By email: productivity.inquiry@pc.gov.au

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Australian Academy of Science submission on the Interim Reports of the Productivity Inquiry

The Australian Academy of Science welcomes the opportunity to comment on the Productivity Commission's inquiry into productivity. This submission responds to the first, second, third and fourth interim reports. The Academy welcomes the Commission's focus on innovation as a driver of productivity across the economy. Scientific research is key to innovation for all Australians yet current policies fail to maximise science's potential benefits to the economy.

The Academy recommends that the Productivity Commission recognises that:

- Support for science is essential to productivity growth
- Australia cannot focus on diffusion at the expense of novel innovation—we must do both to grow productivity and safeguard the national interest
- A robust, mobile and diverse STEM labour market will improve productivity

Science policy is economic policy

Science policy is economic policy. Science is at the core of virtually all products used every day in the modern world, from smartphones to pharmaceuticals and beyond. Support for science is essential to building a productive, sustainable economy.

Sustained economic growth comes mainly from productivity increases; the most significant factor in productivity increases is knowledge capital; knowledge capital is largely gained through skills, R&D, new technology, and efficient services and production processes.[1] Science is key to these.

Science is an intangible good and should not be neglected for that reason. Systems for measuring science must be developed to accurately account for science-related activity as part of our measures of productivity.

A focus on diffusion overlooks the need for sustained fundamental research

The first interim report presents a narrow narrative of innovation that does not reflect contemporary economic strategy performed by other nations. An emphasis on the importation and diffusion of "innovations" is antithetical to developing sovereign capability and safeguarding the national interest.

The report fails to capture the nuance that a portion of the productivity gains from Australian research has been the result of patiently funded discovery research (sometimes called 'fundamental' or 'basic' research). Such research requires '**patient capital**' which is resilient to the short-term demands of immediate shareholder demands (for industry) or electoral and fiscal cycles (for the government).

There are many examples why **Australia must not rely upon overseas innovation, overseas capital, or overseas skilled labour**.

A robust, mobile and diverse STEM labour market will improve productivity

The first report contrasts laboratories 'generating new things' with processes of changing the way a business operates and asserts that the former requires STEM skills while the latter requires 'strategic understanding, creativity, drive, risk appetite, emotional intelligence and adaptability (p. 45). STEM skills generate many of the latter factors. As the first report later acknowledges (p. 47), the ability to problem solve and to think critically are critical foundational skills for the modern economy. These are inherent components of quality scientific training.

The third interim research report also asks 'what kind of arrangements would foster the greater movement of researchers from the social science fields into Australian businesses'. We can only assume that this is a typographical error.

Australia needs highly skilled and well-trained people to move into business in greater numbers than we presently get.

The Academy suggests that the Commission investigates opportunities for small and medium enterprises (SMEs) to engage with and hire scientists. Australia's SMEs dominate our economic structure, but their investment in R&D lags behind global averages. Existing Australian programs which seek to improve the level of SME engagement with R&D have been piecemeal and lacked critical mass. There are successful models from overseas which should be investigated, including Interface in Scotland and the Small Business Innovation Research program in the United States.

Australian businesses are reluctant to hire PhD trained scientists. Hence many early and mid-career researchers explore the possibility of an academic career and are effectively forced to focus on publications and grants rather than exploring industry or business opportunities. This in turn creates the perception that their skills are less relevant for the typical business to employ.

The Academy also notes that **diversity is critical to excellence in science**. A diverse and inclusive science community that combines the widest range of talents, backgrounds, perspectives and experiences, maximises scientific innovation and creativity. This in turn will maximise the competitiveness of Australia and its scientific industries as well as addressing equity issues.

Current grant settings act as a drag on research which slows productivity

A large source of productivity gains is attributable to science, yet the burdensome grant system for publicly funded science hinders rather than helps academic research productivity.

In Australia, months are routinely spent preparing applications for grant funding, yet success rates are generally low, typically between 10-20% of project applications being funded—and often only partly to the level requested by researchers. This low rate is despite more, often many more, being worthy of funding. These problems disproportionately impact early and mid-career researchers (EMCRs). The severe administrative burden limits the ability of EMCR scientists to move between different sectors, including industry. It perpetuates job insecurity for these researchers, who are forced to compete for highly competitive short-term employment contracts while juggling high teaching loads and applying for highly unlikely larger grants.

The public research ecosystem has become characterised by more and greater complexity. In 2021 there were roughly 202 programs distributed across 13 different portfolios—a fragmented and complex system that creates a substantial administrative burden on all parties – from the government to industry, researchers and universities and inhibits scalability. It is unlikely that this complexity has enhanced the quality, volume and impact of Australian research.

It is clear, however, that **Australia's grant funding councils are overwhelmed by demand**, and we need to reinvent our competitive grants system. A new overarching body, modelled on the United Kingdom Research and Innovation should be explored.

There is room for innovation and experimentation in the awarding of grants. For example, the British Academy's small research grants scheme will be allocated for three years by a partially randomised trial.[2]

Open research can support productivity with appropriate frameworks

The Academy has a long-standing position that the advancement of scientific knowledge is best served through the free, open and online distribution of high-quality peer-reviewed research.[3] Recent reforms such as those by the United States and the National Health and Medical Research Council are welcome moves towards this goal.[4] The third interim report of the Productivity Commission rightly notes the importance of open access

to peer-reviewed research for private bodies (p. 80), however, the Academy notes this applies equally—if not more so—to policymakers and public bodies.

The Academy supports open science and notes growing international momentum towards open access for research outputs.[5] Legislative tools such as the Data Availability and Transparency Code 2022 will be key towards creating the right environment where this can support productivity. Data sharing must reflect sound operational principles and the FAIR (Findable, Accessible, Interoperable and Reusable) Principles for research data management.

However, **open research can't be open slather**. For instance, climate modelling—particularly concerning disaster risk—is of increasing interest to private businesses and governments alike. The Academy welcomes the fourth interim report's observation that such increasingly detailed climate projections will be required, but notes that such projections require sustained funding and patient development to produce, especially if they are to reflect local Australian nuances. There is a risk that climate modelling outputs are being inappropriately used to fulfil business and policy needs they were never intended to fill.[6] These underscore two things: the importance of sustained investment in science (in this case, climate modelling), and the need for robust and considered frameworks on how research is shared.

The second interim report should place sufficient weight on the need for appropriate safeguards for the retention and sharing of data. The spate of recent cyber incidents (whether triggered by malice or incompetence) vividly demonstrates the risks presented by poorly designed and implemented data systems. The second interim report positively speculates on the potential for the sharing of government data with the private sector.

The Academy has long supported greater data sharing for the purposes of public good research through trusted parties. Any move to widen the public sharing of data, especially to the private sector, requires significant advances in regulatory architecture, data safeguards and social acceptance. In our judgement, such preconditions do not exist but are worth pursuing.

To discuss or clarify any aspect of this submission, please contact Mr Chris Anderson, Director Science Policy

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[1] Rapid Research Information Forum. *Impact of the pandemic on Australia's research workforce*. https://www.science.org.au/sites/default/files/rrif-covid19-research-workforce.pdf (2020).; OECD. *New Sources of Growth: Knowledge-Based Capital Key Analyses and Policy Conclusions*. https://www.oecd.org/sti/inno/knowledge-based-capital-synthesis.pdf (2013).; Deloitte Access Economics. *The importance of universities to Australia's prosperity Universities Australia*. https://www.universitiesaustralia.edu.au/wp-content/uploads/2022/04/Report-The-importance-of-universities-to-Australias-prosperity.pdf (2020).

[2] The case for lotteries as a tiebreaker of quality in research funding. *Nature* **609**, 653–653 (2022).; Philipps, A. Research funding randomly allocated? A survey of scientists' views on peer review and lottery. *Sci Public Policy* **49**, 365–377 (2022).

[3] NHMRC. NHMRC's revised Open Access Policy released. https://www.nhmrc.gov.au/about-us/news-centre/nhmrcs-revised-open-access-policy-released (2022) [Accessed 3 November 2022].

[4] Brainard, J. & Kaiser, J. White House requires immediate public access to all U.S.-funded research papers by 2025. *Science* (2022).

[5] Australian Academy of Science. *Australian Academy of Science submission on the Exposure Draft of the Data Availability and Transparency Code 2022*. https://www.science.org.au/supporting-science/science-policy-and-analysis/submissions-government/submission-data-availability (2022).

[6] Pitman, A. J. *et al.* Acute climate risks in the financial system: examining the utility of climate model projections. *Environmental Research: Climate* **1**, 025002 (2022).