Queensland University of Technology
response to the
Department of Industry, Science and Resources
consultation on
Australia's draft National Science and Research Priorities

QUT welcomes the opportunity to provide advice on the draft National Science and Research Priorities (NSRPs). QUT acknowledges the constructive and effective process undertaken by the Government, and particularly Australia's Chief Scientist, Dr Cathy Foley, which has produced a set of draft Priorities that are relevant, practical and conceptually sound. Our comments in response to the specific consultation questions, provided below, are made in the context of overall support for the approach and the broad emerging shape of the Priorities.

1. **The draft priorities intend to identify specific challenges facing the country that will require multidisciplinary and multisector efforts to address. Do they achieve this objective? How can we improve them?**

   The four high-level draft priorities do broadly address the nation's key challenges, a word that usefully captures the dual senses of both problems and opportunities. Their overlap in focus appropriately reflects the reality of lived experience, which reveals that all the big challenges are intrinsically and utterly entangled with one another. The high-level priorities are appropriately agnostic as to where the knowledge will come from that we will need to address the challenges, and which segments of our society or economy will produce or apply that knowledge.

   While the draft's design logic appropriately increases focus in terms of detail as it moves down through the strata (from priority to objective, then aim, then critical research path), we notice that the ambit of the elements of each stratum *collectively* also tends to become more constrained. QUT holds that, for the NSRPs to succeed in addressing the broad multivalent challenges, they will need to embrace the full range of inputs – at each level of detail – that can provide useful insights, strategies and breakthrough discoveries.

   The draft's concentration of breadth beneath each priority area has two slightly different manifestations as one descends through the levels:

   - They tend to narrow down into an ever-tightening focus in an often overly literal manifestation of the stratum above them; and
   - They reflect a bias towards the canonical disciplines of western science, technology, engineering and mathematics (STEM).

The former trend is relatively easily addressed, by stepping back and looking at each stratum as a set of elements that between them should span the same breadth as the stratum above it, taken together. It is the latter trend that is of particular concern. Put another way, it constitutes a bias against both the traditional western disciplines of humanities, arts and social sciences (HASS), and other systematic, empirically proven ways of seeing, knowing and discovering, such as First Nations knowledges and knowledge systems (more on the latter at Q^n 2, below). This irrational bias violates the agnosticism and multi-disciplinarity that characterises the top-level priorities and the draft Priorities' framing statements. More to the point, it undermines the NSRPs' potential effectiveness, by occluding a good portion of the knowledge that Australian researchers can and do bring to bear on these shared national challenges. It also fails to account for the reality of research-driven innovation, which frequently utilises insights and discoveries from varied, often disparate, fields.

A good example of both deficiencies noted above is the case of Priority 2, *Supporting healthy and thriving communities*. At the next level down, the objectives reveal an overly literal reduction of the concept of healthy and thriving *communities* to the concept of healthy and thriving *bodies*. That is an effective narrowing of scope of the set of objectives, but it also constitutes an unwarranted and counter-productive exclusion of non-STEM fields. Healthy communities certainly benefit from the good health of citizens, but they are also characterised by factors such as cultural richness, diversity, relevance and accessibility; social cohesion and political stability; and openness, respect and equitable access to opportunities for personal fulfilment. While these community characteristics have benefits for mental health, they are intrinsically important in their own right, and need to be foregrounded in parallel to considerations of somatic and mental health. The health sciences are not the primary enablers of the forms of knowledge that underpin these other forms of community health and growth: those fields are to be found mainly in the HASS domains; additionally, First Nations knowledges and knowledge systems are absolutely critical to these kinds of community health and growth. This overly-narrow and -literal scope is maintained as one moves down through the aims to the critical research paths, which fail to imagine how contributions from outside the health sciences – for example education, creative arts and social sciences – might help make individuals healthier and happier, let alone how they might contribute to the higher-order goal of fostering healthy and thriving communities. Some of these elements make an appearance in Priority 4, *Building a stronger, more resilient nation*, beneath the *Support resilient communities* objective, but that should be the other end of an interlinking strength across priorities rather than a stand-alone aim as it currently appears.

Another example is the case of artificial intelligence (AI), canvassed briefly in Priority 3, *Enabling a productive and innovative economy*. The aims of this priority conceive of AI entirely as a technology of potential: there is no recognition of the non-technological inputs into the development of AI, such as the essential contribution of the discipline of linguistics to the development of the large language models (LLMs) that have swept the world in recent months; neither does it consider the possibility that AI might hold as much threat as promise, opening up questions of detection, human-computer interaction, community protection and social license that are beyond the scope of technological research. Those considerations are the domain of philosophers, critical

textual and visual scholars, social scientists, design specialists, historians and creative practice researchers. None of these absolutely critical aspects of AI's future will be addressed by the programmers or the technologists: it requires HASS researchers.

A third example is the critical challenge of climate change, which pervades the draft Priorities (entirely appropriately, given the pressing existential threat it poses). Despite the urgency and scale of the challenge, there is scant reference to the fundamental importance of research into the social, political, economic and cultural reasons for – and, hopefully, the means to reverse – humanity's stark and stubborn reluctance to change our behaviours quickly enough and dramatically enough to save ourselves and to preserve a planetary environment conducive to life. While there is certainly a lot of scientific work to do around modelling, forecasting, understanding earth systems dynamics, mitigation, adaptation and the like, surely the greatest mystery of all in the entire realm of climate change research is why we are still collectively standing on a burning deck, immobile, in full knowledge of the scale of the coming catastrophe. The corollary to that question, and the greatest challenge by far, pragmatically, is how to change behaviour on the scale required for meaningful action in a timeframe that will see disaster averted. To change the behaviour of societies and nations, it is not enough to bring empirical scientific facts to the table; it is necessary to change the culture, change attitudes, change how people feel. Some areas of science do make expert contributions to this problem – neuropsychology, for instance – but by and large this is the work of the HASS disciplines. The draft NSRPs make no reference at all to these considerations; a clue, perhaps, to why we are in this position, fifty years after the klaxon-call was raised in earnest.

A final demonstration of the danger inherent in these trends is the lack of reference to legal and regulatory frameworks that will be required to enable strong governance and transfer of knowledge, thus ensuring delivery of real outcomes against the priorities. For example, under Priority 1 there is a clear need for socio-economic, governance and regulatory research to build governance structures that guide and underpin next generation technologies. The same can equally be said for equitable health care resourcing in Priority 2 and the building of resilient communities in Priority 4. Consequently, all priorities should explicitly acknowledge the complex governance requirements that will be needed and the role of the HASS disciplines in informing, developing and constructing the new governance structures necessary for Australia to successfully achieve the important aims arising from the new priorities.

These trends – of a narrowing of collective focus, and a skewing towards STEM and away from HASS – are increasingly noticeable as the draft document works its ways down from the objectives through the aims to the level of critical research paths. This is a concern since these lower-level strata of the draft Priorities' taxonomy function to effectively interpret the higher-order ambitions of the priorities and objectives. They are closer to the coalface, and will potentially steer choices of implementation, including the allocation of resources and the identification of skills needed, for example, with implications for granting bodies, human resources departments and the immigration system. It is imperative that the breadth of vision and agnosticism of the high-level priorities are preserved down through the strata and are properly reflected at every level below: objectives, aims and critical research. To do otherwise is to build into the

NSRPs the preconditions for missing opportunities. At this stage in the history of research-driven innovation, it is reasonable to suppose that most, if not all, of the big single-discipline problems have been solved; the vast majority of the remaining challenges are complex and multi-dimensional. They demand a pragmatically pluralistic approach that the draft NSRPs do not yet exhibit.

The imperative of maintaining Australia's defensive security and integrity should be foregrounded beyond an industry opportunity under Priority 3: *Enabling a productive and innovative economy*, since it underpins at least Priority 4: *Building a stronger, more resilient nation* and provides the condition of possibility of the other two Priorities. Specifically, the critical capability of cybersecurity is absolutely fundamental to the success of all the Priorities, in a world becoming increasingly digital for all aspects of life (energy, health, banking, elections, infrastructure management, etc) and relying more and more on intelligent systems to support or make decisions. Cybersecurity must be explicitly included at each level including the critical research paths.

Other significant omissions within the STEM disciplines will also diminish the final NSRPs if not included. The key enabling field of data science (including statistical methods and analytics) underpins every capability in all four high-level priorities and should be explicitly mentioned. Similarly, AI and robotics are foreseeably integral to progression in research beneath every priority and will have a more pervasive – even ubiquitous – influence than only within Priority 3: *Enabling a productive and innovative economy*. Indeed, within that Priority, the fields of AI, robotics and quantum are rightly mentioned as aims, and fundamental and applied research in these areas should also feature as critical research paths relevant to developing new or accelerating existing industries.

2. Feedback stressed the need to work in partnership with First Nations people to embed First Nations knowledge (sic) and knowledge systems in the way we address national challenges. How might governments and the science and research sector best work with First Nations people to achieve this objective?

The opening up of the NSRPs to all research inputs that can make a contribution – mentioned above at Q^n 1 – is the key to the genuine and thorough incorporation of First Nations knowledges and knowledge systems throughout the final Priorities, alongside other forms of knowledge outside the
canonical disciplines of the western STEM paradigm. For governments and the science and research sector to 'best work with First Nations people' to achieve the objective of embedding their perspectives, knowledges, knowledge systems and approaches to discovery, these considerations need to be more completely and intrinsically braided through the NSRPs at every level. It is not enough for the NSRPs to express a general wish to see First Nations knowledges and knowledge systems integrated into our national research practice without incorporating them into the Priorities themselves. The further revision of the NSRPs to better incorporate perspectives, methods and practices beyond STEM – regardless of where they come from – and chosen only for their ability to contribute knowledge needed to address the challenges – is the way to

ensure First Nations knowledges and knowledge systems are appropriately included in the final Priorities, alongside other traditional disciplines outside STEM.

3. The draft priorities provide a range of critical research paths. How could we refine these research paths, for example, to address immediate challenges?

As mentioned at Q^n 1 above, the critical research paths need further revision in order to manifest the agnosticism of the top-level priorities, which are framed so as to invite useful knowledge no matter where it comes from, as long as it can contribute to addressing each priority's challenges. Failing to open these sections up will condemn the Priorities to harnessing less that the full effort on offer, and, more importantly, less than the full effort required to meet these challenges and to operate at our national potential. The work of opening out the inputs at this level to any area of research that can add value will make most sense if undertaken after the same exercise has been conducted at each of the levels above, namely objectives and aims (see above at Q^n 1).

The critical research paths must also explicitly feature critical STEM elements, mentioned Q^n 1 above, that either enable other fields (e.g. data science) or that focus explicitly on the relevant priority or priorities (e.g. robotics, AI and cybersecurity).

Additionally, as a matter of absolute necessity, each priority must feature a critical research path that enshrines the value of fundamental blue-sky discovery research. Without this explicit provision, the draft Priorities run the risk of failing to endorse the basic upstream research upon which all applied research depends. Without that fundamental research, there is ultimately no application, no commercialisation, no tech transfer, no translation, no implementation. This point must be made as a fundamental principle at the highest level, but it should appear at the critical research path level as well, under each priority. As an example, fundamental mathematical and statistical research is absolutely critical for delivery of each and every objective included in the current draft NSRP. As an example, fundamental mathematical and statistical research is absolutely critical for delivery of each and every objective included in the current draft NSRP. Without ensuring that fundamental research is explicitly valued and prioritised alongside more targeted application-led research, our national research effort will be in significant trouble within the 10-year lifespan of the NSRP objectives and aims.

4. How would you implement the priorities in your organisation or setting? What mechanisms would support implementation?

As the University for the Real World, QUT has over many years carefully curated a research program that is already highly engaged with key challenges confronting our communities at all levels – in Queensland, across Australia, and around the world. Unsurprisingly, then, the overwhelming majority of our research effort is already committed to those areas envisaged by the draft Priorities.

We would implement the final NSRPs by using them as an additional, authoritative lens through which to assess the alignment of our research profile with the needs of the public, government and industry; and, based on this assessment, to help us continually realign that profile as required. It would not be the only tool we use for this purpose, but it would be a significant one.

We counsel strongly against any use of compulsion to drive the uptake and implementation of the NSRPs, whether through regulation or funding eligibility. Researchers at the bench and in the field will always be more responsive to emerging and evolving research needs than any formal NSRPs could ever be, and this nimbleness is certain to be lost if the means of encouraging the implementation of the NSRPs is too heavy-handed. The best way for the NSRPs to meet success in implementation is for them to be well suited to the task: not to be a kind of yardstick against which real-world research must artificially conform itself, but instead to be a dynamic, practical and responsive description of both research needs and the research that is being conducted in order to meet our major challenges.

5. The National Science Statement will explain the role our science systems will play in delivering the priorities and maximising the benefits from science for Australia. How can the following best support the priorities:

The most striking thing about this list of elements of the national science and research enterprise is its two significant omissions: universities and industry. (The latter is defined broadly, beyond the private sector, to include the public sector outside the funding agencies and publicly funded research agencies (PFRAs), and the community sector.) Indeed, there is only one use of either of the words *university* and *universities* in the substantive text of the draft Priorities, and that is to name the Universities Accord process as an aligned government priority: the other instances appear only in the appendices and in a footnote reference. Given the significance of the university sector to the national science and research enterprise, this is an alarming oversight. Furthermore, since the vast majority of the fundamental research conducted in Australia takes place within our universities, it is also an omission of concern for the long- and medium-term health of the national research pipeline, as discussed above at Q^n 3.

a. Science agencies

A more coherent and purposeful governance arrangement for all the major federal science and research agencies will allow them to better support the final NSRPs. This would involve the re-establishment of a high-level coordinating body of relevant agency and portfolio heads to help improve collaboration, identify and address critical gaps, minimise duplication of effort and enhance international linkages. A federal inter-agency body could then improve coordination and enhance synergies with state and territory objectives and initiatives.

b. Science infrastructure

Science infrastructure will be best positioned to support the NSRPs if they are placed on a sound footing of governance and resourcing. Considerations include:

- the terms of use, investment and upkeep of shared infrastructure;
- peer-reviewed merit-based access;
- long-term, user-driven, system-wide strategic planning;
- long-term funding security, with reasonable lead-times and horizons;
- sustainable maintenance and upgrade planning; and
- open and consultative decommissioning and repurposing planning for end of life.

c. Australian government science programs

Currently, Australian government science programs do not pay their way: few grants fully cover even the direct costs of the research commissioned, and none cover the full economic cost to universities of conducting research for these programs. The shortfall is covered by universities from other sources – typically, revenues from the teaching program. This unsustainable model has reached its limit, and this systemic flaw must be addressed if universities are to most effectively support the NSRPs. Starting with a commitment to contribute to indirect costs a nominal 50 cents per dollar of grant funding will set university research on a more sustainable footing.

d. Domestic and international science relationships

The challenges identified in the draft NSRPs are universal: while many of the aims and critical research paths have a distinctively Australian flavour, and while the means at our disposal may have some unique elements (such as Australian Indigenous knowledges and knowledge systems), at their highest level the priorities address the common aspirations and challenges of humanity at large. A clearly defined and sufficiently comprehensive set of Priorities will therefore provide a sound, readily explicable basis for international engagement and collaboration. With the improvement of the NSRPs to make adequate allowance for the contribution of and inclusion of HASS and First Nations research – which most international research systems do not downgrade or exclude – the global interoperability of the NSRPs will be greatly enhanced.

e. Universities

Universities will best support the NSRPs where and to the extent to which they perceive them to be aligned with their own missions, interests, objectives, practices and priorities. It is imperative that there is no recourse to compulsion or uniformity in seeking uptake of and support for the NSRPs. Universities must be free to forge their own paths, allowing them latitude to take into account considerations perhaps invisible to central research policymakers but critical to universities' own research strategies, such as local community needs, unique clusters of leading expertise, and

the development of a pipeline of talented and engaged undergraduate students through honours and into higher degree by research programs.

f. Industry

Greater business engagement with public research institutions – such as universities, public medical research institutes (MRIs) and publicly funded research agencies (PFRAs) – would greatly enhance industry's support of the NSRPs. This would be significantly boosted by the implementation of the key recommendation of the 3Fs Review – conducted by Bill Ferris, Alan Finkel and John Fraser into the research and development (R&D) tax concession – to institute a premium rate for R&D collaboration with public research institutions.