THE UNIVERSITY OF SYDNEY

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30 September 2022

The Hon. Ed Husic MP
Minister for Industry and Science
Department of Industry, Science and Resources

Dear Minister,

Thank you for the opportunity to participate in the consultation regarding the 2022 Update of the List of Critical Technologies in the National Interest.

The University of Sydney offers the following feedback in relation to the consultation questions.

1. **Are there technologies that should be considered for inclusion or removal from the original List? What are your reasons for the suggestion?**

   We note that technologies critical to ongoing Environmental Adaptation are not included in the List. We strongly recommend that further consideration is given to including technologies related disaster response and resilience (e.g. bushfires, water management, coastal erosion), negative emissions technologies, infrastructure adaptation, ecological forecasting and ecological engineering, and maintaining and boosting agriculture, as Australia is going to need major investment and development in these areas over the coming years.

2. **Do you have any comments on the individual technology definitions?**

   We offer the following suggestions in relation to two of the individual technology definitions.

   Definition (pg 10):

   Advanced integrated circuit design and fabrication
   Systems and processes to design and fabricate sophisticated integrated circuits using process nodes below 10 nanometres. Examples include systems-on-chip (SoC), field programmable gate arrays (FPGAs), stacked memory on chip and specialised microprocessors for defence industry.

   - Suggestion 1: The statement "using process nodes below 10 nanometres" should be removed.

     Reasoning: This statement technically creates a clash between advanced analog integrated circuit design and digitally integrated circuit design. In commercial digitally integrated circuit design, nodes used are well below this threshold, at 3 nanometres. However, in advanced analog integrated circuit design - which is the foundation of all our day-to-day technology-based activities (from sensory systems to radio frequency front-end electronics) - technologies are used that are well above the 10-nanometre transistor node, for example 130 or 65 nanometres.

   - Suggestion 2: The statement "Examples include systems-on-chip (SoC), field programmable gate arrays (FPGAs), stacked memory on-chip and specialised microprocessors for the defence industry" should be expanded to include other example areas. We suggest the following alternative text: "Examples include systems-on-chip (SoC), field programmable gate arrays (FPGAs), stacked memory on-chip, specialised microprocessors for the defence industry, biomedical microsystems, neurotechnologies, specialised chips for on-device training and inference at the edge,

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and a wide range of custom designed, low-power and high-performance sensory systems".

Reasoning: With the examples currently provided, the enabling aspect of integrated circuit design is limited to digital integrated circuit design. However, analog integrated circuit design is the enabler of all biomedical microsystems and neurotechnologies, as well as any and all sensory systems we experience in our daily life.

Definition (pg 11)

Neural engineering
Systems and devices that directly monitor, or interact with, the brain or nervous system. Applications for neural engineering include biofeedback monitoring, sensory prosthetics and devices to supplement or replace damaged nerves.

- Suggestion 3: Change the name from “Neural Engineering” to "Bionics”.

  Reasoning: A bionic system can replace, restore, enhance, supplement or improve a function or movement in humans or animals. They can be one-way or biofeedback systems and may or may not have anything to do with neurons. Hence the definition “neural engineering” seems too narrow to encompass all bionic system technologies.

3. Do you have a view on the frequency of updates to the List?

Yes, a frequency of review every 24 months is reasonable and should catch new and emerging critical technologies. The capacity for ad-hoc review might also be a helpful instrument to cater for the rare development of an entirely new technology that was unable to be assessed in the 24-month review cycle.

4. Do you have any feedback on the content of the Critical Technology Profiles?

The significant **missing** component in the Critical Technology Profiles is Integrated Circuits Technology - also known as Semiconductor Technology - which is an enabler of a broad range of other technologies from gene sequencing to quantum technology. The NSW Government’s recent establishment of the Semiconductor Sector Service Bureau (S3B) and New Education and Training Model (NETM) programs on semiconductor technology, as well as many recent activities around Defence, are all indications of the strategic significance of this area. The absence of such technology under the Critical Technology Profiles does not match the realities and significance of the role that we envision Australia to play in the world given concerns around overseas manufacturers.

5. Has the List influenced decisions in your organisation about technology investment or adoption?

Yes, insofar as the List includes and/or coincides with technology areas in which the University of Sydney is prioritising development of research capability based on their potential impact and importance.

We hope that this contribution is useful; please do not hesitate to contact me if you would like to discuss any aspect of this feedback.

Yours sincerely,

(signature removed)

Professor Emma Johnston
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