



ARA SUBMISSION

Developing Advanced
Manufacturing in Australia

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The ARA

The Australasian Railway Association (ARA) is the peak body for the rail sector in Australia and New Zealand, and advocates for more than 200 member organisations across the industry.

Our membership covers every aspect of the rail industry, including the:

- passenger and freight operators that keep essential rail services moving;
- track owners, managers, and contractors that deliver a safe and efficient rail infrastructure network; and
- suppliers, manufacturers, and consultants that drive innovation, productivity, and efficiency in the rail industry.

Our members are driven to support vibrant, sustainable and connected communities through greater use of rail across Australia and New Zealand. We bring together industry and government to help achieve this ambition.

Our advocacy is informed by an extensive research program to ensure we offer solutions that are grounded in evidence and focused on delivering tangible value in our daily lives.

We believe the rail industry has a crucial role to play in the region's sustainable development and growth, and know that the industry offers meaningful and rewarding careers for tens of thousands of people in the regions.

Our significant program of work is focused on supporting a strong advocacy agenda, and creating opportunities for the rail industry to network, collaborate and share information, and maximise the benefits we have to offer the wider community.

The ARA thanks the House Standing Committee on Industry, Science and Resources for the opportunity to provide this submission.

Any questions regarding this submission should be directed to Simon Bourke, General Manager – Policy and Government Relations via sbourke@ara.net.au.

Introduction

The rail industry in Australia is currently experiencing an unprecedented level of infrastructure investment, with over \$154 billion in rail construction work over the next 15 years¹. This huge pipeline of investment provides a great platform and opportunity to strengthen Australia's rail manufacturing sector to service local demand, as well as to identify opportunities to export globally.

¹ BIS Oxford Economics 2022, [Australian Rail Market Outlook](#)

Unfortunately, the rail manufacturing supply chain in Australia has suffered from significant legacy issues including a highly fragmented market, which is compounded by varying jurisdictional policies on procurement, standards, type approval, and local content requirements. While these issues are complex and difficult to overcome, they are not insurmountable, and the ARA believe the Australian Government has a key role to play in supporting the revival of Australia's rail manufacturing sector.

It is worth noting that rail is a significant industry in Australia, creating economic activity through its operations and capital investments. It is an industry with activities across every major metropolitan and regional area and is supported by the full spectrum of skills in the Australian workforce. In 2019, the rail industry contributed around \$30 billion to the Australian economy and employed more than 165,000 workers (directly and indirectly in full-time equivalent terms, FTE). The industry is made up of around 900 businesses that are located in approximately 20 major hubs.²

However, the future health and long-term sustainability of the Australian rail supply chain is at a critical juncture. The combination of a record \$154 billion³ in rail construction work over the next 15 years, a wave of replacement investment for ageing technologies, systems and rollingstock, and a fundamental rethinking and reorganisation of global supply chains in the wake of the COVID-19 pandemic provides an unparalleled growth opportunity for the local rail industry and the broader Australian economy. Severe threats and challenges remain but meeting these challenges has the potential to yield tremendous business and employment growth, as well as broader social and economic benefits, in coming years.

The following submission provides information that the ARA believes would be very beneficial to improving the rail manufacturing in Australia and in particular advanced manufacturing, in turn fostering a much stronger and more resilient local supply chain.

Addressing the Terms of Reference

The following section addresses each of the Terms of Reference for the Inquiry.

The opportunities of advanced manufacturing for Australia – including in relation to job creation, productivity and capability

Overview of Rail manufacturing in Australia

Rolling stock manufacturing

The ARA's Value of Rail Report 2020 stated that the rail rolling stock manufacturing and repair industry has revenue of just over \$2.4 billion and a direct value-added of \$515 million. In 2019, the rail rolling stock manufacturing and repair industry supported around 4,087 FTE workers, similar to the amount in 2016. For every million dollars spent by the rolling stock manufacturing and repair industry, around 1.32 (direct and indirect) FTE roles are generated.

² ARA 2020, [Value of Rail 2020](#) Report.

³ BIS Oxford Economics 2022, [Australian Rail Market Outlook](#)

The rail rolling stock manufacturing and repair industry spends five times more on intermediate inputs than wages, whereas the average across the entire economy is closer to two times. For example, it spends more than \$300 million on intermediate inputs from the structural metal product manufacturing industry and professional, scientific and technical services industry. The rail rolling stock manufacturing and repair industry's expenditure on intermediate inputs also boosts employment, especially for labour-intensive industries such as the iron and steel manufacturing industry. This shows that rail rolling stock manufacturing can play a significant role in boosting activity all along the supply chain.

It is also important to know that rolling stock manufacturing accounts for 11 per cent of rail employment in Australia and that regional centres are the major employment hubs for rolling stock manufacturing and repair across Australia.⁴ Employment is largely concentrated in the Sydney and Melbourne metropolitan areas, which together account for 50 per cent of the national total but tends to be in outer-metropolitan areas. The main non-capital city employment bases can be found in Newcastle, Maryborough and Lake Macquarie.⁵ There are also many other rail manufacturing facilities across Australia dedicated to producing rail infrastructure components such as rail, signalling equipment, sleepers, fastenings, points and crossings to name just a few.

In terms of the future of rolling stock manufacturing in Australia, it is worth noting that while a 2013 Deloitte Access Economics' study⁶ envisaged a future where imports dominate Australian rolling stock supply due to the domestic sector's lack of competitiveness, this has not eventuated. Instead, the widespread adoption of local content policies since the release of the study has protected the domestic sector from this eventuality, with the import share of rolling stock manufacturing supply for final uses having fallen, rather than increased, over the last decade.⁷

The table on the following page lists the contracts of the most recent 12 major heavy rail passenger rolling stock contracts showing contracts for Australian manufacturing of rolling stock being awarded. The contracts include rolling stock for urban and regional services across New South Wales, Victoria, Queensland and Western Australia.

A National Local Content Policy, as opposed to a series of State local content policies, offers the key to unlocking the benefits of scale, componentry harmonisation and design efficiencies. These could amount to a cut of some 19 per cent in rolling stock manufacturing procurement expenses, which would be of considerable benefit across the country, allowing state governments to increase spending in areas such as education and health care.

⁴ ABS Census (2016) *Place Of Work (POW) ANZSIC Industry Data*

⁵ Ibid

⁶ Deloitte Access Economics 2013, [Opportunities for Greater Passenger Rolling Stock Procurement Efficiency](#)

⁷ ARA 2023, [Benefits of a National Local Content Policy](#) report

Fig. 1. Heavy rail passenger rolling stock contracts

State	Date	Project	Source	Cost	Quantity	Consortium (Manufacturer)
NSW	2019	Regional Rail Fleet	Spain	\$1.3bn	117 cars	Momentum Trains
NSW	2016	Sydney Growth Trains (Waratah 2)	China	\$1bn+	192 cars	Downer Edi (Changchun Railway Vehicles)
NSW	2016	New Intercity Fleet	South Korea	\$3.9bn	520 cars	RailConnect (Hyundai Rotem)
NSW	2014	Sydney Metro Stage 1	China	\$3.7bn	132 cars	Northwest Rapid Transit (Alstom)
NSW	2016	Waratah	China / Australia	\$3.6bn	626 cars	Reliance Rail (Changchun Railway Vehicles / Downer)
VIC	2022	X'Trapolis 2.0	Australia	\$1bn	150 cars	Alstom
VIC	2019	New Vlocity Trains	Australia	\$0.34bn	119 cars	Alstom
VIC	2016	X'Trapolis	Australia	\$0.1bn	54 cars	Alstom
VIC	2016	High Capacity Metro	China / Australia	\$2bn	65 trains	Evolution Rail (CRRC / Downer)
QLD	2023	Queensland Train Manufacturing Program	Australia	\$7.1bn	390 cars	Downer
QLD	2014	New Generation	India	\$4.4bn	450 cars	Qtectic (Bombardier)
WA	2019	WA Railcar Program	Australia	\$1.2bn	246 cars	Alstom

Source: BIS Oxford Economics (BISOE)

Rail supply chain

The ARA's Rail Supply Chain Report 2021, confirms that the Australian rail supply chain comprises of many hundreds of businesses.⁸ These businesses provide goods or services directly to the rail industry – including manufacturers, equipment suppliers, professional services and contractors – public and private sector organisations that operate or procure rail assets as well as education facilities and registered training organisations (RTOs) that train the rail industry workforce. Many of these organisations also provide goods and services to other sectors of the Australian economy, and so do not necessarily identify themselves, first and foremost, as part of the rail industry. Collectively, however, together with specialist rail businesses, they form a critical supply network of skills, materials, technologies, equipment and value adding services. The report found that 1,200 firms had at least some connection to the rail industry.

⁸ ARA 2021, [Rail Supply Chain Report](#)

The rail supply chain is spread throughout Australia's eight states and territories. Overall, much of the rail supply chain is largely concentrated in New South Wales and Victoria – reflecting that these most populous states will tend to be centres for passenger and freight rail operations. However, there is also a substantial presence of firms in Queensland and Western Australia where heavy haul rail operations for commodities such as iron ore and coal are also significant. The Hunter Valley Coal Chain (HVCC) in New South Wales is also an important driver of supply chain location and operation for heavy haul-related activities in that state.

Many firms operate across borders. In achieving a more sustainable, and competitive rail supply chain, any artificial cross-border barriers that may be preventing effective transfer of capacity or skills between Australian jurisdictions should be reviewed. Implicitly, restricting market access prevents the access to opportunities to achieve costs of scale and a sustainable rail supply chain.

There are also a number of critical factors that determine the health of the local supply chain, including the procurement processes, partners and technologies chosen, and the connections with local suppliers. These factors all have potential long-term impacts on the ongoing maintenance associated with projects, as well as the specific skillsets required. Given the upcoming pipeline of work expected over the next 15 years, and the connections these firms already have with local operations and maintenance suppliers, it is important that rail procurers (particularly in government) are aware of the capabilities and skills of these firms and recognise the longer-term economic benefits that can accrue from utilising locally based manufacturing and construction businesses.

Opportunities for advanced manufacturing

Australia has a viable and active rail manufacturing capability, with a potential to grow.

Growing demand for rail infrastructure and increasing investment in rail infrastructure

Australia has a growing population, which is leading to increased demand for public transport infrastructure, including rail. This presents opportunities for companies involved in rail manufacturing to supply the growing demand.

Subsequently, the huge pipeline of investment in rail projects provides a great platform and opportunity to strengthen Australia's rail manufacturing sector to service local demand, as well as to identify opportunities to export globally. ARA's Australian Rail Supply Chain Report indicated that work on major projects valued over \$2 billion is forecast to more than double within the next five years – from around \$4 billion in FY2020 to around \$10 billion by FY2023 as a range of new passenger and freight assets are delivered.⁹ Within the next five years, simultaneous work on many separate major rail projects is expected to drive annual rail construction activity over \$14 billion - more than double the level of activity at the peak of the mining boom and remain sustained at historically high levels in the subsequent decade.

⁹ ARA 2021, [Rail Supply Chain Report](#)

As well as catering for new demand, the rail industry is also facing a significant wave of investment to replace aging equipment and systems, with many of the current control systems and equipment reaching the end of their useable life. This large phase of investment will place greater demands on Australia's rail supply chains across manufacturing, construction, transport and logistics, as well as operations and maintenance activities as the new assets come online.

Demand for natural resources

Meanwhile, strong global demand for Australian iron ore and coal for global steel production is driving further substantial private and public investment in heavy haul rail networks in Western Australia, Queensland and New South Wales. Public stimulus measures around the world resulting from COVID 19 are likely to drive further increases in demand for raw commodities, providing a further boost to demand for Australia's high quality mineral resources, which will in turn necessitate further investment in heavy haul transport networks.

Focus on sustainable and innovative technologies

Government must also be conscious of climate change commitments when considering investment in assets such as rolling stock, which typically have a service life well in excess of 30 years. Accordingly, any new motive power for rail (locomotives and multiple-unit passenger trains) purchased from now on would be expected to remain in service until at least 2050. The necessary transition away from diesel fuel in order to achieve net-zero emissions by 2050 must be factored into rolling stock procurements starting now. Clean motive power technology for rail therefore represents a significant and immediate opportunity to establish new capabilities and businesses in Australia's manufacturing sector to support the rail industry's energy transition.

The increasing interest in sustainable and innovative technologies within the rail sector, including lightweight materials, energy-efficient systems, and digital technologies, offers Australian manufacturers an opportunity to be well positioned to secure contracts in the Australian market to offer these technologies. Further, Australian rail manufacturers may also have export opportunities in Asia, where there is significant demand for rail infrastructure and a growing interest in sustainable and innovative technologies.

Investment in capacity and capability

All of this presents a 'once in a generation' opportunity for the Australian supply chain to invest in their own capacity and capability, and in doing so, grow local businesses and employment. With the right policy settings, the Australian rail supply chain could achieve greater economies of scale, greater participation and innovation, raise overall industry productivity, as well as improve international competitiveness and export potential.

The COVID-19 pandemic has also shown how the measures to restrict the movement can be a key threat and opportunity for the Australian rail supply chain. Australian rail businesses, as with their counterparts overseas, were negatively impacted by measures designed to restrict the spread of COVID-19, particularly in the free movement of skills. But the pandemic has led to a re-evaluation of the strength and depth of global supply chains, the need for diversified sources of supply, and accelerating the adoption of new productivity-enhancing technologies.

Australia's relatively strong performance in suppressing COVID-19, greater competitiveness from a lower Australian dollar, and the increasing need for stronger, more diversified global supply chains represents an unprecedented opportunity for the Australian rail supply chain to grow and prosper in both local and international markets.

On balance, the record forward pipeline of rail investment and new behaviours wrought from COVID-19 offer an unparalleled opportunity for the local rail supply chain to break free from well-known and previously reported constraints that have held it back from achieving sustained, healthy growth in the past. Some of these constraints include boom/bust investment cycles, fragmented markets, risk-averse procurement, and a lack of harmonisation, all of which result in low economies of scale with limited opportunity for innovation and investment.

Maximising the use of the local supply chain is the key to optimising the broader economic impact of the strong pipeline of rail investment and ultimately creating thousands of new, highly skilled, Australian jobs. The future health and long run sustainability of the Australian rail supply chain is at a critical juncture. Severe threats and challenges remain but meeting these challenges now has the potential to yield tremendous employment, as well as broader social and economic benefits, in coming years.

Consequently, industry and governments urgently need a better understanding of the current capabilities and capacity of the Australian rail supply chain, the challenges they face that stymie growth and jobs creation, where opportunities for reform exist and recommendations which will maximise benefits for Australia. Experiences during COVID-19 have prompted a public discussion about the reliability of global supply chains and to what extent Australia needs local manufacturing capabilities to deliver critical transport infrastructure and services.

Expanding opportunities for local suppliers to compete does not need to involve direct subsidies or blunt procurement regulations favouring Australian suppliers. Instead, a broad-based view across procurement, skills and commercial arrangements could help ensure Australia's manufacturing sector has the appropriate opportunity to participate over the longer term. Australian governments could coordinate ordering to create more reliable pipelines of work for local manufacturers.

It is very encouraging to see that there is a genuine recognition across federal and state governments that the interoperability and harmonisation issues that have plagued the rail industry for decades must be addressed. With National Cabinet now recognising that jurisdictions must come together to begin addressing some of these long-standing interoperability issues, the ARA believes this is an excellent opportunity to also improve the efficiency of rail procurement processes across the country.

The ARA is also pleased with the Australian Government committed to implementing a National Rail Manufacturing Plan, as well as establishing the Office of National Rail Industry Coordination in the Department of Industry, Science and Resources that will deliver a National Rail Procurement and Manufacturing Strategy; the impending appointment of a Rail Supplier Advocate to help manufacturers identify procurement and export opportunities; and the intended establishment of a Rail Industry Innovation Council to support the rail manufacturing industry.

On Track to 2040, whilst published close to 10 years ago, outlines trends and drivers, and assesses Australia's rail manufacturing opportunities against its assessed capabilities, which still holds true.¹⁰ It identified opportunities that align with Australian local capabilities in:

1. Materials and manufacturing;
2. Monitoring and management; and
3. Power and Propulsion

BIS Oxford Economics indicated in the Australian Rail Supply Chain report that strengthening opportunities for domestic manufacturers could enhance competitive tension, and create more economic stimulus in regional areas; as most rail manufacturing is done regionally.¹¹ In addition, the increasing use of automated and connected technologies combined with the critical role that rail transport plays in our economy suggests that Australia may need to enhance its domestic capabilities in areas such as cyber-security and telecommunications in rail in particular. Other key drivers in rail include energy storage, safety, productivity, asset management, digital technologies, customer experience and traffic control systems.

Research and development

The ARA's report Finding the Fast Track for Innovation in the Australasian Rail Industry highlights that Australia is well behind its international peers in the development and application of new technologies and innovations, and there are a number of barriers unnecessarily limiting the rail industry in becoming a world leader.¹² These barriers include:

- market fragmentation in rail-based systems, creating a fractured buyer market for new technology and requiring multiple pathways to market for the same product;
- multiple standards and type approvals based on the varying requirements of each operator;
- lack of continuity in government funding and investment in rail R&D, and a collaborative mechanism in bringing industry and innovators together, with a focus on commercialisation;
- a risk averse culture which does not foster or encourage experimentation and innovation; and
- public sector procurement mechanisms do not properly assess whole of life costs or incentivise innovation.

New rail technologies require significant funding and strong partnerships between innovators, manufacturers and operators to develop, commercialise, manufacture and deliver at scale. Having a local body to help lead and coordinate research and development (R&D) streamlines innovation, provides access to previous R&D activities and their outcomes, and, depending on the funding structure, helps share the large upfront cost amongst many different firms reducing individual burdens.

¹⁰ ANU et al, 2012, [On Track to 2040](#)

¹¹ ARA 2021, [Rail Supply Chain Report](#)

¹² ARA 2020, [Finding the fast track for innovation in the Australasian rail industry](#) report

In this regard, the closure of the Rail Manufacturing Cooperative Research Centre (RMCRC) in June 2020 was a backwards step. Without a national approach to rail innovation, Australia risks missing substantial opportunities in a post-COVID environment, where advanced manufacturing is recalibrating global supply chains to ensure resilient and efficient local supply.

The sustainability of the Australian rail supply chain in the longer term requires firms to be continually innovative, to seek best-in-class solutions and be ready to adopt or develop new technologies. Australian rail suppliers tend to be 'technology takers' given the availability of scaled rail technologies and systems that have been finetuned and developed overseas. However, Australian firms can and have developed niche, nimble technologies, products and services that can support these overarching systems, in turn creating world-leading solutions that can themselves be adopted across global supply chains.

The development of pantograph manufacturing (the apparatus mounted on the roof of an electric train or tram to collect power through contact with an overhead line) in Australia is an example of how innovation and local manufacturing incentives can be aligned to produce world class rail products and a valuable export industry. However, this requires ensuring there are incentives to innovate, so that the industry, the tertiary sector and governments can develop collaborative R&D and innovation models. It is also important to ensure that Australian innovation is recognised and promoted globally.

Current rail procurement processes in Australia tend to favour risk averse solutions. This creates an incentive to focus on lowest risk solutions that utilise established technologies at the expense of cost or performance. This in turn drives a focus on lower risk solutions even if they are more expensive to deliver. This approach adversely affects the cost of local innovation and improvements to rail technologies, systems and processes – impacting long-term value for money and potentially limiting growth in advanced manufacturing and highly skilled jobs. Without support to undertake innovative (and naturally riskier) solutions, Australian firms are simply unable to dedicate optimal resources to innovation.

There is also an opportunity for procurement processes to support innovation that drives improved sustainability outcomes in the infrastructure sector. Infrastructure Australia's 2019 Australian Infrastructure Audit, and the later release of its sustainability principles, highlighted the importance of adopting sustainability-enhancing approaches to infrastructure assets. Australia has an opportunity to establish itself as a leader in this field.¹³ However, the focus on risk averse solutions in current procurement processes can limit innovation to support this goal.

As jurisdictions increase their focus on emissions reduction and the long-term liveability of their cities and towns, consideration should be given to ensuring the procurement process supports the development of sustainable and resilient infrastructure that delivers long term value to the community. Additionally, the challenge of differing standards, requirements and type approvals between jurisdictions leads to technologies being implemented inconsistently across Australia.

¹³ Infrastructure Australia 2019, [Australian Infrastructure Audit 2019](#)

Streamlining regulatory testing processes for new technologies, so that type approval by one network operator provides 'trust markers' for others, would greatly enhance the prospects for inter-jurisdictional standardisation.

The ARA does note the previous Government's investment in research capacity at regional universities as a positive step forward and seeks continued investment in such initiatives.¹⁴

International trends in advanced manufacturing

The rail industry has been going through a period of transformation, with a growing demand for rail services around the world, particularly in emerging economies. Advanced manufacturing is playing an increasingly important role in this transformation, with the development of new technologies and manufacturing techniques helping to improve the quality, efficiency, and sustainability of rail systems.

Some of the international trends in rail advanced manufacturing include:

- **Digitalisation:** Rail companies are increasingly adopting digital technologies to improve manufacturing processes and reduce costs. This includes the use of artificial intelligence, machine learning, and automation to streamline production and improve product quality.
- **Additive Manufacturing:** Additive manufacturing, also known as 3D printing, is becoming more widely used in the rail industry, particularly for the production of complex parts and components. This technology allows for faster prototyping and customization, reducing the time and cost required for product development.
- **Lightweight Materials:** The use of lightweight materials such as aluminium and composite materials is increasing in the rail industry, particularly for rolling stock. These materials offer significant weight savings, resulting in improved fuel efficiency and reduced emissions.
- **Modular Manufacturing:** Modular manufacturing is becoming more popular in the rail industry, particularly for the construction of new trains and other rolling stock. This approach allows for faster production times and greater flexibility in the manufacturing process.
- **Sustainability:** There is an increasing focus on sustainability in the rail industry, with a growing demand for low-emission, energy-efficient rail systems. Advanced manufacturing techniques such as lightweight materials and modular manufacturing are helping to improve the sustainability of rail systems. Further, there is increasing uptake and performance improvements of renewable energy production, storage and deployment.
- **Automation and artificial intelligence:** The increasing usage of robotics, automation and AI in manufacturing processes are resulting to shortening of product delivery and less reliance on labour workforces.

¹⁴ The Regional Research Collaboration (RRC) program links universities and local businesses to solve local and global challenges in areas such as energy and hydrogen technology, which are applicable to rail

Competitive strengths and advantages of Australia in advanced manufacturing, including Australia's comparative international position in advanced manufacturing

Rail manufacturing in Australia has many strengths and opportunities for further development and expansion, many of which are raised throughout this submission. However, there should be a particular focus on:

- sustainability (including development of jobs and skills);
- a national approach to rail manufacturing;
- high efficiency, automation driven manufacturing to remain competitive with low-cost labour nations; and
- resilient planning and cooperation with other suppliers in the face of uncertain volatile markets.

In addition to the key areas of Power & Propulsion; Materials and Manufacturing; and Design, Modelling and simulation, identified in the On Track to 2040 report¹⁵, the Rail Manufacturing Cooperative Research Centre recommended in its *Collaborative Rail R&D Successes, Challenges and Future Opportunities, a Rail Manufacturing CRC Perspective* report published in 2020, that Australia's rail industry should focus on the following key areas of ongoing research, to deliver the needs of the rail industry into the future:

- energy storage systems for light rail, hybrid rail and auxiliary power applications;
- high temperature batteries for outback rail applications;
- rollingstock-based sensors and applications for real-time condition-based monitoring above and below rail;
- coatings and laser repair treatments of rail components, including cold spray coatings for anti-corrosion and surface repair, and laser repair of rail components;
- weld modelling for ensuring the quality and reproducibility of fabricated rail parts;
- condition-based modelling and predictive maintenance models for rollingstock and rail infrastructure;
- passenger congestion systems that alleviate crowding, reduce train dwell times and improve customer service;
- passenger information systems that provide passengers with information to create a better customer experience;
- automated use of drones and robots to monitor track, culverts and rollingstock reducing corridor access times and reducing risk to staff;
- advanced materials and material analysis for increased longevity, reduced volume to landfill at end of life;
- virtual and augmented reality applications for training;
- new lightweight materials for rollingstock;
- video analytics for fault detection; and
- the use of low-cost robotics in rail manufacturing and maintenance facilities.

¹⁵ ANU et al, 2012, [On Track to 2040](#)

An internal survey of Australian suppliers indicated they are currently focusing their research efforts in the following areas, as they consider this to be the largest area of future opportunity in the rail sector and more broadly:

- energy storage, energy efficiency, energy movement;
- sustainability – hydrogen fuel systems, battery storage, clean energy technologies;
- cybersecurity;
- big data and artificial intelligence;
- rollingstock productivity – maintenance periods, passenger management, reliability, lower costs, accessibility;
- digital transformation;
- new passenger and freight mobility systems;
- carbon footprint, low emissions manufacturing;
- closed loop consumption;
- project related social performance; and
- passenger and freight end to end journey, accessibility and inclusion.

It is also worth noting that Australia has become a world leader in heavy haul rail technologies and heavy freight rail automation due to its large mining industry that requires efficient and reliable transportation of large amounts of minerals and resources. The freight rail network supporting Pilbara's iron ore industry spans 3,664km and is home to the world's first fully automated heavy haul rail network. This outstanding example of productivity and efficiency delivers real environment and safety benefits too, with one automated train in the region carrying the equivalent of 631 B-Double trucks.

Lastly, systems engineering, asset management, and systems management are competitive and value add manufacturing areas Australia should focus on continuing to develop.

Barriers to the growth of advanced manufacturing in Australia – including barriers to existing manufacturers, particularly small and medium enterprises, adopting advanced manufacturing technologies and processes such as AI and robotics

While the health of the local rail supply chain has improved in recent years with the significant pipeline of rail investment, challenges and threats to its longer-term sustainability remain.

The domestic rail industry has numerous legacy issues that impact its ability to scale up and operate at optimal efficiency. While some of these problems are due to the unique development of the rail industry in Australia, others are the result of persistent mismanagement, misallocation of resources and poor national transport policy. Threats to the local supply chain include:

- Historically fragmented sub-national markets in terms of regulations, standards, systems, technologies and competencies that stymie scale economies, innovation and skills development.
- Regulatory, funding and pricing models that disproportionately favour investment in road freight haulage at the expense of rail freight, considering rail's economic and social benefits.

- Procurement processes that are inconsistent between jurisdictions, increasingly complex, increasingly allocate risk from procurers to the supply chain and do not effectively support innovation nor local participation and investment.
- Local content policies that tend to amplify challenges wrought by fragmentation and work against developing a strong national supply chain, exacerbated by manufacturing facilities being duplicated in various jurisdictions.
- Volatility of investment in fixed rail assets, as well as rollingstock, which also inhibits private sector investment in long term capacity.

Critically, many of these issues are interlinked. While the fragmentation of the Australian rail industry is a historical legacy issue, subsequent regulatory, innovation and procurement policies have continued to hamper industry sustainability and growth. It is the culmination of these issues that has created a significant barrier to achieving requisite scale in the Australian market for many rail manufacturers. Only with sufficient scale can local industry invest in skills, undertake necessary investment in innovation, and build more reliable and internationally competitive advanced manufacturing systems and processes that can more readily compete in global markets.

This is important as international markets are a source of more stable, supplementary demand that can support growth and sustainability in Australia's rail supply chain. Unfortunately, the pathways for local Australian suppliers into global supply chains is not clear or available for most. Foreign companies tend to rely on their own local subcontractors and supply chains where they are most familiar with quality and other risks and challenges. Unless Australian firms team up with major international suppliers, being more integrated with global supply chains is extremely difficult in practice.

The COVID-19 pandemic and the steps governments have taken to bring it under control, have unfortunately had a significant impact on some parts of the economy. For rail manufacturing, this has had the greatest impact on workforce limitations. The Australian rail supply chain relies heavily on strong, coordinated global production and trade links, noting the increasing internationalisation of complex rail equipment, systems and components. Even with this significant international reliance, the Australian rail supply chain has remained somewhat resilient, albeit with increasing challenges and costs. However, limited migration and movement of skilled workers, both internationally and domestically have certainly impacted access to skills. With many large manufacturers being national or multinational companies, rail supply chains are highly interlinked across borders, and as a result this has constrained access to skills in manufacturing and has particularly hampered onsite commissioning and testing of rail assets. Overall, restrictions on the movement of people have highlighted the need for a more resilient local skills pool. This could be supported by more stable domestic demand and would assist in balancing volatilities in export opportunities.

Australia should be selective of where it should invest in manufacturing capacity. Australia will be uncompetitive internationally if it attempts to compete on cost in low-value, low-design, and low-tech manufacturing, due to its high input costs. However, there are significant manufacturing investment opportunities in high value add sectors. There are many examples of Australian manufacturing capabilities that have shown they can compete internationally.

Pandrol, a manufacturer in Western Sydney is having success in exporting components to the Asian region, being competitive on cost, due to its manufacturing processes but also through its superior product design.

Another example is Knorr-Bremse Australia, which is considered a regional Centre of Competence for HVAC (heating, ventilation, air-conditioning). The organisation has 35 engineers and a research and development centre with world class climate chambers located at Granville, NSW. Knorr-Bremse Australia is currently locally producing HVAC units for Melbourne (HCMT) and Perth (Metronet) in Melbourne and Perth, units for export to Dhaka at Granville, units for defence applications for domestic defence contractors, as well as units for mining and exporting to the US and Thailand. In addition, they are currently engineering, project managing and invoicing from Australia rail projects in Vancouver, Chicago, Hong Kong, Doha, Philadelphia and Baltimore using intercompany contract manufacturers.

This example demonstrates that if an organisation can establish competent local specialist engineering capability, combined with reasonable local volumes (ideally aggregated in one location) then it opens up the ability to export and play successfully on a global stage. However, if local manufacturing capability is lost in key skill areas, it not only increases the risk around project delivery should the international supply chain experience volatility, but the maintenance capability is also impacted in the local market. Manufacturing is also a major source of commercial innovation to enable growth. It is essential that we have government policies that foster the growth of local manufacturing capabilities, rather than hinder it.

Resources consumed in the procurement process also take away from the industry's capacity to deliver, presenting barriers to growth in Australian rail manufacturing.¹⁶ Utilising these scarce resources more efficiently (on productive and value adding outcomes) is vital in order to get the best outcomes for upcoming rail projects. Markets where procurement practices are seen as inefficient and expensive, where tenders are either not awarded or are significantly delayed, or where the scope or risk profile changes significantly after the initial decision to bid is made, are likely to be seen as unattractive.

The ARA notes that Australia's tendering practices are found to be significantly costlier and more time consuming compared to international benchmarks. The tendering costs in Australia are estimated to be around 1-2 per cent of a project's total cost, at least double the world benchmarks of 0.5 per cent.¹⁷ Increased tender costs immediately reflect in project pricing, so reducing costs of tendering should be important to all parties. High tender costs also increase the risk profile for tenderers and thereby tend to discourage participation.

¹⁶ Further information on local content best practice principles for rail procurement can be found in the ARA [A Best Practice Guide to Rollingstock and Signalling Tendering in the Australian Rail Industry](#) and [Best Practice Principles for Rail Construction Procurement](#) reports.

¹⁷ Rail Express 2012, The Sustainability of Rail Contracting in Australia.

The ARA therefore proposes that significant benefits could be realised if improvements were made to current Australian industry procurement practices. Substantial improvements can be achieved through more streamlined and consistent tender processes that improve efficiencies for both suppliers and purchasers, from pre-qualification right through to contract award.

In particular, to ensure that there is an efficient tender process that minimises the consumption of resources on redundant and non-productive outcomes. This would also tend to reduce procurement cycle times, further reducing costs and releasing industry capacity for delivery. Further, tendering on the basis of appropriate and more standardised contracting models and risk allocation frameworks for delivery will also reduce tender development and negotiation costs. Creating such a consistent and well understood delivery environment will also lead to more successful project delivery outcomes.

Financial and non-financial investment opportunities or possible reforms to support the growth of advanced manufacturing in Australia in: renewables and low emission technology; medical science; transport; value adding in agriculture, forestry and fisheries; value adding in resources; defence; and enabling capabilities

There are several gaps and barriers impeding private sector investment in rail transport, including:

- a lack of coordinated research and development (R&D) and inappropriate R&D models;
- the scale of investment required, with minimal transparency from jurisdictions regarding investment decisions;
- the unpredictable nature of investment in infrastructure and transport by governments;
- state based local content policies applied by some Australian jurisdictions that disadvantage those lead to duplication facilities and diluted investment;¹⁸ and
- type approval processes that hinder the adoption of new innovative products.¹⁹

Applications that are being used in energy, manufacturing and defence are transforming the opportunities for rail, with intelligent systems, automation, sensors, predictive maintenance, advanced asset monitoring, traction and train control technologies, and energy efficiency. New technology and innovation can involve high deployment costs and complexity when integrating with legacy rail systems, but can deliver higher relative benefits than traditional projects:

It is important to note that while Australia has a sufficient research community, incentives are needed to strengthen industry collaborations with sectors such as rail, and transport more generally. Currently much of the rail research in Australia is performed in an ad-hoc manner, usually through established collaboration relationships between research groups and industry partners.

¹⁸ Further information on local content can be found in the ARA [Towards a National Local Content Policy](#) and [Benefits of a National Local Content Policy](#) reports.

¹⁹ Further information on type approvals can be found in the joint ARA and RISSB [Estimating the economic cost of Type Approval processes in the Australian rail industry](#) report.

Funding made available by the Australian Government could be used to establish a new national compact to boost the economic contribution and legacy of Australian research and industry for planned rail investment over the coming decades, with deep partnership across governments, industry and operators to:

- make rail innovation a national priority a new national public body is needed to drive national planning and coordination of investment, support long term R&D and commercialisation investment, and develop national capability and an export strategy for the sector;
- develop a single market for rail technology a single market is needed with common standards, nationally accredited testing, a national industry policy, and industry-standard training;
- build a culture for rail innovation, best practice procurement and contracting is needed with the development of states' smart rail strategies to build an investment pipeline for digital technology, and building the brand for Australian rail innovators globally; and
- aid in industry collaboration, a technology and innovation roadmap is needed to guide research direction and investment which would assist in the application of new technology or systems as this can be challenging for the rail sector.²⁰

An international benchmark of railway research and innovation undertaken by Monash IRT in 2022, demonstrated that countries with the most technologically advanced railway systems have a national agenda to deliver and strengthen innovation in railways which has been integrated into national planning and policy development.

Tax and concession incentives can also be used to support rail manufacturing in Australia by providing financial incentives that encourage investment, research and development, exports, employment, and infrastructure development in the industry.

The opportunities to increase the number of workers employed in advanced manufacturing, including consideration of ways to increase the participation and retention of women and other historically underrepresented groups

There are several opportunities to increase the number of workers employed in rail manufacturing in Australia noting that this requires a collaborative effort from industry, government, and educational institutions to attract and develop a skilled workforce that meets the needs of the industry:

- Collaboration with educational institutions: Rail manufacturers can collaborate with educational institutions to develop training programs and apprenticeships that equip students with the skills needed for jobs in the rail manufacturing industry.
- Upskilling of existing workers: Companies can invest in upskilling their existing workforce by providing training and development opportunities that enable them to learn new skills and technologies.

²⁰ Further information on rail technology and innovation can be found in the ARA's [Finding the fast track for Australasian rail innovation](#) report.

- Government support: The government can provide financial incentives and subsidies to companies that invest in training and development programs for their workforce.
- Regional development initiatives: Rail manufacturers can collaborate with regional development initiatives to attract workers to regional areas where there may be a shortage of skilled workers.
- Promotion of the industry: The industry can work to promote itself as an attractive long term career option for young and diverse people, particularly those interested in technology and engineering. The ARA's Work in Rail website that is in the process of being developed is an example of industry seeking to promote careers in rail.
- Consistency of skills and recognition of skills across jurisdictions: Government needs to work with industry to ensure that the required safety qualifications are harmonised across jurisdictions.

Skills needs in advanced manufacturing

Trades are central to manufacturing, however with an increasing digital complexity part of rollingstock manufacture, rail will require skills in systems engineering as well as graduates from degrees such as computer science and mechatronics. Systems integration skills will also be central to rail operations in the future. Also, importantly workers need to have the ability to adapt to rapidly changing technology and working environments utilising analytical thinking. The emergence of AI, machine learning and coding demonstrates the need for workers to adapt to emerging technologies.

Rail has historically suffered from a lack of consistency of skills and recognition of skills across states and territories. In the manufacturing area this is less of an issue, however when testing and commissioning at the end of a manufacturing process, government needs to work with industry to ensure that the required safety qualifications are harmonised across jurisdictions.

Government could assist by supporting the build of training packages in the VET sector that ensure systems integration is a key feature. Similarly, government needs to review relevant trade qualifications to determine whether or not the content within the qualifications is preparing apprentices and trainees for the world of work in the manufacturing space. Robotics and automation are much more a feature of manufacturing of rollingstock than was the case even five years ago.

The ARA is pleased to note that the Australian Government intends to better fund the TAFE sector and we hope that in doing so the needs of large industry sectors such as rail can be considered as a focus for TAFE funding.

Government needs to continue to support the National Rail Skills Hub to undertake research that identifies pathways for learners from post school through to all the roles needed in the manufacture of rollingstock.

New skills will be required due to the development of new technologies and innovations to improve network operations, reduce power consumption, smarter monitoring and asset management processes, and advanced safety, threat detection and intervention.

Conclusion

Many of the issues facing the Australian rail manufacturing sector are long-standing and will be familiar to anyone that has had some involvement in the rail industry. There have been numerous reports, inquiries, and recommendations canvassing these issues over the year.

The ARA welcomes the Australian Government commitment for renewed coordination in the National Rail Action Plan and the National Rail Manufacturing Plan. However, the significant procurement reform and incentivised standardisation across rail networks are still required to make rail manufacturing a stronger and more viable industry that can support the delivery of the \$154 billion investment pipeline for rail over the coming 15 years, as well as foster more Australian innovation and export opportunities.

Rail manufacturing, and manufacturing in general in Australia, has evolved significantly from its blue-collar beginnings into a high-technology industry focussed on innovation. There is a significant opportunity to create an industry that invests in skills, research and development, as well as production facilities that can support not just rail but the broader transport, aviation, defence, and clean energy industries.

Now is the time for Government action to commit to broader support for the long-term sustainability and growth of the rail manufacturing supply chain in Australia, which in turn will help drive job growth in the regions, as well as secure our broader economic recovery.