



Inquiry into the Australian Manufacturing Inquiry

Questions on Notice

Question 1

Your submission pointed identified that Australia has a national advantage in education and research skills at present, but that this was “relatively untapped at present”, with graduates typically choosing career pathways outside of manufacturing. You suggested an option where industry could be invited to help co-design programs that would give students industry experience and exposure to manufacturing. Could you expand on a bit on what that might look like, and whether there are any similar programs that you are aware of which could be looked at as a potential model?

Response

CSIRO supports building a pipeline of industry-ready STEM (science, technology, engineering, and mathematics) talent and has provided a range of programs over many years to address this goal. A recent example is a new program to place STEM undergraduates (universities and TAFE) into SMEs and large organisations across New South Wales.

Funded by the NSW Department of Education, *Generation STEM* is a 10-year initiative to attract, support, retain and train NSW students in STEM and school, and open pathways into further education and into employment.¹ The *Generation STEM* program aims to place 300 students into businesses over the next 30 months – with a focus on growing sectors such as manufacturing. The students are paid a fixed wage and the companies are provided a grant of \$2,500 to cover half the cost of the placement. CSIRO provides a matchmaking, facilitation and monitoring service for both parties.

As well as creating future employment opportunities for the students, the program aims to build relationships between universities and industry, which may lead to longer term collaborations. Should the pilot prove successful, this program could be rolled out at a national scale.

Other opportunities to expand the pipeline of manufacturing industry-ready STEM talent include:

- Programs to drive industry-focused postgraduate research degrees (PhD and Masters) including industry internships, projects identified by industry partners, and professional development and training components.
- Postdoctoral and graduate placement programs to place early career researchers (ECRs) from universities and publicly funded research organisations (PFROs) into businesses to develop and implement new ideas with commercial potential.

¹ See <https://www.csiro.au/en/education/programs/generation-stem>

Question 2

Your submission highlighted ‘sustainable and agile’ manufacturing as an opportunity area and suggested that “moving toward closed loop systems with re-cycle, re-use and re-manufacturing principles will enable Australia to offer traceable premium green products and reduce reliance on imported critical parts and materials”. Could you expand a bit on how you think the government could support the growth of the manufacturing sector in a way that is comparable with this circular economy approach you’ve identified as an opportunity?

Response

CSIRO’s *Circular economy roadmap for plastics, tyres, glass and paper* (2021)² identified five strategies that can be used to provide considerations for the government to support the growth of the manufacturing sector. These are summarised in the table below.

STRATEGY	CONSIDERATIONS
Improving product design, collection and sorting outcomes to retain the quality and value of materials and prevent material loss	<ul style="list-style-type: none">• Government investment in product stewardship schemes to encourage industry to increase recovery of materials at end of life is an excellent example of improving collection and sorting outcomes.
Building capacity for reprocessing and manufacturing of recycled products nationally aimed at increasing the ability to create wealth from waste domestically	<ul style="list-style-type: none">• Developing and implementing advanced recycling technologies that can convert plastic waste back into food grade, plastic products could create domestic wealth from waste while boosting our manufacturing sector.• CSIRO’s recently published research on advanced recycling demonstrates the importance of investing in innovation and supply chain collaboration.• CSIRO’s Ending Plastic Waste Mission has early-stage plans for a national innovation hub for the advanced recycling of plastics which is a mechanism for government, industry and research to co-invest and collaborate on the responsible scale up of these technologies in Australia.
Encouraging and facilitating market development to grow the circular economy including boosting market demand for recycled products and products that contain recycled content	<ul style="list-style-type: none">• Government procurement strategies can be used to support or remove barriers to the sustainable procurement of products derived from recycled content.• Supporting or enabling circular economy networks and organisations (such as CSIRO commercialised technology ASPIRE) can be used to improve markets for waste exchange.• Other examples of government support that will enhance local manufacturing opportunities to deliver cost effective, environmental services are forward commitment procurement approaches (see page 92 of the Roadmap) or targets for procurement of recycled content.
Harmonising standards, regulations and messaging across jurisdictions to provide consistency in governance and create sustainable materials management capability in Australia	<ul style="list-style-type: none">• This work is ongoing by Federal, State and Territory Governments.

² See full report for further details: <https://www.csiro.au/en/research/natural-environment/circular-economy>

STRATEGY	CONSIDERATIONS
Facilitating systemic change from linear to circular material supply chains that foster sustainable consumption and production.	<ul style="list-style-type: none"> Economic transitions to decouple economic growth from environmental impact often intersect the responsibilities of multiple Government Departments. For example, as Australia transitions to a circular economy for plastics, this would reduce the environmental impacts of plastic pollution (DAWE) while simultaneously providing opportunities for industry engagement and investment (DISER). Change could be enabled through education for industry on circular supply chains, consumer education campaigns, and continued and increased collaboration between Departments.

Question 3

Another opportunity that you have identified is in ‘value-adding downstream processing of minerals’, including the production of refined metals, pre-cursor chemicals, alloys and high-end engineered products. You added that supporting growth in these areas would strengthen our supply chain sovereignty, improve environmental impacts associated with mining, and generate high-technology jobs and industries. Can I ask you to expand upon what you see as the current barriers to the downstream processing of minerals, and what role government might be able to play in enabling industry growth in these areas?

Response

The CSIRO *Critical Energy Minerals Roadmap* outlines opportunities to extract new value from our mining and manufacturing sectors and identifies detailed barriers and actions.³ CSIRO’s Critical Energy Metals Mission, which is under development, seeks to create and demonstrate breakthrough technologies to unlock the full economic potential of energy metals for Australia.

The Roadmap identifies the following barriers:

- **Customer location:** For most of the shortlisted energy technology value chains, production of high specification materials and their associated powders, alloys and components will require know-how and core intellectual property (IP) that exists in overseas jurisdictions. However, Original Equipment Manufacturer (OEM) decisions regarding technology licensing and investment in new regions is likely to depend on proximity to large consumer markets and the availability of dedicated R&D precincts to enable continuous improvement.
- **High cost of energy:** Particularly on the east coast of Australia, the cost of energy continues to remain high which represents a barrier to cost competitive mining and manufacturing due to the price sensitivity of relevant processes.
- **Willingness to pay a premium:** The potential to supply sustainably sourced materials is a key comparative advantage for Australia. However, compliance with various sustainability measures and frameworks typically increases the cost of production. There is considerable conjecture over the willingness of OEMs to pay the consequent premium, particularly as they seek to levelise the cost of emerging energy technologies with fossil fuel incumbents.

Actions and considerations identified by the Roadmap varies by the opportunity in question. At a broad level, actions within the Roadmap include the following:

³ See full report for further details: <https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/futures-reports/critical-energy-minerals-roadmap>

- Assist deployment of (non-mine specific) infrastructure (e.g., energy, transport).
- Revise mine royalty regimes to include chemicals and alloys.
- Implement centralised research institutes to coordinate collaborations between industry and the research community.
- Improve tertiary training programs for production of high purity materials and chemicals.
- Incentivise greater exploitation of secondary minerals among major miners via joint ventures with junior miners.
- Ensure consistency of environmental and technical standards with key trading partners.

Question 4

Your submission pointed identified the ‘maximisation of local manufacturing capabilities’ as an opportunity area, particularly within the aerospace and defence industries. Other reports that you have pointed to listed significant opportunities within the Medical Technologies and Pharmaceuticals, low emissions technology, critical energy, food waste processing, hydrogen, and quantum technologies. There is obviously a broad scope of areas where government can try to support the development of new industries, but as always, there is a balancing act between providing targeted support and not being so targeted that you run the risk of missing other opportunities that might not have been as immediately obvious. Did you have any thoughts on how the federal government should balance that task in a way that enables rapid growth in some of these areas of potential advantage, without potentially doing undue harm in other areas of the economy?

Response

The answer to this question is multi-faceted as there are several approaches that could be considered. One approach would be to consider further development of and investment in industrial innovation hubs.

CSIRO’s recently released *CO₂ Utilisation Roadmap*⁴ provides examples of how industrial hubs can help de-risk multiple manufacturing opportunities by bringing together necessary infrastructure, capabilities, resources and initial customers to support scale-up. For example, the Roadmap discusses how CO₂ could be utilised for chemicals and fuels manufacturing and the manufacture of building products and materials – thereby turning CO₂ from a waste stream or a risk into an opportunity. Chemicals and fuels manufacturing requires large amounts of hydrogen and can be aligned to existing national hydrogen strategies and hub investments. In the case of building products and materials, there is potential to manufacture products that lock away CO₂ and use various feedstocks including waste streams from steel making (steel slag) or mine tailings (particularly nickel-based tailings). These feedstocks can also be used to support areas such as metal mining and processing. For example, hydrogen can be used as a reductant for steel making and might also be used for the processing of rare-earth elements (REE) and battery metals.

Other examples of hubs can be seen in existing CSIRO initiatives, such as the Lab22 Innovation Centre⁵ and the Lindfield Collaboration Hub.⁶

⁴ See full report for further details: <https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/futures-reports/co2-utilisation-roadmap>

⁵ See <https://www.csiro.au/en/research/technology-space/it/lab22>

⁶ See <https://research.csiro.au/lindfieldhub/>.