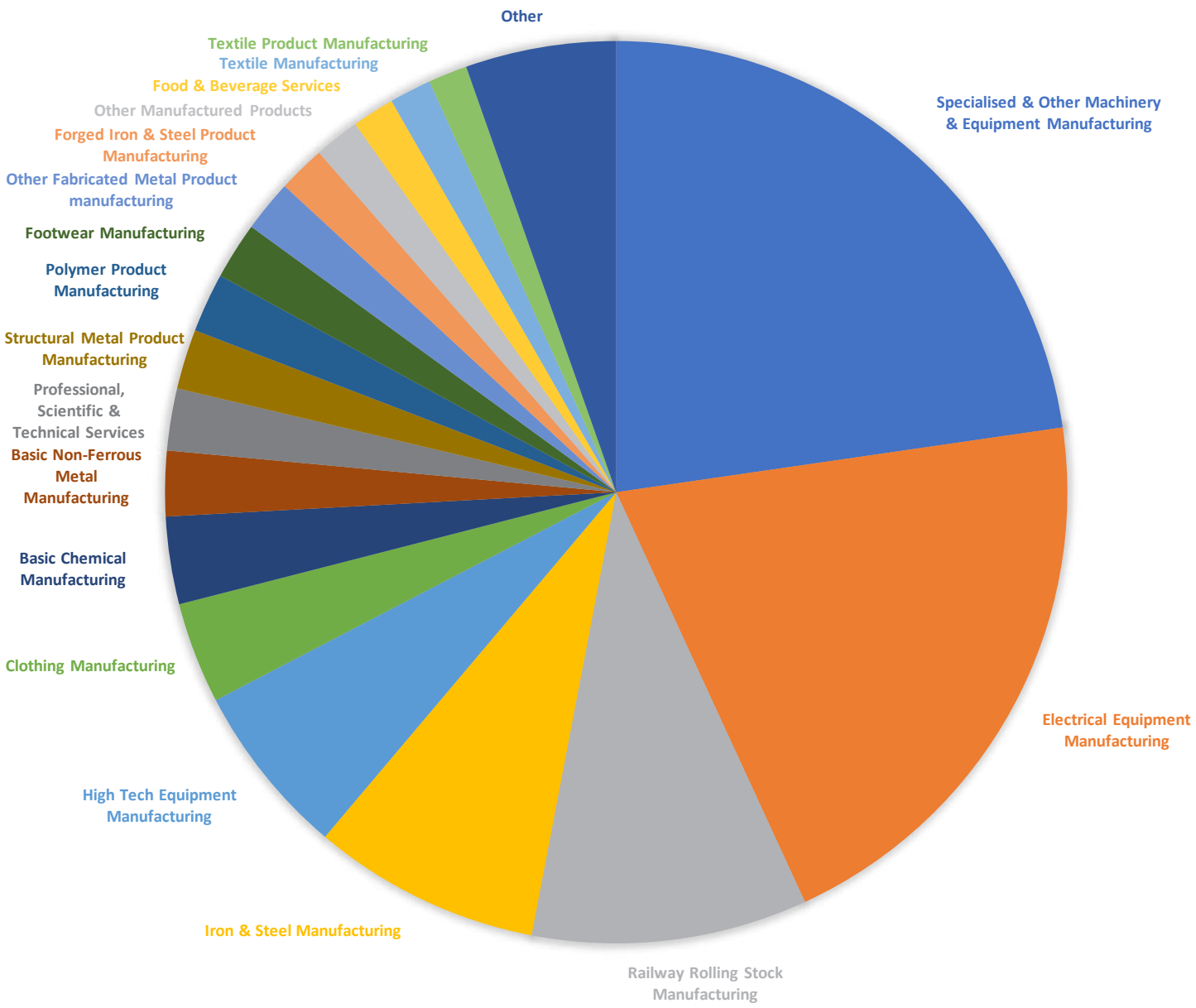

Figure 6: Increased employment in the rolling stock sector based on total import replacement. Based on data from 2016–17 ABS I-O tables and the 2016 census.

These calculations serve as a proxy for increased procurement at the national scale. How closely this represents public transport rolling stock in Victoria depends on how closely we consider the example of the generic tram in Figure 2 (p9), or how close a generic electric train or diesel passenger train is to the national average. While we can only give a qualitative response to this, the answer is that employment in passenger rolling stock is likely to be higher due to its greater complexity compared to freight stock. The details in terms of procurement will depend on the actual mix of imports within a particular build. Note that this only holds as long as the structural composition of the sector is not affected. A large economic shock can cause 'crowding out', competition between sources of supply and demand for labour, or changes to the price structure would alter the I-O matrix, making the current industry structure no longer valid.

Bus manufacture

In 2016–17, national supply of vehicles with 10 or more passengers was $938 million, $875 at basic (producer) prices, made up of $626 million Australian production and $250 million imports. Household consumption was $96 million and capital formation by private companies $830 million. The latter will be mainly bus company fleets, whereas the former will be small buses for mainly private use. Bus manufacture is about 71% local content at basic prices.

Buses are part of the sector Motor Vehicles and Parts; Other Transport Equipment Manufacturing sector, which has a total supply of $12,341 million within the full I-O tables. With buses comprising <8% of the total sector, it is not possible to accurately quantify inputs or to develop an employment profile of the supply chain.

Rail transport

The primary functions within the rail transport sector are more diverse than for rolling stock manufacturing and maintenance. The sector is divided into passenger and freight but also contains storage, operations and some infrastructure. The latter three, combined with passenger operations, describe the public rail transport sector in Victoria but omit tram operations (whereas rail manufacture includes light rail manufacture). In 2016–17, national sector production totalled $14,944 million. Industry used $4,615 million and households consumed $3,808 million. Capital formation was $490 million and $6,024 million went to exports. Household consumption and a small part of export (related to international tourism), represents the passenger component; with the remainder relating to freight. More detailed supply data released in mid-November 2019 show that urban passenger railways domestic production was $4,305 million and imports $308 million, and interurban passenger $632 million and imports $304 million. Imports are almost all international travel consumed by households.

Domestic passenger travel was state-subsidised by $3,026 million in urban areas and $308 million in regional areas.

Diverse intermediate inputs into rail transport (the supply chain) totalled $7,196 million (Figure 7). Construction services provided $1,183 million, transport support services and storage $750 million and rolling stock manufacturing $714 million. The non-residential property operators sector refers to leases on rail infrastructure, mainly track. GVA is 45% of total production, comprised of $4,845 million on employee compensation (31%), $2,127 gross operating surplus (14%), -$28 m tax/subsidy on products (<1%) and $85 million tax/subsidy on production (1%).

Rail transport has a GVA of 47%, comprised mainly of wages and salaries (32.4%) and an operating surplus of 14.2%. Imports are 3.9% of total production. It is not possible to separate out the public transport component of the operating surplus, but the sector overall has a higher surplus than rolling stock manufacturing. It is therefore appropriate to say that rolling stock manufacturing, while not highly profitable in itself, contributes to greater productivity within the transport services sector.

Imports into the supply chain totalled $583 million, 41% of which is fuel, followed by structural metal and specialised equipment manufacturing. There is no simple way to separate production into passenger and freight, given the ABS provides these details for the supply of rail transport, but not its production.

There is limited scope within the sector nationally to substitute domestic production for imports. However, there will be strategic opportunities on a case-by-case basis where manufacturing inputs can be substituted for, as already seen for rolling stock manufacturing. Some of the sectors in Figure 8 are also clearly associated with the upkeep and refurbishment of rolling stock, so government procurement can play a role there.

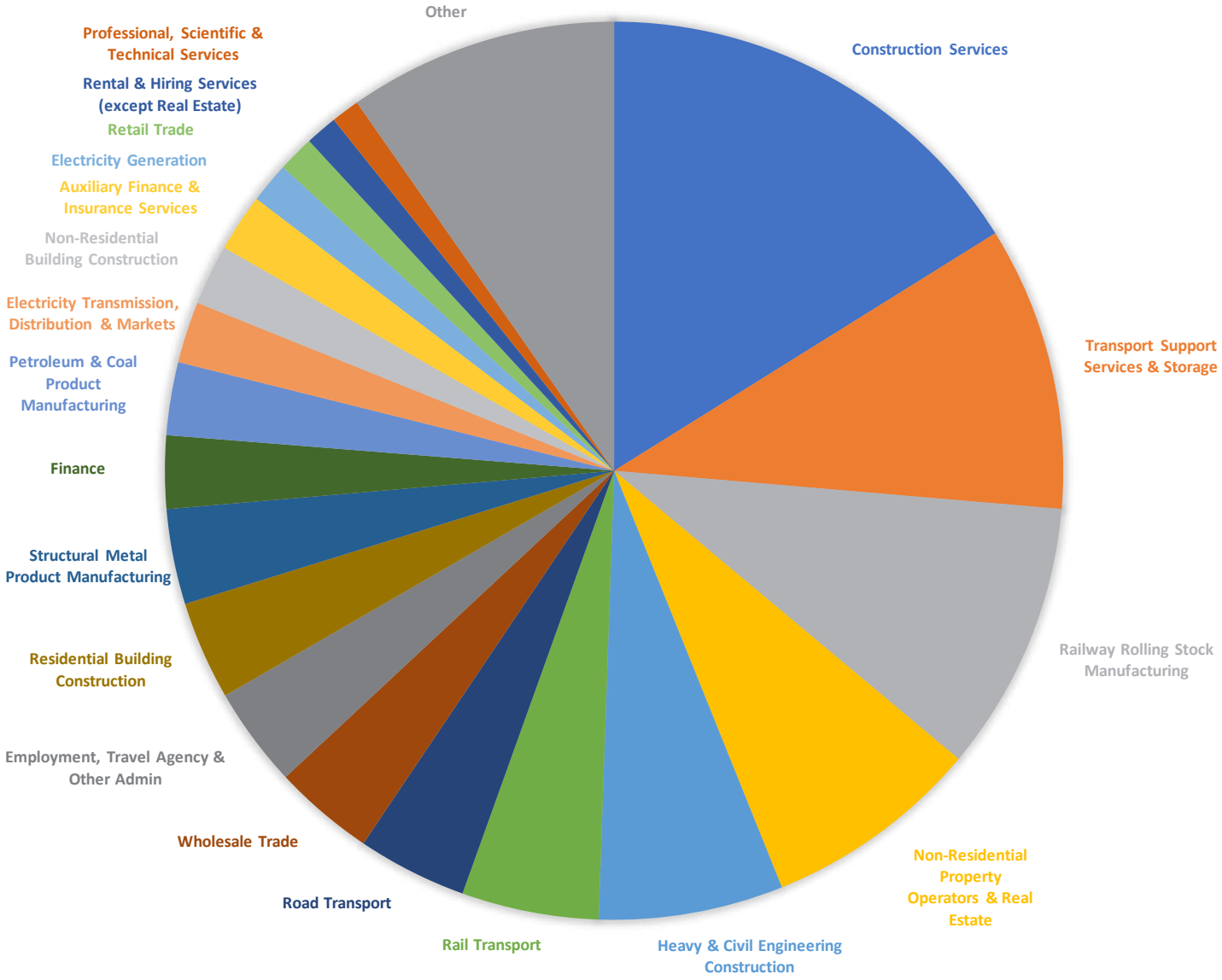

Figure 7: Intermediate (supply chain) inputs to the rail transport sector excluding imports (percent). Source: ABS I-O tables.

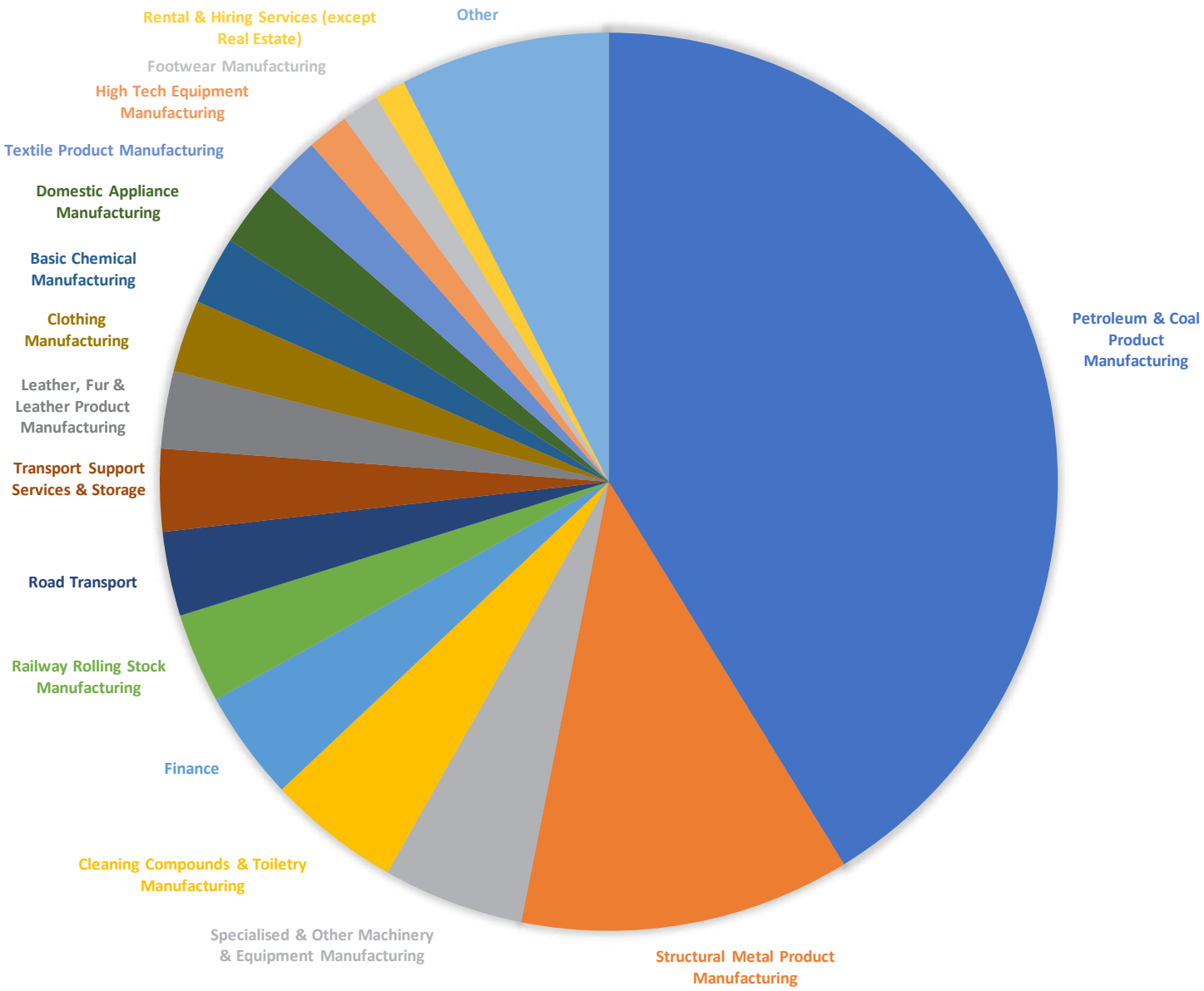

Figure 8: Intermediate (supply chain) import replacement for the rail transport sector (percent). Source: ABS I-O tables.

Rail transport employment

Total employment in the sector was 43,704 when adjusted for those who failed to identify specific modes within transport services, compared to the 42,971 who identified rail. Most employment is associated with passenger rather than freight. Employment within the supply chain is estimated to be 18,290, for a total of 61,944 in the sector and supply chain (allowing for rail transport in the supply chain). The sectoral distribution of direct and supply chain employment is shown in Figure 9. Induced employment is 17,837 jobs. For every job in the rail transport sector, there is roughly 0.4 each of an FTE in the supply chain and in induced employment.

Employment is also recorded at the state scale, but separating out passenger rail from freight is difficult because of the many who fail to identify which type they are employed in. Nationally 62% fail to do this, and of the remainder, passenger rail occupies 62%. At the state scale, 40% do not identify their mode of rail transport and 81% of the remainder do. This would result in 5,452 people employed in the passenger rail sector in Victoria.

The 3.9% imports out of total production translates into a projected difference of 1,259 FTE jobs in terms of supply chain employment nationally. The distribution of employment is different to that for cost of production (Figure 10). Petroleum and coal product (diesel fuel) moves from the largest import to fifth for displaced employment, whereas clothing manufacturing moves from tenth to first.

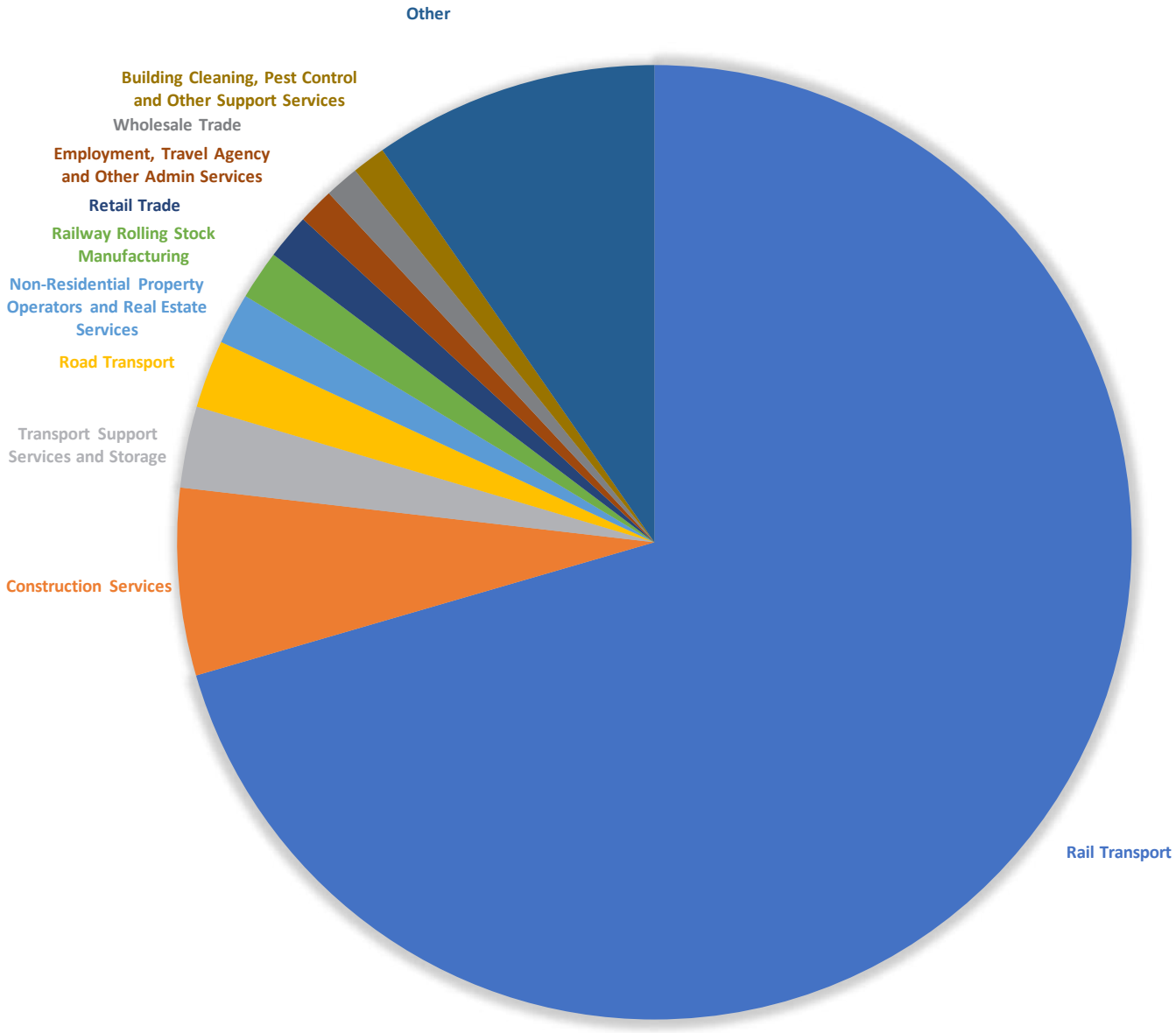

Figure 9: Primary and intermediate employment in the rail transport sector excluding imports (percent). Based on data from 2016–17 ABS I-O tables and the 2016 census.

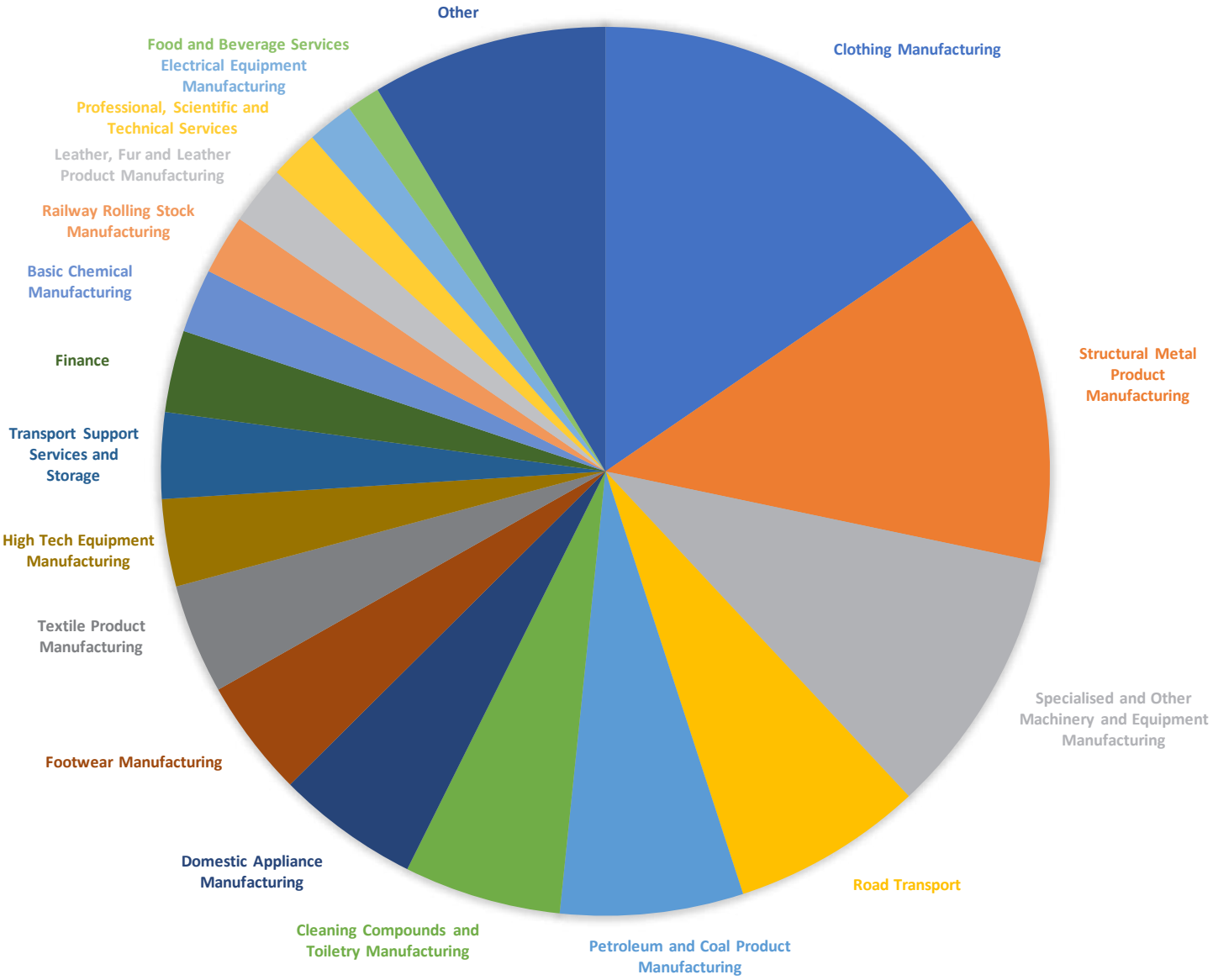

Figure 10: Areas of projected employment increases in the rail transport sector based on total import replacement. Based on data from 2016–17 ABS I-O tables and the 2016 census.

Opportunities to increase employment due to import substitution in the supply chain are limited. Supply chain inputs such as structural metal, specialised machinery, rolling stock and high-tech equipment have been identified as potential procurement opportunities for rolling stock manufacture and it makes sense to link the input side of rail transport to this. The second area for employment is in uniforms and safety clothing, evidenced by clothing and footwear manufacture, textiles and leather sectors in the supply chain. However, to put that into perspective, total import replacement would directly employ about 400 FTE in manufacturing, 350 in clothing and 100 in cleaning products, with approximately twice those numbers in indirect and induced employment.

Bus and tram transport

Bus and tram transport are part of the road transport sector in the I-O tables, which is dominated by freight transport. Demand also differs significantly between passenger and freight, so the analysis carried out for rail transport cannot be repeated. More detailed figures on supply released in mid-November 2019 for 2016–17 show that for interurban and long-haul bus transport, domestic production was $1,714 million and imports $427 million, and for urban buses and tramways, domestic production was $4,016 million and imports $195 million. Imports are Australians travelling overseas, and exports of road transport represents international tourism in Australia. Subsidies for interurban travel totalled $97 million and urban travel $997 million. Household expenditure on interurban transport was $1,586 million. For urban transport it was $1,598 million with government expenditure of $1,305 million. As total household expenditure on road transport is close to $13 billion, this provides further evidence for not being able to separate out the passenger component.

By scaling up the census employment figures by the employment survey data, we estimate that nationally, urban bus and tramways services employment was 41,944 and interurban and rural bus transport 6,719, larger than the whole of the rail sector (freight plus passenger). The Victorian component of this, based on all passenger transport (buses plus taxis), is approximately 30%.

The opportunity to replace some imports through procurement will be similar to those for rail transport, where most opportunities lie with aligning procurement for the manufacturing, maintenance and repair aspects of the sector with those involved in the manufacture of rolling stock. The international travel component is not substitutable. The net gains will be small compared to manufacturing, but will support some areas of manufacturing.

Testing procurement strategies on employment

A major public benefit of government spending through procurement is seen as job creation. Less headline worthy, but just as important, is the overall sustainability of employment. This includes the ability of industry to manage from project to project when demand is uneven, and to adjust to industry changes driven by costs and changes in technology.

The I-O tables provide a snap-shot of industry in time, omitting any dynamic elements, limiting the capacity to make projections about future change or predict the impact of specific interventions. Estimates of change are valid, so long as the sectors being investigated are relatively homogenous with respect to the specific aspects being changed, and that these changes do not fundamentally alter industry structure (i.e., they are marginal).

The previous sections have provided an analysis of rolling stock manufacture, maintenance and operations sectors at the national scale. We used the ABS I-O tables for 2016–17 combined with the 2016 Census employment data, the ABS Quarterly Employment Survey and the ABS Household Expenditure Survey to build up an understanding of the supply chain and supply chain employment for rolling stock manufacturing and maintenance and rail transport nationally. Data availability for bus and tram transport operations and employment is limited. We argued that data at the national scale is relevant for rolling stock manufacturing at the state scale because of similarities between different types of rail rolling stock. Further disaggregation of the other sectors has not been possible because of the mixing of freight and passenger transport.

Two types of intervention can be tested:

1. Direct substitution of imports in the value chain
2. Changes in production with different levels of imports in the supply chain.

Both are estimated by changing key inputs in the tables modified to estimate primary, intermediate and induced jobs.

Direct substitution of imports in the supply chain was carried out for most of the sectors in Figures 6 and 10. Table 2 shows the estimated primary, intermediate and induced employment for each $1 million import replacement. All the inputs in the value chain are assumed to be procured locally with no imported components. Because this represents a supply chain, the results need to be interpreted carefully. For example, railway rolling stock manufacturing can be an input into the supply chain, where bulk components (e.g., bogies) are imported to build trains or trams. This suggests that for every $1 million import replacement of such components, 3.7 jobs would be created, but only 0.3 in the rolling stock sector directly and 2.6 through the supply chain. Bogies themselves are made up of other components from iron and steel manufacturing, forged iron and steel and so on, and each have their own employment profiles.

Table 2: Estimated jobs created for each $1 million import replacement in selected capital inputs and support services for the rail rolling stock manufacture and transport sectors. Note: Table contains rounding errors.

Sector	Imports ($million)	Employment	Primary	Intermediate	Induced	Total
Manufacturing inputs rolling stock sector						
Railway rolling stock manufacturing	113	164	0.3	2.6	0.8	3.7
Specialised and other machinery and equipment manufacturing	91	377	1.0	2.9	0.9	4.8
Electrical equipment manufacturing	74	339	1.6	2.0	0.8	4.4
Basic non-ferrous metal manufacturing	47	39	0.1	0.9	0.5	1.5
Iron and steel manufacturing	33	135	1.5	1.4	0.7	3.6
Forged iron and steel product manufacturing	28	28	0	2.8	0.6	3.5
Basic chemical manufacturing	25	52	1.0	0.1	0.5	1.6
High tech equipment manufacturing	22	103	3.7	0.6	1.0	5.3
Petroleum and coal product manufacturing	21	7	0.1	0.8	0.4	1.2
Structural metal product manufacturing	15	36	0.0	2.7	0.6	3.4
Natural rubber product manufacturing	14	13	0.1	2.5	0.6	3.2
Polymer product manufacturing	13	35	0.4	2.0	0.7	3.1
Other fabricated metal product manufacturing	11	31	0.1	2.6	0.6	3.2
Other manufactured products	4	27	1.7	2.4	0.8	4.9
Textile manufacturing	6	25	0.7	3.6	0.8	5.1
Clothing manufacturing	5	60	7.2	2.0	1.3	10.5
Textile product manufacturing	6	23	0.7	3.7	0.9	5.2
Support services rolling stock sector						
Professional, scientific and technical services	8	37	1.3	2.4	1.1	4.8
Food and beverage services	2	25	0.0	2.7	0.6	3.3
Manufacturing inputs rail transport sector						
Petroleum and coal product manufacturing	241	84	0.1	0.8	0.4	1.2
Structural metal product manufacturing	69	162	0.0	2.7	0.6	3.4
Specialised and other machinery and equipment manufacturing	30	123	1.0	2.9	0.9	4.8
Cleaning compounds and toiletry manufacturing	28	72	0.4	2.0	0.7	3.1
Railway rolling stock manufacturing	19	27	0.3	2.6	0.8	3.7
Leather, fur and leather product manufacturing	16	27	0.7	3.7	0.9	5.2
Clothing manufacturing	15	195	7.2	2.0	1.3	10.5
Basic chemical manufacturing	14	29	1.0	0.1	0.5	1.6
Domestic appliance manufacturing	14	65	0.7	3.3	0.9	4.8
Textile product manufacturing	12	50	0.7	3.7	0.9	5.2
High tech equipment manufacturing	9	40	3.7	0.6	1.0	5.3
Footwear manufacturing	8	54	3.6	3.9	1.4	8.8
Support services rail transport sector						
Finance	23	38	0.3	2.8	0.9	4.0
Road transport	18	87	0.0	2.1	0.5	2.6
Transport support services and storage	17	39	0.3	3.2	1.0	4.5
Professional, scientific and technical services	5	22	1.3	2.4	1.1	4.8
Food and beverage services	1	15	0.0	2.7	0.6	3.3

In this way, it is possible to drill down into supply chains to look at different inputs and how their procurement within a large acquisition may affect local industry and employment. Most of the manufacturing inputs are capital intensive, some more so than others. Basic metal manufacturing, petroleum and coal are the lowest employers, with their production based on automating extraction and supply of bulk products.

Clothing manufacture has a high labour content, a major reason why it is sourced off-shore. The two main uses for clothing products in transport are uniforms and safety clothing. The former is more conventional, but the latter is fast becoming a highly specialised area of manufacture. The benefits of comfort and safety in terms of OH&S benefits can easily outweigh price margins (this realisation often only comes after the fact). Likewise, textiles for rolling stock furniture, where specialised fabrics need to look fresh and be comfortable for years in challenging conditions, can be highly specialised. Under this degree of specialisation, the sector-wide employment averages for general clothing (e.g., 10.5 jobs per $million) may not hold, but the manufacture of such products may reflect the general averages for skilled manufacture, in the range of 3 to 5 jobs per $million. The more complex manufactured components have higher rates of employment. Specialised, electric and high-tech equipment manufacturing employs between 4.4 and 5.3 people per $million of production.

This creates a tension between cheaper imported prices with lower wages embedded in the production process, and a local price that contains a higher wage component. Estimates locally and internationally suggest a local price premium, which is likely to be greater for higher labour content manufactures (e.g., in fabrics). We do not have enough information to conduct a cost-benefit analysis of the above alternatives for specific industries, however the following points can be made:

- Import replacement in the supply chain does not change national productivity because the industry delivering the final product does not 'care' where it comes from in economic terms – they still build the end product. Increases in primary employment in Table 2 come from sectors that use their own product in the value chain, whereas intermediate employment comes from other parts of the value chain. Despite this, local employment will create further jobs because employees spend their wages, but changes in an industry sector in a single state will have little impact on the national accounts.
- The creation of local jobs may be justified where the overall benefits, monetary and nonmonetary, outweigh the costs. This may not be the case for capital-intensive industries – for example, basic non-ferrous metal manufacturing uses aluminium, where import replacement would yield 1.5 jobs per $1 million. Given that most Australian production is fossil fuel-based and international production is hydropower-based, if the costs of carbon emissions are taken into account, domestic production may be more costly because global costs may outweigh local benefits. On the other hand, imports are currently dominated by complex manufactures. Local substitution in these areas of manufacturing would provide direct local benefits because of additional net employment and strategic benefits through industry and skill development.
- We compared the proportion of inputs coming from other sectors to the rolling stock sector against total production for those sectors. Rolling stock consumed less than 1% except forged iron and steel manufacturing, which provided 11.5% of its production to rail rolling stock. This suggests that there is no compelling industry-wide economic case for maintaining local production in rail rolling stock beyond the immediate benefits to the sector itself. There would be, however, an overall benefit from industry development that builds a more complex and resilient supply chain, has higher rates of technological exchange and higher skill levels. This may be achieved by the rolling stock sector becoming more integrated with compatible sectors (e.g., defence, energy, other transport).
- Many of the inputs to rolling stock are specific to that sector. As detailed in Young et al. (2020b), there are general skills that relate to a broad occupational base and those that are attached to specific tasks. The materials in the supply chain have a parallel relationship with this, where most of the components used by rolling stock are purpose built, with their own, sometimes multiple, standards. However, technology clusters, where like technologies contribute to synergistic development, are also highly relevant to complex manufacturing. Battery technology, energy-saving braking systems, polymer manufacture, big data and real-time monitoring are all examples where there is crossover between different areas of skilled manufacturing.

The other aspect of procurement is in maintaining and creating employment. If there has been an ongoing program of acquisition, then new orders of approximately the same size will not create jobs, but will maintain existing employment. A gap in production may lead to lay-offs, and discourage training and other areas of business development. However, new levels of production will increase jobs and the design of local procurement can play an essential part of this. Scheduling and continuity has been raised as an issue for industry (Deloitte Access Economics, 2013).

We used the I-O tables to estimate potential jobs for every $million investment across all four sectors that have a relationship with the manufacture and operations of rolling stock – railway rolling stock manufacturing, motor vehicle manufacturing, and road and rail transport (Table 3). We have previously supplied caveats about the accuracy of such estimates; however, they appear to be consistent with current workforce estimates and turnover. Ground-truthing these estimates cannot easily be carried out without more accurate data on current workforce, annual turnover and content at the state scale.

For rail transport, supply and employment data separating freight from passenger rail was available, allowing the ratio of employment to be estimated (2.02). The same procedure was used to estimate change in employment for interurban bus (0.81) and urban bus and tram (2.20). Motor vehicle manufacturing was also included, but there is too little information available to test the bus component (<8%) for reliability.

Table 3: Estimated primary, intermediate and induced employment increases for every additional $1 million invested in the sector

Sector	Primary	Intermediate	Induced	Total
Railway rolling stock				
With current imports (18.8%)	1.4	1.5	0.8	3.7
All domestic	1.4	1.9	1.0	4.4
Rail transport (urban and interurban trains)				
With current imports (3.9%)	5.9	1.2	2.1	9.3
All domestic	5.9	1.5	2.5	9.8
Motor vehicle manufacturing				
With current imports (21.8%)	3.8	1.7	1.1	6.6
All domestic	3.8	2.0	1.3	7.1
Road transport (interurban bus)				
With current imports (8.1%)	4.0	1.8	1.0	6.8
All domestic	4.0	2.0	1.2	7.2
Road transport (urban bus and tram)				
With current imports (8.1%)	10.9	1.8	2.0	14.7
All domestic	10.9	2.0	2.4	15.3

Note that the figures in Table 3 cannot be directly compared with those in Table 2. Table 2 directly substitutes for imports, which constitutes 19% of total productivity in the rail manufacturing sector, whereas Table 3 represents a $1 million increase in supply.

A generic model for local procurement

Using all of the above pieces of information, we have built a simple model that estimates local employment under different levels of local procurement, from the minimum possible through to 100%. This model is meant as an illustrative example. If employment benefits were needed to assess a specific project, more specific industry and project-relevant data would be required to refine it.

As described earlier, employment generated by local procurement can be separated into three categories: direct employment in the primary industry sector, indirect employment in the supply chain providing goods and services to the primary sector, and induced jobs created by consumption produced by the wages of those employed in the primary sector and supply chain. Great care has been taken to ensure that the integrity of the I-O tables is not being compromised and there is no double counting. If we take total cost of rolling stock as the price provided by the OEM, then this contains everything in the I-O tables, the inputs, GVA and imports. A word of caution comes from a study by Pollin et al. (2015), who report on how local content is being interpreted and managed in the US, finding that nominal percentages can differ widely when verified through I-O models, depending on how inputs are being counted.

The procurement model is informed by the following considerations.

By producing rolling stock, the OEM corresponds with the industry sector in the I-O table. It provides the primary employment in the I-O tables, or direct employment in the sense of working on rolling stock itself. In the I-O tables, with 100% domestic production, industry value added is a nominated 20.2% of total production, comprised of industry margins and local employee wages. Around 13% of the supply chain also constitutes wages and salaries, making up approximately 32% of total production.

When imports are added into the model (approximately 20% of total production), we follow the I-O tables in assuming their origin does not matter much. Employment within the sector itself remains the same when the rolling stock, train or tram is being assembled, and it does not matter much to the OEM at this level of content where components come from. However, as imports increase, and whole components or parts of trains are being imported, then primary employment will also decline as it is replaced by employment overseas. For multi-nationals with vertical manufacturing, this may not matter much as they can still source from within their corporate supply chain.

Imports are increased by decreasing the proportion of the intermediate inputs or supply chain produced domestically by a known amount. In the I-O tables, this is currently at just under 80% of the total. Imports start at zero then are reduced according to the current pattern in 10% increments. This process stops at 12.7% of domestic production in the supply chain. These remaining inputs are aspects such as transport, warehousing, administration and waste collection that would continue even if the rolling stock was fully imported. As fully-imported trains and trams still need to be tested and certified, there is employment within the OEM domestically. In the model, this is estimated as 7.6% of the total, or 20.2% of full production, which may be too high.

This results in variations to direct and supply chain employment, which is calculated in $ per FTE, for each sector in the supply chain and rolling stock sector. Induced employment produced by consumption of the households of the employed is also calculated according to household consumption in the I-O tables. This is a more conservative approach than would be achieved by using the ABS household expenditure survey. This was not attempted because it would be too hard to integrate into the I-O tables in the time available. Induced employment using this method can be considered as a conservative estimate (e.g, it underestimates retail, a high employment sector).

The results are shown in Figure 11 and Table 4. They show that there are 46.5 jobs projected for $10 million capital expenditure at 100% procurement levels that decline gradually to 12.4 jobs at 20%, representing the floor for domestic production. While this estimate may not be strictly true on the ground, the overall pattern represents the rolling stock industry at the national scale. Employment in the supply chain is most affected. The prime, or primary, employer is somewhat insulated, and in the case of global suppliers, can produce rolling stock overseas and finish it domestically.

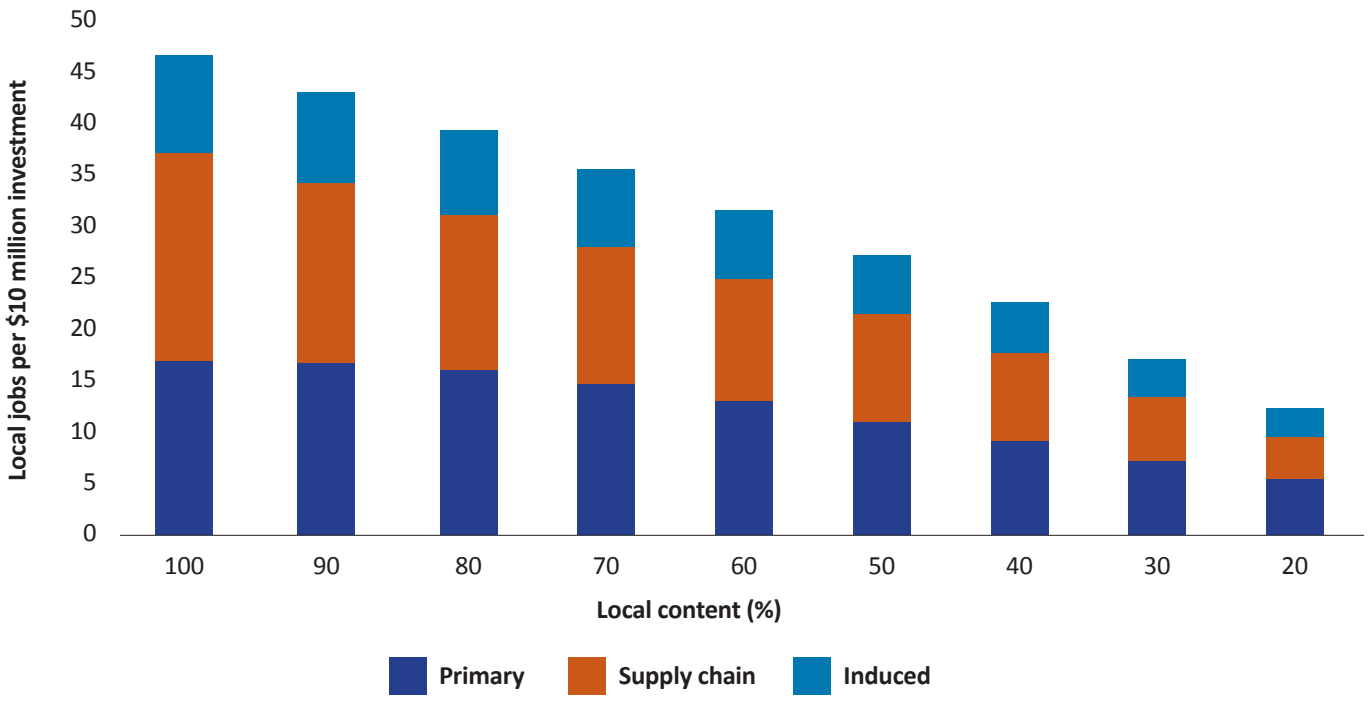

Figure 11: Estimated primary, supply chain (intermediate) and induced employment for nationally averaged patterns of imports in the rail rolling stock manufacturing sector for a $10 million investment

Table 4: Data breakdown for the estimated primary, supply chain (intermediate) and induced employment per $10 million investment for nationally averaged patterns of imports in the rail rolling stock manufacturing sector shown in Figure 11

Local content (%)	Primary	Supply chain	Induced	Total
100	17.0	20.1	9.4	46.5
90	16.7	17.5	8.9	43.0
79	16.0	14.8	8.1	38.9
68	14.5	12.7	7.3	34.4
56	12.3	11.3	6.3	29.9
43	9.6	9.7	5.2	24.4
30	7.2	6.2	3.7	17.1
20	5.5	4.1	2.8	12.4

The results convert into a rough rule of thumb where the primes (OEMs and some Tier 1) are relatively insulated above 70% procurement, and a change of 10% in procurement will result in two FTEs difference in the supply chain and almost one induced FTE, for a total of just under four FTEs. Between 30% and 70%, the decline between rolling stock and the supply chain is similar. With increasing imports, local FTEs reduce even faster, reaching up to 5 FTEs per $million import replacement below 50% local content.

The rate of reduction in supply chain employment under higher levels of import are currently influenced by the national pattern of imports in the I-O tables. Decreases in the supply chain outweigh those in the prime initially, but the difference is subject to the nature of imports. Table 1 shows that at the higher end, complex manufactures are more job-rich than energy- and material-intensive components. The trade-offs made in any large-scale procurement of rolling stock will depend on which components are proposed to be sourced domestically and which are imported. Preferencing supply chain inputs with components that require higher labour inputs will provide more local jobs.

At full domestic production, for every $1 million production the I-O table allocated $330,000 to employment, about 20% to income and taxes totalling 52% of production, the rest nominally being outputs to capital. The employment allocation falls to less than $200,000, as the supply chain and prime go offshore. This suggests that depending on the level of desired procurement, each extra $million in the supply chain can deliver between $200,000 to $330,000 in additional household income to the community, depending on the amount of local content. To obtain a more accurate picture, we would need to work with industry to develop a more detailed picture of the trade-offs between capital, labour and manufactures applicable to passenger trains and trams being manufactured in Victoria. With some manipulation, this could also apply to buses if a supply chain breakdown was available.

A similar project to this was carried out in the US, looking at procurement under the “Buy America” policy for rail cars (Pollin et al., 2015). They had access to a detailed break-down of rail cars and buses, assessing the employment make-up of the components using a model with 440 industry groups, and projects with different levels of imports. In US$ (2012), they estimated 4.9 jobs per $million for 40% local content, 6.3 jobs for 60% local content and 8.4 jobs for 90% local content. Manufacturing wages in Australia at the time were 34% higher (Pollin et al., 2015). Allowing for the exchange rate and wage difference, our employment estimates are about two-thirds those of Pollin et al. (2015). Allowing for the likely higher employment rate in passenger vehicles compared to the national ‘train’ which is a mix of freight and passenger, drilling down into the supply chain with more detailed data may lead to rates of employment approaching those estimated by Pollin et al. (2015) in some sectors.

Employment benefits to the local economy can be balanced against a possible price premium for local manufacture depending on the specific good or service. It has been difficult to obtain objective estimates of price differences at the component level because there is little in the literature, and header contract costs vary due to a range of reasons (e.g., Pollin et al., 2015). Higher mark-ups are mainly associated with labour costs, but may also reflect a need to invest in manufacturing capital (i.e., technology).

From this point of view, procurement negotiating above the mandated 50% local content will result in more local jobs, inputs purchased and extra operating surplus. Even if some of that surplus subsequently goes offshore to multinationals and foreign-owned companies, imports would see almost all benefits going offshore. We have not tried to assess the optimal level of local content versus additional cost due to a lack of suitable data. Additional non-monetary benefits such as increased organisational capacity, and improved training and governance are difficult to contrast with economic efficiency but can potentially offer a greater long-term return on investment if done well.

In the literature review (Young et al, 2020a), we described an analysis by Flaig and Stone (2017) who showed that the neoclassical 'free markets' view of the risks of local procurement on price were largely unfounded. Most modelling was based on the use of tariffs, which are inefficient, affecting all goods or services of that type. When changes in the volume being procured were modelled explicitly in a trade model, the resulting effects on GDP were small. The I-O tables assume no change in GDP between competing imports and domestic supply, but wages spent on household consumption will have a small effect on GDP. Additional funds to industry surplus and capital also lead to improved capacity to undertake R&D, innovation and training. For example, for innovation to be successful, it will largely be funded by surplus and capital, not labour (see the organisational report on reasons why adding innovation to existing staff roles without organisational change is unlikely to succeed).

Intangible benefits of local procurement

The stated goal for assessing government procurement in specific circumstances is value-for-money. The current process for assessing this is required by the National PPP Policy and Guidelines and Partnership Victoria Requirements. The actual test is based on the Public Sector Comparator that assesses whether the state or industry provides better value-for-money over its whole lifecycle. For the High Capacity Metro Trains Project, this came to $3.8 billion against $2.3 billion for a 38% saving (DEDJTR and DTF, 2017). The other requirements were considered to be qualitative. These are detailed in Appendix 3, but concern local content, employment and training provisions.

Despite governments commonly having policies that foster social and environmental procurement, cheapest price is commonly favoured over best value-for-money (Pollin et al., 2015). Of a database of 31 contracts let between 2006 and 2012 in the US where data was made public, 87% chose the lowest price despite having the "Buy America" policy in place that was designed to favour local content and other goals compatible with Victoria's procurement policies (Nguyen and Paterson, in Pollin et al., 2015). This is an acknowledged issue for government procurement generally, and may in part be linked to a lack of clear guidelines and data on how best value may be calculated, taking account of monetary and non-monetary benefits (e.g., Dimitri, 2013). However, there are very different framings for how value for money can be defined and allocated, so tests need to be sensitive to how value is conceived through policy and can be delivered by industry.

In addition to local procurement contributing to wages, operating surplus and capital that would otherwise be offshored, a number of intangible economic benefits from local procurement can be identified. Some of these are already in play as a key part of Victoria's social procurement policy and some relate to training. The economic benefits of training are covered in some detail in the training report. While we do not cover green procurement here (being mostly concerned with where production occurs), given the positive social and environmental benefits of public transport in saving energy and relieving congestion, there are substantial benefits to be gained. Environmental agendas in supply chain logistics, manufacture and operations are driving technological change in the sector, so is a very strong force for innovation (Golightly et al., 2019; Hasanbeigi et al., 2019).

Social procurement policies acknowledge that some people do not have the same access to employment through personal circumstances, or through structural inequities in society and the economy (DEDJTR et al., 2018). While we have concentrated on the number of FTE jobs that may be created through local procurement, the economic benefits of job creation (or sustaining existing employment) depend on the marginal gain/loss for an employee or cohort of employees. For example, an entry from the long-term unemployed, a person with a physical disability who may not gain productive employment otherwise, or young or older person from a disadvantaged socioeconomic background where the cohort faces high unemployment, all represent a large net gain. This can be compared with someone who is moving from one job to the next with a relatively small increment in pay, which counts as a marginal gain.

One often overlooked area of unemployment and low economic activity is the health and welfare of unemployment and the benefits of employment creation.

Health and welfare costs of unemployment

The economic, personal and social costs of unemployment include (Watts and Mitchell, 2000):

- loss of current output
- social exclusion and loss of freedom
- skill loss
- psychological harm
- ill health and reduced life expectancy
- loss of motivation
- the undermining of human relations and family life
- racial and gender inequality, and
- the loss of social values and responsibility.

According to the Ottawa Charter on the Promotion of Health (WHO, 1986), employment is a source of health and wellbeing (Harris and Morrow, 2001). Under this Charter, job creation and retention, if practiced widely enough, will serve as a population health measure.

There is a statistically robust association between unemployment and many adverse health consequences (Jin et al., 1995). From the Household, Income and Labour Dynamics in Australia (HILDA) survey, severe depressive symptoms are partially a consequence of economic inactivity, and are higher if unemployed for an extended period (Bubonya et al., 2017). From the latest National Health Survey 2017–18, the unemployed report 32.2% suffer from depression (with a margin of error of 5.2%), compared to 18.3% for those in employment.

Younger Australians who disengage from education early are almost four times more likely to report poor health, have mortality rates up to nine times higher than the general population, and are more likely to require welfare support and government subsidised services (Black, 2007). Unemployment early in life can have a lasting impact, affecting future employment and health prospects (Janlert et al., 2015).

Involuntary job loss amongst older workers increases morbidity, reflected in both poorer physical functioning and mental health (Gallo et al., 2000). Severe depressive symptoms are partially a consequence of economic inactivity. These symptoms were higher if individuals were unemployed for an extended period. Men's mental health falls as they exit the labour force, while women's health only worsens after they have been out of the labour force for a period of time (Bubonya et al., 2017).

According to Watts and Mitchell (2000) the costs of unemployment are felt in most areas of government, including police, community, welfare and health services. Mohanty et al. (2016) estimated the welfare payments and lost taxation revenue from long-term joblessness cost the federal Government $5.55 billion per year. Joblessness also has intergenerational effects, as children who grow up in jobless families are more likely to be in poverty and experience other difficulties (Blanden et al., 2001; Gregg et al., 2010). Reducing unemployment, therefore, has economic benefits in terms of reducing a range of government costs, many of which may be hidden. Newstart is currently $12,732 per annum for a single person, but also included are health care and a range of other costs.

The largest non-monetary benefit is to the welfare of an individual and their close family. These benefits are indirect, measured economically through the Quality of Life Years (QALY) index, where full quality is 1 and various physical and mental conditions reduce this. QALYs are valued on multiples of average per capita income, equalling $74,873 in 2019 dollars.

Medical interventions are valued at being effective with a level of 1.3 QALY up to 2.4 on the Australian Pharmaceutical Benefits Scheme (Access to Medicines Working Group, 2008; George et al., 1998) with an upper limit of 3 suggested by the World Health Organisation (WHO Commission on Macroeconomics and Health, 2001).

The valuing of QALYs for mental and behavioural wellbeing is difficult, with most studies assessing willingness to pay to be free of such a condition, and for someone with that condition they will subtract a value from 1 (perfect health and wellbeing). The literature also supports the view that many mental health issues are experienced as being more debilitating than physical issues or disease.

For a sensitivity estimate, if we assume that an average cohort of ten unemployed people with the average background mental health effects for the unemployed are provided with employment, for those affected their QALYs improve by 25%, and the average duration of contract is three years. We assume that 32% of people coming in are affected and that employment means that one-third (about 10% in total) of those improve for the duration of the contract. This is an improvement of a 0.75 QALYs. Within the range 1.3 to 2.4 as multiplier, this converts into a benefit per person for the whole cohort of $7,300 to $13,500 each. Alternatively, if we said that everyone was 5% better off in terms of QALYs by working for three years instead of being unemployed, the benefit would be double this. These benefits are only counted over three

years – if long-term, they would be much higher. Put another way, an improvement in wellbeing each year equalling the cost of Newstart would range between 0.07 and 0.13 QALYs. It is reasonable to suggest that it would be worth more than that to most people.

Huang et al. (2018) used the HILDA survey of wellbeing linked to income loss to benchmark the effect of change in QALYs and on perceived wellbeing – that is, they took people's reactions to income loss and compared it to health conditions and wellbeing. When interpreted through utility, they found in the range of $45,000 to $72,000 per QALY in current values, but also found that a change in life satisfaction from 3 to 10 (i.e., a life-changing event such as a job) could by valued at $112,000 per year over two years using the same method. This shows the value people place on their wellbeing.

Usually, the intervention is costed and the change in QALYs measured as the return. These figures, although highly uncertain, show that the benefits are likely to outweigh the cost of modestly-funded employment and training support programs currently available, and by a large amount if the recipient enters long-term employment.

Companies will select the fittest candidates according to their entry criteria, so if they do not have diversity and inclusion goals, may winnow out those who they perceive will not meet skill and productivity levels. Social procurement policies are designed to take those who are vulnerable to the health effects summarised here. If successful, this will yield greater health and welfare benefits than those who have better access to employment, as well as helping to improve general productivity.

There may be gaps in skills and capacity between many people who want to work and companies that want productive workers. Considering young people and the risk of intergenerational unemployment, health costs accrued over a lifetime and measured in QALYs provide good reason for intervention through training and pre-training, which might include basic language and life skills. This also applies to people with special needs. It also applies to those of Aboriginal and Torres Strait Islander heritage who face multiple barriers, some of them health-related. Because of this, the national project Assessing Cost-Effectiveness in Prevention (Vos et al., 2010), assessed Indigenous health separately, setting higher thresholds against which to test cost-effectiveness.

While much of this report has been aimed at the benefits of procurement, if 10–15% of total employment comes from areas of disadvantage, the health benefits will pay for themselves in terms of community health and dollar-equivalent health values.

Usually health interventions are assessed for the cost of the action, which is then assessed for cost-effectiveness against other measures. If the resulting benefits can be assessed, full cost-benefit analyses may be carried out. The above is a sensitivity analysis exploring the nominal health benefits of taking an average cohort from unemployment to employment, and savings to government services are additional to this.

Following the principles established by the Ottawa Charter on the Promotion of Health, targeted training and job creation might be considered as a preventative measure for poor health – especially chronic mental and behavioural conditions. If unemployment or other forms of disadvantage are protracted, other physical conditions associated with low socioeconomic status may also play a role.

Small to medium enterprises

We have been unable to accurately measure the contribution of SMEs in the supply chain compared to OEMs and larger Tier 1 and Tier 2 firms, but given the diverse components that make up the rolling stock supply chain, it can be described as a rich industrial ecosystem. We can separate this ecosystem into three main groups:

1. Firms that see themselves as part of the rolling stock industry where some to all of their production is dedicated to rolling stock manufacture, maintenance or operations.
2. Firms that see themselves as more generic, providing a manufacturing-related range of goods and services, some to rolling stock.
3. Firms that may not identify with rolling stock at all but are included in the I-O tables, such as transport and warehousing. The latter may or may not be included as part of local content rules.

Informal discussions were held with SMEs, including an industry group discussion, site visit and follow-up emails. Various barriers to participation were discussed, covering the following topics:

- Local content
- Contractual risk
- Standards and price
- Relationships and procedural complexity
- Technology and skills.

Local content

Industry participants stated that most content could be sourced locally, consistent with the ABS assumption within the I-O tables where imports compete with domestic production. This is not so in every case, with examples given of inputs that could only be sourced from overseas. Businesses were concerned about transparency, the details of how local content is calculated, and the opportunities for participants in the supply chain to engage in negotiations during the tendering process. They were not convinced that the large players or government buyers were fully aware of local capacity. They were also concerned about local employment and industry sustainability, identifying the inconsistent history of rolling stock procurement as a risk to business continuity. Involvement at the planning stage also helps internal planning for workforce development, new technology and to increase production capacity. Once agreements for supply were set, they were also concerned that orders may be cancelled and local production replaced by imports, with there being little recourse if such events occurred.

What constituted local content, understanding the benefits to the local economy and how value-for-money was being assessed were also questions raised. Addressing these questions became a key aim of the economic work.

Contractual risk

There was considerable discussion about contracts, especially their terms and conditions. Two aspects were raised – stricter terms and conditions, and a greater adherence to 'small print', sometimes punitively. SMEs in the supply chain for rolling stock consider they are bearing the business risks, which are disproportional to the size of the business passed down to them. The terms and conditions (T&Cs) of the procurement contracts are complex and difficult to understand. It imposes legal advice costs onto the SMEs just to interpret the T&Cs of the contract without the certainty of a contract. At least one supplier with capacity said they had withdrawn from the industry because of this.

One written submission nominated six areas where contractual requirements were considered prohibitive:

1. Insurance: required to take responsibility for the customer's negligence that shifts all risk to supplier. Discussions with our insurer resolved this would be uninsurable, thus default to self-insurance.
2. Title: to pass on delivery rather than standard commercial terms upon payment.
3. Security bond: to be held by the customer with unconditional option to cash them in at their complete discretion.
4. Payment terms: 60 days or greater with the inclusion of offset clauses.
5. Defects and warranty: extended warranty period in excess of commercially standard 12 months and the ability to make unauthorised repairs at supplier's costs (recovered from supplier through set-off provisions).
6. Termination: no cause termination or suspension without cost to customer (supplier cannot claim for materials and labour incurred).

Standards and price

The number of standards, sometimes with different ones for the same components and lack of coordination in bringing in new standards was brought up by a significant number of participants. This issue has been raised in a range of forums, and is a focus of the national Transport and Infrastructure Council (Transport and Infrastructure Council, 2016).

SMEs on the receiving end have speculated that buyers have used changes in standards to break contracts (for example, by requiring a change in the source and type of inputs). This can leave an SME with stranded inventories of specialised goods. Buyers further up the supply chain have also used the tactic of negotiating a price for a larger quantity, then later ordered a smaller quantity with a shorter delivery period. In losing these economies of scale, the SMEs ended up with a smaller profit margin or are unable to honour the quoted price. Some SMEs have also had margins squeezed by the weaker dollar, resulting in increased prices for imported materials. If an SME invests in inventory and/or skill training (complex manufacturing requires lengthy gestation period for skill formation), to demonstrate that they have the capability to meet contracts that are unsuccessful or terminated prematurely, they may have to bear the financial loss of excessive inventory and cost of skills training.

Relationships and procedural complexity

What were two-way relationships in the past had become very much one-way, where lowest price had become the main goal instead of the best possible outcome. This required more ethical conduct and respectful interactions between contractor and suppliers, and the ability to discuss issues rather than 'take it or leave it'. Some also felt that there were inconsistencies between the government's aims as the procurer and the prime contractor. Defence was one industry where favourable comparisons were made. There was more clarity from the client about what was expected and better communication related to problem solving, which resulted in better outcomes.

Technology and skills

There is potential for technology cross-over between procurement sectors (e.g., defence to rail), and more technology foresighting would allow firms to plan innovation pipelines. There is some evidence of crowding effects, where previously mining and now infrastructure was taking up some skills (e.g., skilled welders). Many small organisations (<20 employees) can do little more than train for the job, and have difficulty with social procurement targets due to the size of the outlay compared to the size of the business.

Summary

This report looks at the economics of the procurement of rolling stock through the local supply chain and the potential effects on employment. It explores selected benefits of demand-side procurement including social procurement – demand-side procurement is where the government purchases goods or services that the market may not readily provide and is considered a part of innovation policy (Edler and Georghiou, 2007). This requires looking at the non-monetary benefits that can flow through to individuals, business and the community. Ultimately, many such benefits will flow through to the economy but may be too diffuse to be measured.

Any action designed to improve supply chain and workforce capacity needs to account for the international context of the rolling stock industry. The passenger rolling stock industry worldwide is dominated by government procurement, oversupply of production and consolidation of the major players. Original equipment manufacturers are becoming less profitable except for the largest players and vehicle systems manufacturers more profitable. Yet most regions have their own supply chain and governments as procurers will influence to varying degrees the role that local supply chains play in the industry. International trade agreements allow interventions that include support for SMEs, local content requirements, and technological transfer and development. For the multinationals, this is part of doing business.

Key international trends transforming the industry include a change in emphasis from the vehicle to the service being offered to the customer, which links design through to the service being provided during the vehicle's operational life. Improved technology is one key to offering a better service, but cost pressures are also changing the way that maintenance is being carried out, from periodic and breakdown, to condition-based, then predictive using real-time monitoring. This means that life cycle costs need to be considered as part of the economics of procurement, not just the price on delivery.

The local context is informed by the expectation that most of Melbourne's passenger growth over the next decade is projected to take place via public transport schedules. Regional Victoria has planned improvements in connectivity. This will require a steady stream of new rolling stock and refurbishment of existing rolling stock. The challenge for local industry and its workforce is to be part of the transformation of the rolling stock sector while developing the capacity to do so.

We explored the opportunities to develop the local workforce through deeper engagement with the supply chain by taking the input-output tables from the ABS for 2016–17. These table include the inputs to the national economy for 113 sectors, accounting for the supply chain inputs, each sector value-adding through its own production, the total value-add equalling national GDP. The tables also include imports. We added employment data as a factor of production so that a change in domestic production could be used to estimate changes in employment. Changes were estimated for direct employment with a sector, indirect within the supply chain and induced within the community from additional wages.

We used the value-added production and supply chain of the rolling stock manufacturing and maintenance sector to build a generic train/tram, estimating the employment with different levels of domestic production versus imports, and the employment benefits of substituting for different components in the supply chain.

In 2016–17, the rail rolling stock manufacturing sector had a total production of $3,016 million, and employed an estimated 4,370 people directly with 4,555 in the supply chain. This includes freight and passenger, trains, trams and maintenance. For rail passenger operations, $4,937 million of total production employs an estimate of over 27,000 people directly, with about 6,000 in the supply chain. Bus manufacture is over $600 million nationally, and road passenger transport (bus and tram) produces over $5,700 million and employs over 48,000 people nationally. Roughly one-quarter of manufacturing and 30% of operations occurs in Victoria.

The number of jobs created by every additional $1 million investment at current import levels is estimated to be 3.7, with 4.4 jobs being 100% local production. Fully imported trains would be limited to around 1.2 jobs per $million. In the supply chain, replacing imports in capital-intensive manufacturing would produce an estimated 1.2 to 1.5 jobs per $million, but advanced manufacturing produces 3.1 to 5.3 jobs per $million. By carefully targeting the labour-intensive and advanced manufacturing parts of the supply chain, local employment can be maximised.

These figures are conservative. We compared them with a similar US study that modelled passenger rail cars (Pollin et al., 2015). Allowing for exchange rate differences with US$, they estimated about 60–65% more jobs in the supply chain and for employment induced in the community through additional wages being spent. If we had access to similar data for trains, trams and buses in the Victorian public transport supply chain, our jobs estimates would be more accurate and probably higher.

For other parts of the public transport sector, every $1 million in added production would add an estimated 9.3 jobs for rail transport, 6.6 jobs for motor vehicles manufacture (we could not calculate this directly for buses), and 14.7 jobs for road passenger transport (buses and trams).

The key to understanding returns on investment through procurement lies in addressing value for money. This can be interpreted normatively from lowest costs through to being able to quantify social, environmental and strategic benefits to industry and the community. For example, physical and mental health and wellbeing improve when people move from unemployment into jobs. We estimated a health benefit over three years of $7,300 to $13,500 per person using differences in mental health data between the employed and unemployed. Alternatively, if everyone's health was improved by 5%, the benefit would be about double. Potential direct savings include social security (Newstart $12,732 pa) and community support costs, and reduced healthcare expenses.

Environmental benefits can be gained through less carbon-intensive production and operation, the promotion of such actions through the supply chain and the requirement for standards that meet long-term environmental goals. Strategic benefits to industry include supply chain strengthening, technology transfer, training and R&D initiatives.

SMEs were a particular focus, and consultation revealed concerns in the areas of local content, especially: how it is accounted for and verified; contractual risk, especially the transfer of risk down through the supply chain; standards and price, where standards were not well coordinated and price could be changed without notice; relationships and procedural complexity in the procurement and tendering process especially; and access to technology and skills.

Although we were unable to fully test the benefits of import replacement, the combination of additional employment on production levels, social returns to the community and the benefits identified in the organisational and training areas, suggests there are opportunities within the supply chain to substantially increase local content. However, further investigation using data sourced from the local supply chain would be needed to identify the scale of returns, including non-monetary returns, for a given investment.

Glossary

ABS – Australian Bureau of Statistics

Basic price – what the producer receives without any additional charges or taxes

DEDJTR – Victorian Department of Economic Development, Jobs, Transport and Resources

DTF – Victorian Department of Treasury and Finance

Direct or primary employment – employment involved in the primary inputs to production

DoT – Victorian Department of Transport

FTE – Full-time equivalent (employment)

GDP – Gross domestic product

GVA – Gross value added

HILDA – Household, Income and Labour Dynamics in Australia survey conducted by the Melbourne Institute, University of Melbourne

Indirect or supply chain employment – employment involved in the indirect inputs to production, otherwise known as the supply chain

Induced employment – Employment induced by the added consumption by household spending of wages and salaries received by additional direct and indirect employment

Input-Output Tables (I-O Tables) – Tables created by the ABS assessing the contributions of industry production of goods and services to the economy

Intermediate use – the use by industry of goods and services in primary production

OEM – Original equipment manufacturer

PPP – Public-private partnership

QALY – Quality-adjusted life years

RMCRC – Rail Manufacturing Cooperative Research Centre

SMEs – Small and medium enterprises, generally calculated as being under 20 employees and up to 200

Supply chain – goods and services either contributed to be a sector to overall supply or describing the use by industry of goods and services in production. In this report it is used in the latter sense.

Tiers 1, 2 and 3 – supply chain in the rolling stock manufacturing industry where Tier 1 supplies components and systems, Tier 2 supplies made parts or discrete services and Tier 3 largely supplies material inputs.

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Appendix 1: Input-output data – rolling stock manufacturing

Selected data from the ABS 2016–2017 I-O tables for the rail rolling stock manufacturing and maintenance sector, specifically Tables 2, 3, 5 and 6.

Sector	Products produced by RS industry	Industries that produce RS product	Industry direct use + local supply chain	Use by industry of domestic supply of RS	Use of imports by RS industry	Use by industry of RS imports	All use by RS industry produced locally	All RS used by industry produced locally
Sheep, Grains, Beef & Dairy Cattle	0	0	0.1	1.4	0	0	0.1	1.4
Poultry & Other Livestock	0	0	0	0.1	0	0	0	0.1
Other Agriculture	0	0	0.1	1.2	0	0	0.1	1.2
Aquaculture	0	0	0	0.1	0	0	0	0.1
Forestry & Logging	0	0	0.3	0	0	0	0.3	0
Fishing, Hunting & Trapping	0	0	0	0	0	0	0	0
Agriculture, Forestry & Fishing Support Serv	0	0	0.1	0.5	0	0	0.1	0.5
Coal Mining	0	0	0.3	122.8	0	0	0.3	122.8
Oil & Gas Extraction	0	0	5.2	5.2	0.3	0	5.5	5.2
Iron Ore Mining	0	0	0.5	41.2	0	12.2	0.5	53.4
Non Ferrous Metal Ore Mining	0	0	0.5	12.6	0	0	0.5	12.6
Non Metallic Mineral Mining	0	0	0.8	0.4	0	0	0.9	0.4
Exploration & Mining Support Serv	0	0	0.8	8.1	0	0	0.8	8.1
Meat & Meat Product Manuf	0	0	0.4	0.8	0	0	0.4	0.8
Processed Seafood Manuf	0	0	0.2	0	0	0	0.2	0
Dairy Product Manuf	0	0	1.1	0.7	0.4	0	1.5	0.7
Fruit & Vegetable Product Manuf	0	0	0.3	0.4	0	0	0.3	0.4
Oils & Fats Manuf	0	0	0.1	0.1	0	0	0.1	0.1
Grain Mill & Cereal Product Manuf	0	0	0.3	0.3	0	0	0.3	0.3
Bakery Product Manuf	0	0	1.8	0.4	0.6	0	2.4	0.4
Sugar & Confectionery Manuf	0	0	0.3	0.4	0	0	0.3	0.4
Other Food Product Manuf	0	0	1.2	0.6	0	0	1.2	0.6
Soft Drinks, Cordials & Syrup Manuf	0	0	0.4	0.3	0	0	0.4	0.3
Beer Manuf	0	0	0	0.1	0	0	0	0.1
Wine, Spirits & Tobacco	0	0	0.4	0.4	0.1	0	0.5	0.4
Textile Manuf	0	0	0.5	0	6.3	0	6.8	0
Leather, Fur & Leather Product Manuf	0	0	0.8	0.1	0.8	0	1.6	0.1
Textile Product Manuf	0	0	1.6	0.1	5.6	0	7.2	0.1
Knitted Product Manuf	0	0	0	0	0	0	0	0
Clothing Manuf	0	0	0.7	0	4.7	0	5.4	0
Footwear Manuf	0	0	0	0	5.0	0	5.0	0
Sawmill Product Manuf	0	0	0.3	0.3	0	0	0.3	0.3
Other Wood Product Manuf	0	0	14.8	0.7	4.5	0	19.3	0.7
Pulp, Paper & Paperboard Manuf	0	0	0.2	0.5	0.1	0	0.3	0.5
Paper & Converted Paper Product Manuf	0	0	1.7	1.0	0.4	0	2.1	1.0
Printing (including recorded media)	0	0	1.6	1.3	0	0	1.6	1.3
Petroleum & Coal Product Manuf	0	0	16.0	1.8	20.9	0	36.9	1.8
Human Pharma & Medicinal Product Manuf	0	0	1.2	2.4	0.1	0	1.3	2.4
Vet Pharm & Medicinal Product Manuf	0	0	0.1	0	0	0	0.1	0
Basic Chemical Manuf	0	0	12.6	1.2	25.5	0	38.1	1.2
Cleaning Compounds & Toiletry Prep Manuf	0	0	0.8	0.2	0	0	0.8	0.2
Polymer Product Manuf	0	0	18.9	1.4	12.9	0	31.7	1.4
Natural Rubber Product Manuf	0	0	2.2	0.1	14.1	0	16.3	0.1
Glass & Glass Product Manuf	0	0	20.9	0.6	4.2	0	25.1	0.6
Ceramic Product Manuf	0	0	0.2	0.2	0	0	0.2	0.2
Cement, Lime & Ready-Mixed Concrete Manuf	0	0	0.4	1.4	0	0	0.4	1.4

Sector	Products produced by RS industry	Industries that produce RS product	Industry direct use + local supply chain	Use by industry of domestic supply of RS	Use of imports by RS industry	Use by industry of RS imports	All use by RS industry produced locally	All RS used by industry produced locally
Plaster & Concrete Product Manuf	0	0	0.6	0.3	0	0	0.6	0.3
Other Non-Metallic Mineral Product Manuf	0	0	0.1	0	0	0	0.1	0
Iron & Steel Manuf	0	0	47.9	0.6	32.8	0	80.6	0.6
Basic Non-Ferrous Metal Manuf	0	0	3.6	1.4	46.9	0.4	50.5	1.8
Forged Iron & Steel Product Manuf	0	0	79.1	0.2	27.7	0	106.9	0.2
Structural Metal Product Manuf	0	0	164.4	3.3	15.3	0	179.7	3.3
Metal Containers & Sheet Metal Product Manuf	0	0	4.1	0.6	0.6	0	4.6	0.6
Other Fabricated Metal Product Manuf	0	0	21.7	2.9	10.7	0.6	32.4	3.5
Motor Vehicles & Parts; Other Transp Equip Manuf	35	0	3.5	2.0	0.3	0	3.7	2.0
Ships & Boat Manuf	0	0	2.1	1.6	0	0	2.1	1.6
Railway Rolling Stock Manuf	2204	2204	402.2	402.2	113.1	113.1	515.2	515.2
Aircraft Manuf	0	0	0.4	2.3	0	0	0.4	2.3
High Tech Equipment Manuf	0	0	16.4	3.1	22.5	0.6	38.8	3.7
Electrical Equipment Manuf	0	0	14.0	0.8	74.4	0	88.4	0.8
Domestic Appliance Manuf	0	0	0.4	0.2	0	0	0.4	0.2
Specialised & Other Machinery & Equipment Manuf	1	0	39.7	1.9	90.9	0	130.6	1.9
Furniture Manuf	0	0	2.1	0.3	0.4	0	2.5	0.3
Other Manufactured Products	0	0	3.5	0.1	3.9	0	7.4	0.1
Electricity Generation	0	0	8.2	0.5	0	0	8.2	0.5
Electricity Transmission, Distrib & Market Operation	0	0	13.7	0.8	0	0	13.7	0.8
Gas Supply	0	0	1.8	0.2	0	0	1.8	0.2
Water Supply, Sewerage & Drainage Serv	0	0	5.6	0.2	0	0	5.6	0.2
Waste Collection, Treatment & Disposal Serv	0	0	41.1	2.7	0	0	41.1	2.7
Residential Building Construction	0	0	1.8	9.8	0	0	1.8	9.8
Non-Residential Building Construction	5	0	2.4	6.6	0	0	2.4	6.6
Heavy & Civil Engineering Construction	6	0	1.0	67.6	0	0	1.0	67.6
Construction Serv	10	0	11.6	23.3	0	0	11.6	23.3
Wholesale Trade	40	0	102.7	75.4	0	0	102.7	75.4
Retail Trade	0	0	31.7	63.1	0	0	31.7	63.1
Accommodation	0	0	2.7	2.0	1.4	0	4.1	2.0
Food & Beverage Serv	0	0	22.1	43.2	2.3	0	24.4	43.2
Road Transport	1	0	26.4	10.7	0	0.8	26.4	11.5
Rail Transport	0	170	9.3	713.6	0	18.9	9.3	732.4
Water, Pipeline & Other Transport	0	0	1.8	3.9	0	1.0	1.8	4.8
Air & Space Transport	0	0	1.1	4.0	0.1	0	1.2	4.0
Postal & Courier Pick-up & Delivery Service	0	0	2.6	7.5	0	0	2.7	7.5
Transport Support Serv & Storage	0	0	16.5	20.1	0	0.3	16.5	20.4
Publishing (except Internet & Music Publishing)	0	0	0.6	1.1	0.2	0	0.7	1.1
Motion Picture & Sound Recording	0	0	0	1.4	0	0	0	1.4
Broadcasting (except Internet)	0	0	43.8	1.5	0	0	43.8	1.5
Internet Serv Providers, Publishing, Search & Data Proc	0	0	5.3	1.6	0.5	0	5.8	1.6
Telecommunication Serv	0	0	26.9	35.9	0.9	0	27.8	35.9
Library & Other Information Serv	0	0	0	0.1	0	0	0	0.1
Finance	0	0	139.8	0.9	2.0	0	141.9	0.9
Insurance & Superannuation Funds	0	0	6.4	4.9	0.2	0	6.6	4.9
Auxiliary Finance & Insurance Serv	0	0	13.1	13.4	0.2	0	13.3	13.4
Rental & Hiring Serv (except Real Estate)	0	0	17.2	31.5	4.9	0	22.1	31.5
Ownership of Dwellings	0	0	0	2.7	0	0	0	2.7
Non-Residential Property Operators & Real Estate Serv	514	0	30.9	26.2	0.1	0	30.9	26.2
Professional, Scientific & Technical Serv	200	0	196.8	56.6	8.1	0	205.0	56.6
Computer Systems Design & Related Serv	0	0	9.5	16.2	0.2	0	9.7	16.2

Sector	Products produced by RS industry	Industries that produce RS product	Industry direct use + local supply chain	Use by industry of domestic supply of RS	Use of imports by RS industry	Use by industry of RS imports	All use by RS industry produced locally	All RS used by industry produced locally
Employment, Travel Agency & Other Admin Serv	0	0	108.2	26.0	0	0	108.2	26.0
Building Cleaning, Pest Control & Other Support Serv	0	0	6.0	9.4	0	0	6.0	9.4
Public Administration & Regulatory Serv	0	0	5.9	10.3	0	0	5.9	10.3
Defence	0	0	0.1	1.6	0	0	0.1	1.6
Public Order & Safety	0	0	0.4	4.4	0	0	0.4	4.4
Primary & Secondary Education Serv	0	0	0	6.6	0	0	0	6.6
Technical, Vocational & Tertiary Education Serv	0	0	2.7	6.5	0	0	2.7	6.5
Arts, Sports, Adult & Other Education Serv	0	0	0.1	4.3	0	0	0.1	4.3
Health Care Serv	0	0	0.9	11.5	0	0	0.9	11.5
Residential Care & Social Assistance Serv	0	0	0	6.0	0	0	0	6.0
Heritage, Creative & Performing Arts	0	0	0.1	1.8	0	0	0.1	1.8
Sports & Recreation	0	0	0.3	4.7	0	0	0.3	4.7
Gambling	0	0	0.9	2.7	0	0	0.9	2.7
Automotive Repair & Maintenance	0	0	0	1.6	0	0	0	1.6
Other Repair & Maintenance	0	0	2.6	1.2	0	0	2.6	1.2
Personal Serv	0	0	0	2.1	0	0	0	2.1
Other Serv	0	0	0.8	0.5	0	0	0.8	0.5
Total intermediate use	**3016.0**	**2374.0**	**2406.5**	**1699.4**	**567.2**	**147.8**	**2406.5**	**2133.4**
Compensation of employees (P1)			**433.0**					
Gross operating surplus & mixed income (P2)			**146.0**					
Taxes less subsidies on products (P3)			**14.5**					
Other taxes less subsidies on production (P4)			**16.0**					
Australian production			**3016.0**	**3016.0**				
Competing imports	**404.0**		**567.2**				**0**	

Appendix 2: Input-output data – production and employment

Estimated employee numbers, production and employee costs as a function of production and wages derived from the ABS input-output tables 2016–2017, and the 2016 Census and Quarterly Employment Surveys 2016–2017.

Sector	Employees	Wages & salaries ($million)	Total Australian production ($million)	Competing imports ($million)	Inter-mediate use (supply chain, $million)	Employment costs $ per FTE	Production per FTE	Gross operating surplus (%)
Sheep, Grains, Beef & Dairy Cattle	144,963	2,957	48,937	2,921	24,486	20,398	337,583	35.9
Poultry & Other Livestock	17,276	757	8,437	255	2,677	43,819	488,378	55.1
Other Agriculture	89,819	2,789	27,277	1,141	11,845	31,051	303,689	40.5
Aquaculture	8,412	331	1,880	240	812	39,349	223,495	23.1
Forestry & Logging	7,972	658	3,617	271	1,413	82,536	453,695	32.7
Fishing, Hunting & Trapping	7,645	268	2,728	302	927	35,054	356,822	42.6
Agriculture, Forestry & Fishing Support Serv	28,264	1,353	9,193	359	5,679	47,870	325,253	18.1
Coal Mining	49,408	5,959	60,150	2,740	18,665	120,609	1,217,423	53.8
Oil & Gas Extraction	20,991	4,356	43,505	1,172	15,711	207,521	2,072,585	50.4
Iron Ore Mining	33,577	5,232	62,886	1,463	13,927	155,823	1,872,908	66.5
Non Ferrous Metal Ore Mining	41,469	5,464	37,870	3,308	21,770	131,760	913,204	17.4
Non Metallic Mineral Mining	10,345	1,076	4,944	272	2,154	104,014	477,922	25.6
Exploration & Mining Support Serv	63,140	3,974	13,035	522	5,701	62,939	206,445	20.0
Meat & Meat Product Manuf	63,974	3,712	28,911	220	23,048	58,024	451,920	5.8
Processed Seafood Manuf	2,044	125	1,290	80	890	61,140	630,968	14.4
Dairy Product Manuf	19,766	1,801	12,520	815	8,812	91,116	633,413	7.6
Fruit & Vegetable Product Manuf	10,706	861	4,845	781	2,968	80,426	452,569	4.0
Oils & Fats Manuf	1,161	159	1,540	212	956	136,990	1,326,824	12.8
Grain Mill & Cereal Product Manuf	8,959	675	5,526	180	4,416	75,341	616,794	3.5
Bakery Product Manuf	67,202	2,548	7,393	816	3,670	37,916	110,012	3.0
Sugar & Confectionery Manuf	13,724	1,563	9,438	688	6,146	113,885	687,683	10.0
Other Food Product Manuf	21,411	1,534	10,389	1,056	5,743	71,645	485,216	18.9
Soft Drinks, Cordials & Syrup Manuf	8,785	755	5,687	604	3,623	85,947	647,389	10.9
Beer Manuf	5,249	611	4,092	174	1,995	116,393	779,510	27.2
Wine, Spirits & Tobacco	19,232	1,118	6,702	235	4,394	58,132	348,480	12.3
Textile Manuf	1,792	84	452	17	258	46,875	252,232	17.7
Leather, Fur & Leather Product Manuf	1,889	71	1,139	125	753	37,579	602,856	15.5
Textile Product Manuf	11,807	657	2,854	278	1,397	55,646	241,726	15.7
Knitted Product Manuf	448	21	89	4	53	46,833	198,484	6.7
Clothing Manuf	15,045	550	1,174	185	272	36,558	78,034	12.5
Footwear Manuf	2,063	128	302	44	80	62,037	146,369	12.9
Sawmill Product Manuf	11,279	743	4,377	56	3,042	65,872	388,050	10.7
Other Wood Product Manuf	29,754	1,859	8,641	519	5,154	62,479	290,416	11.5
Pulp, Paper & Paperboard Manuf	5,056	430	2,571	306	1,546	85,055	508,548	10.2
Paper & Converted Paper Product Manuf	13,049	1,163	6,517	915	3,745	89,129	499,443	9.5
Printing (including recorded media)	43,765	2,167	6,729	891	2,906	49,515	153,754	9.6
Petroleum & Coal Product Manuf	6,822	728	19,575	7,969	5,913	106,720	2,869,571	24.5
Human Pharma & Medicinal Product Manuf	20,730	1,494	9,466	1,453	4,868	72,070	456,638	16.8
Vet Pharm & Medicinal Product Manuf	745	101	724	287	211	135,509	971,368	16.6
Basic Chemical Manuf	23,686	2,089	11,590	1,469	6,335	88,197	489,327	12.6
Cleaning Compounds & Toiletry Prep Manuf	8,242	624	3,196	357	1,168	75,707	387,755	31.6
Polymer Product Manuf	34,599	2,803	12,644	2,049	6,144	81,014	365,446	11.6
Natural Rubber Product Manuf	646	177	721	98	289	274,123	1,116,624	19.4

Sector	Employees	Wages & salaries ($million)	Total Australian production ($million)	Competing imports ($million)	Intermediate use (supply chain, $million)	Employment costs $ per FTE	Production per FTE	Gross operating surplus (%)
Glass & Glass Product Manuf	8,132	828	3,342	388	1,464	101,815	410,949	17.8
Ceramic Product Manuf	3,346	242	1,363	116	611	72,320	407,325	26.5
Cement, Lime & Ready-Mixed Concrete Manuf	9,684	1,235	9,007	525	5,936	127,532	930,109	12.9
Plaster & Concrete Product Manuf	5,455	677	3,324	348	1,744	124,108	609,359	15.1
Other Non-Metallic Mineral Product Manuf	7,831	472	1,784	163	806	60,271	227,802	18.0
Iron & Steel Manuf	36,208	1,933	8,766	600	5,733	53,386	242,101	4.8
Basic Non-Ferrous Metal Manuf	32,954	2,234	39,888	7,048	29,264	67,791	1,210,407	2.8
Forged Iron & Steel Product Manuf	695	151	687	71	314	217,312	988,700	20.8
Structural Metal Product Manuf	34,926	3,435	14,992	1,996	7,609	98,351	429,251	11.4
Metal Containers & Sheet Metal Product Manuf	11,225	1,081	4,005	466	1,769	96,299	356,780	15.8
Other Fabricated Metal Product Manuf	20,369	2,200	7,111	1,296	3,019	108,005	349,101	6.5
Motor Vehicles & Parts; Other Transp Equip Manuf	47,415	3,117	12,341	2,687	5,693	65,738	260,275	5.4
Ships & Boat Manuf	14,549	1,122	4,798	762	2,561	77,118	329,779	6.0
Railway Rolling Stock Manuf	4,370	433	3,016	567	1,839	99,075	690,093	4.8
Aircraft Manuf	10,611	1,596	5,180	960	2,220	150,407	488,164	6.4
High Tech Equipment Manuf	43,057	2,629	9,403	2,291	2,001	61,059	218,387	25.1
Electrical Equipment Manuf	19,219	962	4,219	805	1,862	50,054	219,522	12.7
Domestic Appliance Manuf	6,497	361	1,379	227	555	55,564	212,251	16.0
Specialised & Other Machinery & Equipment Manuf	47,975	3,593	11,580	1,912	4,830	74,894	241,377	9.2
Furniture Manuf	54,600	1,127	4,653	713	2,149	20,641	85,220	12.7
Other Manufactured Products	15,727	716	2,297	265	836	45,526	146,051	19.5
Electricity Generation	13,631	1,422	17,728	714	13,006	104,321	1,300,567	22.7
Electricity Transmission, Distrib & Market Operation	46,022	5,341	50,702	718	28,783	116,053	1,101,691	24.1
Gas Supply	13,036	217	4,670	128	2,807	16,646	358,236	29.3
Water Supply, Sewerage & Drainage Serv	29,613	3,314	21,481	911	7,576	111,911	725,394	42.4
Waste Collection, Treatment & Disposal Serv	35,130	2,670	14,451	709	9,483	76,004	411,360	9.5
Residential Building Construction	189,942	7,729	91,231	5,730	67,147	40,691	480,311	10.7
Non-Residential Building Construction	92,473	5,449	50,655	3,464	36,218	58,925	547,781	10.0
Heavy & Civil Engineering Construction	72,892	4,573	66,662	3,075	34,918	199,925	914,528	20.0
Construction Serv	730,433	1,468	219,956	14,893	127,394	56,772	301,131	15.0
Wholesale Trade	363,322	3,469	134,334	5,942	58,625	119,643	369,738	17.7
Retail Trade	1,239,303	49,585	124,758	2,592	45,947	40,010	100,668	18.7
Accommodation	117,802	4,730	16,845	719	7,418	40,152	142,994	17.9
Food & Beverage Serv	745,398	4,148	68,986	2,715	31,544	32,396	92,549	10.5
Road Transport	265,842	14,605	53,806	4,383	24,742	54,939	202,399	14.1
Rail Transport	43,704	4,845	14,944	583	7,333	110,859	341,936	14.2
Water, Pipeline & Other Transport	17,022	1,637	9,822	296	4,666	96,167	577,005	31.4
Air & Space Transport	59,385	4,948	25,752	4,046	12,525	83,321	433,648	15.0
Postal & Courier Pick-up & Delivery Service	92,253	3,666	14,313	1,154	7,559	39,738	155,149	10.2
Transport Support Serv & Storage	140,714	10,767	61,796	531	28,355	76,517	439,162	34.3
Publishing (except Internet & Music Publishing)	29,554	3,176	10,137	741	3,387	107,465	343,001	26.3
Motion Picture & Sound Recording	34,690	2,009	8,640	771	4,823	57,914	249,066	10.2
Broadcasting (except Internet)	30,280	2,011	11,074	1,365	4,439	66,413	365,715	28.3
Internet Serv Providers, Publishing, Search & Data Proc	9,661	2,076	12,592	682	6,010	214,888	1,303,404	29.7
Telecommunication Serv	98,800	7,672	58,403	2,675	32,941	77,652	591,124	25.0
Library & Other Information Serv	13,261	616	1,815	47	438	46,452	136,867	38.3
Finance	222,508	21,613	137,076	863	24,764	97,134	616,051	62.4
Insurance & Superannuation Funds	84,425	6,897	52,704	850	35,070	81,694	624,272	13.2

Sector	Employees	Wages & salaries ($million)	Total Australian production ($million)	Competing imports ($million)	Intermediate use (supply chain, $million)	Employment costs $ per FTE	Production per FTE	Gross operating surplus (%)
Auxiliary Finance & Insurance Serv	130,206	15,696	53,730	1,437	23,848	120,547	412,653	21.6
Rental & Hiring Serv (except Real Estate)	40,041	4,538	20,929	638	13,031	113,333	522,684	11.3
Ownership of Dwellings	11,075	–	196,938	527	46,106	–	17,782,129	67.9
Non-Residential Property Operators & Real Estate Serv	158,052	13,553	84,298	875	37,358	85,750	533,354	33.6
Professional, Scientific & Technical Serv	802,888	64,872	177,283	4,502	82,520	80,798	220,807	12.5
Computer Systems Design & Related Serv	215,634	20,263	51,621	2,626	20,983	93,969	239,392	13.3
Employment, Travel Agency & Other Admin Serv	215,404	41,538	75,316	1,818	26,256	192,837	349,650	5.2
Building Cleaning, Pest Control & Other Support Serv	215,153	5,820	18,435	463	8,906	27,050	85,683	15.9
Public Administration & Regulatory Serv	546,534	47,220	90,520	1,524	32,501	86,399	165,626	8.9
Defence	28,313	12,304	31,159	1,799	11,266	434,570	1,100,517	18.0
Public Order & Safety	201,986	15,441	27,392	698	8,292	76,446	135,613	8.2
Primary & Secondary Education Serv	553,609	41,594	62,591	2,417	13,635	75,132	113,060	6.9
Technical, Vocational & Tertiary Education Serv	243,174	28,450	49,801	2,723	15,208	116,994	204,795	5.8
Arts, Sports, Adult & Other Education Serv	185,140	3,039	9,129	406	3,654	16,415	49,309	22.0
Health Care Serv	931,259	54,091	105,645	6,005	32,015	58,084	113,443	11.5
Residential Care & Social Assistance Serv	632,300	47,456	67,272	2,527	12,923	75,053	106,392	5.2
Heritage, Creative & Performing Arts	74,929	1,605	8,184	474	3,795	21,420	109,224	31.9
Sports & Recreation	117,194	4,495	17,774	3,114	8,558	38,355	151,663	7.6
Gambling	27,657	2,131	11,537	1,147	6,218	77,052	417,150	15.7
Automotive Repair & Maintenance	143,088	5,565	19,270	4,008	6,741	38,892	134,673	12.9
Other Repair & Maintenance	73,285	3,411	14,113	2,429	6,213	46,545	192,578	13.5
Personal Serv	115,547	4,402	15,111	1,189	7,642	38,097	130,778	10.4
Other Serv	154,351	8,443	12,074	194	1,049	54,700	78,224	15.2

Appendix 3: Procurement and contractual arrangements

The HCMT project plan provides a good model for the assessment of value-for-money. The value-for-money test is based on whether the project was delivered by the state using the Public Sector Comparator model (DEDJTR and DTF, 2017). For this project it was estimated to be 38.5%.

The additional benefits were:

- 60% local content, 10% above the requirement
- 15% workforce development in the form of apprentices and cadets 5% above requirement
- 7% of the workforce classified as disadvantaged (Aboriginal and Torres Strait Islanders, special needs, long-term unemployed)
- Trains above safety minimum requirement
- Additional safety and security on trains.

The following costs are borne by the State:

- State project management costs of administering the Project Agreement
- Project delivery risks retained by the State
- The State's 50% share of Independent Reviewer costs
- Land acquisition costs for the depot and light service facility
- Information and communications technology (ICT) upgrades required to state-side ICT systems to interface with the new fleet
- Supply of digital train radio systems equipment for the fleet
- Provision, installation and fitment of high capacity signalling equipment
- Project management, test driver and driver training costs of the franchisee (the operator of the Melbourne metropolitan network)
- Supply of depot signalling equipment at the stabling yard.

Other provisions cater for risk, etc. Aside from the ability of major subcontractors to place a cure notice as notice of default on the contract, there is nothing else in the broad project agreement that relates to subcontractors.

The maintenance part of the contract also applies, where the contractor has to build maintenance facilities and cost in maintenance over the life of the project. This has created short-term jobs in construction. The facility, the trains and sundries pass back to government ownership at the end of the maintenance contract.

If we accept this as the base case, value-for-money of procurement, beyond testing the PPP arrangements compared to direct government delivery, is not being quantitatively assessed.

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