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Australian Academy of Science submission on the draft National Science and Research Priorities

The Academy of Science welcomes the draft National Science and Research Priorities (NSRP). We thank the Minister, Department and the Chief Scientist of Australia for their work in producing these draft priorities.

Australian researchers cannot do everything. It is important that a proportion of our science and research budget is used to prioritise national needs that are of direct interest to us. Funding authorities must make sure there are suitable and effective incentives for enough of our researchers to focus their work in these areas.

At the same time, however, we share a planet with all other living systems. As global citizens, Australia has an obligation to commit effort to meeting global challenges. That commitment gives the nation a seat at the table where knowledge is shared, where challenges are identified and where decisions are made. We must be there, and priorities should include ensuring capabilities in these areas, too.

Scope of this response.

Science is a process that has universal applicability for systematically and rigorously gaining, validating, and documenting knowledge, guided by the development and testing of theory. Its power lies in converting information into understandings that have predictive capacity beyond where the information originated. Science is the foundation for the incredible development that the world has witnessed over the past century.

Science as a system of knowledge should be explicitly acknowledged as fundamental to Australia's National Science and Research Priorities.

Notwithstanding, the Academy acknowledges that many complex challenges we face, such as climate change, require science, but they also require research in disciplines in the technologies, the health sciences, the humanities, and the social sciences.

The national benefit.

The well-being of the nation and our citizens depends on science to develop, not only utilise, our knowledge and understanding. We will make little medium to long-term progress if all we do is drain the existing corpus of knowledge. Fundamental to our future is our exploration of the very basics of our existence, and the challenges to that existence - again calling on the sciences, humanities and social sciences.

The thirst for knowledge.

The Academy understands that some of the basic knowledge-gathering will occur within priority areas, as it should. But room must also be left for quality research to be conducted when talented people pursue answers to satisfy a basic curiosity about how and why. It was, after all, Howard Florey who said: *people sometimes think that I and others worked on penicillin because we were interested in suffering humanity. I don't think it ever crossed our minds about suffering humanity. This was an interesting scientific exercise, and because it was some use in medicine is very gratifying, but this was not the reason we started working on it.*¹

Where would Australia be if curiosity-motivated research was seen as an afterthought? If we paralleled the fate of a bookshop when the owners just sell all the books and neglect to replace them? Short-term and limited future.

We collectively are the owners of our knowledge, and we have the responsibility to ensure its substance, its development and its application.

¹ Howard Florey, in Australian Nobel Laureates, 1998.

The key is implementation – whole of government, consistent and patient. To make it work this time, Australia needs to learn from previous attempts to develop and implement research priorities.

The last set of NSRP was ineffective. There was no implementation plan. The turnover of Prime Ministers, Ministers and Departmental Secretaries meant that only the ones in office at the time had any ‘commitment’ to the announced priorities. Lack of ‘ownership’ led to minimal compliance and even less impact.

This time, Australia needs to be clear about what success would look like. The description of success must be bold and decisive, not vague and generic. The NSRP should focus on what we want, why and how to get there, the opportunity for resources to be focused is clearer, and the opportunity to leverage from other sources of funding increases.

If current priorities are to have an impact, there needs to be an upfront and appropriately detailed implementation plan. Not one looking backwards, but one starting now. Future funding must be distributed deliberately, transparently, and in appropriate amounts – consistent with the recognition that we cannot continue to deprioritise national funding in R&D, which is on a 14-year decline, and just expect to have the capability to do what we will need to do as the challenges to our health, prosperity, and security grow.

Fourteen portfolios presently administer 175 research programs. The most significant are listed in Table 1. Any national priorities with any value will be within the domain of several portfolios.

- The Academy recommends that the priorities need a robust, whole-of-government and legislated implementation framework.
- A root-and-branch review of Australia’s research support to ensure maximum value and maximum return.

Reshaping the draft priorities.

- The Academy recommends that by the end of this review process, we declare unambiguously what we want to achieve and explain clearly how we plan to get there.

Accordingly, the present Priority 4, should become the core sentiment of a ‘vision’ - a reason why we do research in priority areas.

Purpose – an inspiring future:

BUILDING A STRONGER, MORE RESILIENT AUSTRALIA – A HEALTHY COMMUNITY: THRIVING, PRODUCTIVE AND INNOVATIVE.

How:

The draft priorities should be revised as grand challenges – and be more cohesive and clearly aimed at delivering the purpose.

Why?

Grand challenges allow for long-term investment to solve the challenges of our time. The mission format serves to galvanise a country’s research and development effort and allows for holistic strategic orientation and policy coordination.

BUILDING A STRONGER, MORE RESILIENT AUSTRALIA – A HEALTHY COMMUNITY: THRIVING, PRODUCTIVE AND INNOVATIVE

Grand Challenge 1

Grand Challenge 2

Grand Challenge 3

Grand Challenge 4

Grand Challenge 5

Box 1 - Grand Challenges

The Academy has drafted some (not all possible) examples, each with the following features: they are specific enough to be visualised; they are bold enough and go beyond the ‘business of usual’ and they can be achieved in the time frame.

Below are a handful of examples that are neither exhaustive nor comprehensive but are included to demonstrate how some grand challenges could be framed.

By 2050, we will have reduced Australia’s greenhouse gas emissions beyond net zero with the ambition to limit human-caused warming to well below 2°C, and preferably 1.5°C.

How: focus research on renewable energies and their distribution to users; avoid funding promises that are forever promises; build in flexibility from the start – the capacity to shift funding; develop specific skills in student cohorts both to research the essential science and to research the cultural and behavioural challenges to deliver change. Build straightforward processes to safeguard intellectual property.

By 2035, we will have reliable global climate projections at kilometre scale, coupled with downscaling to levels relevant to human decision-making for Australia and the Pacific, enabling effective local-scale adaptation and resilience.

How: recognise that Australia’s geography, demography, weather, climate and oceans are not homogeneous. Therefore, chasing a ‘one-size-fits-all’ approach is counter-productive. We need to plan at local scales and deliver outcomes based on local knowledge, models and science.

By 2050, we will have established a better understanding of the biodiversity of Australia, our surrounding regions and Antarctica and be able to identify species to be prioritised for documentation and protection.

How: Species are likely to be differentially affected by climate and weather changes. We need to know which, when and how to protect them.

By 2050, we will have a secure food and water supply, resilient to the impacts of climate change.

How: the people populating the driest inhabited continent have a strong incentive to use well our water systems, including aquifers. It is possible that some crops are not suitable to Australian conditions – although they can be grown if water is readily available. Will it be? And if it isn’t? Can genetic modification help secure food supplies? Would we know if we do too little research? And our old and largely infertile soils – how do we use them better as weather patterns change?

By 2030, we will have a modern recycling system in Australia, including for metals, plastics and concrete, supporting the development of a circular economy.

How: primitive recycling does not facilitate a circular economy. As populations grow, so does the waste and so does the need for appropriate recycling – and safe re-use, at scale.

Implementation is everything.

As part of the strategy, the priorities should inform building capability and capacity – the recruitment, education, and training of students in priority research areas. Meeting the priorities will require attracting and supporting a diverse cohort of students in priority areas.

The implementation plan should include processes for review, responsiveness, and renewal. There should be capacity for the priorities to be advanced and refocussed as they progress. Formal, ongoing consultation with

the research, industry and commercial sectors, as well as the general public, will ensure Australia's science and research priorities remain focused on Australia's needs.

The NSRP should have cabinet-level authority to apply to investment programs and procurement frameworks. The Minister for Science should have the authority to monitor their implementation across government, and Parliament should legislate and require regular reporting, review and revision.

Some suggestions on how the NSRP might or should apply to science and innovation programs are provided in the Table below.

Indigenous knowledges and the national science and research priorities.

The Academy acknowledges important and significant knowledge of our country within Indigenous communities and fully supports the growing participation of Indigenous peoples as participants and partners in relevant research. The NSRP and National Science Statement (NSS) should highlight the priority of building the capability of indigenous peoples – either to enter science as individuals, to work with scientists on country, or to preserve indigenous knowledges.

The Academy advises that the NSRP and NSS should acknowledge that Indigenous knowledges are relevant to particular priorities and areas of science. Further, the NSRP should engage with Indigenous peoples and how their knowledge intersects with science.

| Table 1. Selected Australian Government R&D programs and activities in 2021-22 & 2022-23 (\$m current prices) | Estimated Actual | Budget Estimate | Should the NSRP be applied |
|---|------------------|-----------------|--|
| Program/activity | 2021-22 | 2022-23 | |
| R&D Tax Incentives – Refundable | 2400.00 | 2542.00 | Reform Opportunity. The Government could incentivise or focus the R&D Tax Incentive on either the NSRP or NRF priorities |
| Research Training Program | 1069.18 | 1092.77 | No. |
| Commonwealth Scientific and Industrial Research Organisation (CSIRO) | 949.04 | 991.13 | Yes. Minister can direct CSIRO through the statement of expectations to have regard to the NSRP |
| Research Support Program | 930.66 | 951.19 | No |
| NHMRC Research Grants | 830.21 | 898.34 | No. NHMRC grants are largely investigator-led |
| Australian Research Council (ARC) - National Competitive Grants Program | 803.70 | 831.59 | No. ARC grants are investigator or collaboration focused. There could be opportunities through Industry Fellowships or Research Hubs |
| Medical Research Future Fund | 455.00 | 650.00 | Yes. The MRFF could be asked to revise the MRFF Innovation priorities with regard to the NSRP |
| R&D Tax Incentives - Non Refundable | 580.00 | 620.00 | Reform Opportunity. See R&D Tax Incentives - Refundable |
| Defence Science and Technology Group (DST Group) | 493.21 | 472.70 | No. The Defence Strategic Review informs DSTG's Innovation strategy. However, the NSRP needs to support DSTG capabilities. |
| Australian Renewable Energy Agency (ARENA) | 422.01 | 312.63 | Yes. NSRP should be positioned to support ARENA |
| National Collaborative Research Infrastructure Strategy | 273.57 | 286.04 | Yes. The next National Research Infrastructure Roadmap should ensure challenges align to the NSRP |
| Australian Nuclear Science & Technology Organisation (ANSTO) | 262.80 | 264.43 | Yes. Minister can direct ANSTO through the statement of expectations to have regard to the NSRP |
| Australian Antarctic Division | 216.47 | 222.42 | Yes. Minister can direct AAD through the statement of expectations to have regard to the NSRP |

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|---|-----------------|------------------|--|
| National Institutes Program - ANU Component | 211.97 | 216.64 | No. |
| Cooperative Research Centres (CRC) Program | 187.34 | 199.37 | Yes |
| Defence Innovation Hub funded through the Single Innovation Fund (includes DMTC and CTD) from Program 2.1 Strategic Policy and Intelligence | 99.86 | 121.67 | Superseded by ASCA in Defence. See comments on DSTG |
| Grains Research and Development Corporation | 90.39 | 105.47 | Yes. Opportunity to ensure activities build on NSRP areas |
| Australian Centre for International Agricultural Research (ACIAR) | 100.55 | 102.10 | Yes. Opportunity to ensure activities build on NSRP areas |
| GeoScience Australia | 260.05 | 331.89 | Yes. Minister can direct GA through the statement of expectations to have regard to the NSRP |
| Business Research Innovation Initiative | 16.02 | 5.875 | Yes. BRII should be scaled up and used as a major procurement lever for the NSRP |
| National Reconstruction Fund | NA | NA | NSRP should be positioned to support the NRF priorities |
| Total | 10652.03 | 11218.255 | |