

POLICY BRIEF:

# FAST TRACKING RAIL INNOVATION

## 1. CHALLENGES OF RAIL INNOVATION

When Australia's first railways were developed in the mid-nineteenth century, they catalysed economic and social development and connected distant settlements. However, the political arrangements in the colonial era and the tyranny of distance meant that the railways developed separately, with different standards and gauges.

This also resulted in vertically integrated state-owned enterprises that largely built and maintained their own rolling stock and infrastructure, which included in-house technical innovation capability.

Nearly two centuries later, successive reforms and investment have modernised and electrified these railways, and established a standard interstate rail network and a single national rail safety regime. But the original state-based fragmentation remains, and continues to thwart optimal rail development in Australia, with the innovation legacy of the past being lost.

There remains no national agreement on the signalling, automation or smart rail standards needed for a modern rail system in the 21st century. While technology offers network-scale interoperability benefits, Australia continues to develop different systems in different jurisdictions. Significantly the sustainability credentials for rail are not being used as a key driver for meeting environmental targets and reducing energy use.

The closure in June 2020 of the Rail Manufacturing Co-operative Research Centre (RM CRC) has left a funding and leadership gap in the national landscape for local collaboratively developed manufacturing solutions and products. In light of COVID-19, many advanced manufacturers are recalibrating global supply chains to ensure resilient and efficient local supply.

The Australasian Centre for Rail Innovation (ACRI) is now the only national body that pursues collaborative pursuits of innovation through targeted applied independent research. In 2014, ACRI emerged from the previously government seed funded CRC for Rail Innovation to become both industry funded and led. Devoid of ongoing Federal funding support and without the broader uptake of industry, the \$10 million of research delivered to date is the bare minimum Australasia needs for opportunities that lie ahead.

With \$155 billion in rail investment committed and forecast over the next 15 years, there is a landmark opportunity to ignite national collaboration and innovation, with potential direct application on Australian rail projects, as well as building local innovation expertise and capability.

## 2. HOW DOES AUSTRALIA COMPARE?

The ARA commissioned L.E.K. Consulting to undertake international benchmarking in rail innovation. The research found Australia lags behind global comparators in research and development (R&D) in commercialisation, and in rates of technology adoption. In addition to the lack of funding available in Australia, some of the key drivers include:

- Multiple rail operators, track owners, rules and type approvals make Australia a challenging market for technology developers and suppliers
- Weak linkages across the value chain will see the continuation of a small pool of local commercialisation
- State-based local content requirements that inhibit the achievement of scaled rail manufacturing in Australia
- Rail planning, investment and procurement is risk averse and does not incentivise innovation well

International research found an unequivocal link between well-funded national rail research and productive and efficient railways. The implication is that rail innovation in Australia needs a focus both on driving collaborative research and on building a culture that demands innovation and continuous improvement.



### 3. WHY IS RAIL INNOVATION IMPORTANT?

The global market for rail technology is worth AU\$362 billion, and is growing, with almost all aspects of modern rail systems experiencing digital and technological innovation. In particular, the convergence of information and communications technologies has changed the way that railways are planned, built, run and maintained. For Australia to maximise the benefits of its rail network, it is essential that Australia develops and adopts technological innovations. International experience demonstrates the benefits that can be achieved. For example:

- **Cost savings:** Building Information Modelling on complex rail construction in Germany reduced costs by 10 per cent, with ongoing energy and maintenance savings<sup>1</sup>
- **Capacity:** The Rail Sector Deal in the United Kingdom (UK) invested in data, digitalisation and sustainability, and was estimated to deliver up to £31 billion pounds in benefits<sup>2</sup>
- **Reliability:** The sensor arrays and artificial intelligence of MOXI, being used by VicTrack and East Japan Railway, have been able to predict adverse car and track conditions to better than 90 per cent accuracy, improving safety, maintenance costs and allowing earlier action on faults<sup>3</sup>
- **Time savings:** ICT tools used to optimise online rail operations halved wait times between trains on Berlin's U-Bahn network, and enabled safer operation on high risk corridors<sup>4</sup>
- **Safety:** In the United States, preventative maintenance technology such as wayside detectors, smart sensors and infrared lasers assess the condition of bearings, axles and wheels, reducing mainline equipment-caused accidents by 36 per cent over a decade<sup>5</sup>
- **Energy Efficiency:** Energy storage systems on Tehran Metro yielded daily energy savings of 25 per cent<sup>6</sup>

### 4. DRIVING RAIL INNOVATION – THE WAY FORWARD

Bringing Australian rail up to international standards needs a renewed commitment to innovation from industry and government. *The ARA recommends a national agreement between government and industry to boost and commercialise Australian research to support planned rail investment over the next 15 years.*

The Agreement would have the following objectives and recommended actions, noting these should be considered and progressed concurrently.

#### **OBJECTIVE:** MAKE RAIL INNOVATION A NATIONAL PRIORITY

National recognition of the importance of rail technology and innovation will drive the productivity and performance of the national land transport network, while fostering higher value-added local industries. The ability of *innovation and technology to help achieve sustainability targets* must also be recognised.

#### ➔ **Action - Establish a National Body to direct and adopt Rail Innovation**

- A new national body is needed to lead rail innovation, *drive national planning and coordination of investment, support long term R&D and commercialisation investment*, promote the adoption of global innovations, and develop national capability and an export strategy for the sector.
- Consideration should be given to *evolving and expanding the role of the Australasian Centre for Research and Innovation (ACRI)* to be this new national public body. ACRI has advised it is motivated and stands ready to engage in further discussion on an improved model that meets industries needs.
- It is recommended that the importance of rail innovation, and the establishment and resourcing of the new body should be *endorsed through a Memorandum of Understanding between governments and industry*, via the Infrastructure and Transport Council and the Australasian Railway Association.



The new national body would take responsibility *for the following three actions:*

➔ **ACTION - Establish an investment program to initiate and commercialise rail R&D**

- Australia requires a *publicly funded investment program to fund rail R&D* commensurate with its strategic importance, with matching contributions from the rail industry.
- The new national public body would work with governments and industry to establish the parameters of the investment program.

➔ **ACTION - Develop a National Rail Innovation and Capability Strategy**

- There is a need for an *overarching strategy to ensure rail innovation is aligned to jurisdictions' future digital and technology investment pipelines*. The strategy would set long term goals as well as more immediate focus areas.

➔ **ACTION - Develop an exports strategy for Australian rail innovation**

- An exports strategy would be aimed at *building and promoting the Australia rail innovation sector globally*, leveraging trade missions and international events to target high value and exportable rail innovation.

**OBJECTIVE: DEVELOP A SINGLE MARKET FOR RAIL TECHNOLOGY**

A single market with common standards for rail technology would support innovation by promoting scale efficiencies, support supplier specialisation and local manufacturing, and encourage 'pull-through' in the innovation system from research to development. The ARA recognises that the National Rail Action Plan (NRAP) is an attempt to reach agreed outcomes on skills and workforce development, interoperability and standards, and this must continue to be supported.

➔ **ACTION - Transition towards development and adoption of common standards, linked to nationally accredited testing**

- Government and industry should *increase efforts toward supporting the continued development and application of national standards* (through RISSB and the NRAP), *supported by common type approval processes* that address unnecessary regulatory fragmentation and streamline the path to market for new technology. Standardising rail requirements across jurisdictions will streamline processes and encourage more innovation across the industry.
- A common approvals process should be *supported by a new national testing facility* (see for example the Transportation Technology Centre in America<sup>1</sup>) or a national network of testing facilities to remove unnecessary duplication of approval requirements. An Australian based national testing facility would also result in shorter durations for approvals and would help promote local content requirements.

➔ **ACTION - Advocate for the replacement of state local content policies with a national policy, with a focus on innovation.**

- *Governments should move towards the implementation of a national local content policy*. This would deliver substantial benefits to both procurers and proponents through more employment opportunities, economic activity and innovation, nurturing local supply chains and building resilience, minimising whole of life costs, maintaining skills capabilities (including understanding of local conditions) and investment in assets and new technologies.
- Noting the impacts of the COVID pandemic, there is an opportunity to reduce reliance on international supply chains and *strengthen the resilience of Australia rail supplier network* with a national local content policy.
- State based local content policies can inadvertently limit investment, growth, competitiveness and innovation for local suppliers. *Governments must work together to support the sector* through collaboration and long-term vision.

<sup>1</sup> The Transportation Technology Centre is a c.77km test track located in Colorado, US, owned by the FRA but leased to a private operator. The test facilities play a major role in the development and application of new technologies for railways, solving technical problems with full-scale testing and computer modelling prediction services.



→ **ACTION - Develop industry-standardised training for new rail systems**

- As common standards and testing across Australia are developed, there will be a need for *industry and governments to drive the development of a new approach to rail skills acquisition, which should include standardised competency management*. This approach should consist of foundation skills that are applicable to all rail systems in Australia with the ability to then specialise in different learning modules specific to the job and/or network.

**OBJECTIVE: PROMOTING INNOVATION**

Developing a culture that promotes rail innovation must start with rail network planners, transport executives and Ministers. This positive approach to innovation should flow through from the planning of investments and post-build improvements to agency-level procurement and contracting.

→ **ACTION - Focus on best practice procurement and contracting**

- Governments must recognise the role they play in *fostering innovation and technology through procurement and contracting processes*. Mechanisms that can accelerate technology adoption include innovation targets and incentives for rail contractors and operators, and removing terms that discourage the procurement of like-for-like replacement of components where newer technologies are available.
- Government procurement policies should also *assess new and existing products based on lowest end of life cost* (capital and operational costs combined).

- Jurisdiction base differences between tendering processes add unnecessary cost and red tape. ARA has produced a *best practice tendering framework for rolling stock and signalling procurement* to create a nationally consistent approach.

→ **ACTION - Develop states' smart rail strategies to build the planning pipeline for digital technology**

- Through the Infrastructure and Transport Committee, *there should be a commitment from Governments to develop state-based smart rail investment strategies* to support a culture change within the rail sector.
- This initiative would *improve planning transparency and assist the supplier sector prepare more efficiently*. These would be subsidiary plans to state-based infrastructure strategies, and would inform the National Rail Innovation and Capability Strategy.

→ **ACTION - Build the brand for Australian rail innovators at global trade shows**

- Industry and Government must consider *more strategic international positioning to build Australia's brand as a rail innovator*. This would include strong and coordinated representation at international trade shows (such as the InnoTrans trade fair) to foster more local demand for innovation and expose Australian railway procurers to emerging technologies.

**ENDNOTES**

1. (119) Ehrbar, H., Building Information Modelling – A new tool for the successful implementation of major projects of German railways, Dec 2016, Geomechanics and Tunnelling 9, No.6.
2. (120) Oxera, Economic benefits of the Rail Sector Deal, Rail Supply Group, July 2018, Economic benefits of the Rail sector deal.
3. (121) Cho, A., Rail Lines Apply Sensors and AI to Predictive Maintenance, 2019, ENR FutureTech, visited 17 June 2019.
4. (122) Niculescu, Golgojan, Bednarz, Ivanova, Maly et al., Smart Rail Infrastructure, Maintenance and the Life Cycle Costs, 2014, Transport Problems, Volume 9, Smart rail infrastructure.
5. (114) Association of American Railroads, 2018, Putting technology to work – How freight rail delivers the 21st century  
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6. (122) Niculescu, Golgojan, Bednarz, Ivanova, Maly et al., Smart Rail Infrastructure, Maintenance and the Life Cycle Costs, 2014, Transport Problems, Volume 9.

**WANT TO KNOW MORE?**

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